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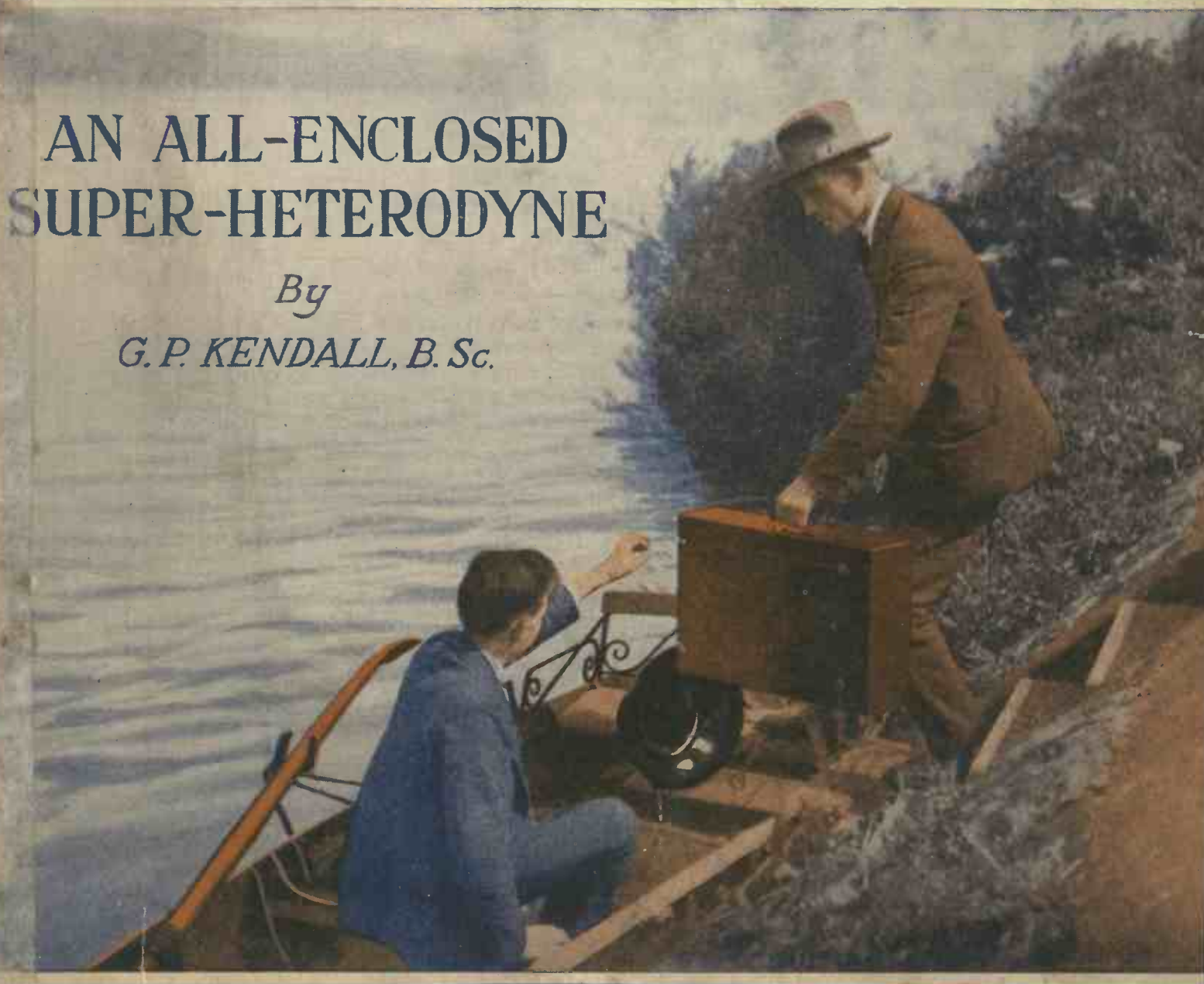
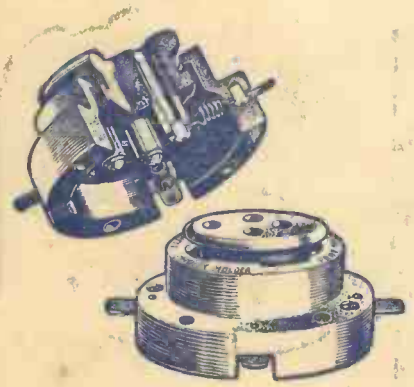
AN ALL-ENCLOSED SUPER-HETERODYNE

By

G. P. KENDALL, B. Sc.



Prevent microphonic valve noises by using Burndept Anti-Phonic Valve Holders



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The Anti-Phonic Valve Holder consists of two parts. The valve holder proper is supported on springs inside an insulated shell, which carries soldering tags. Vibration and mechanical shocks are completely absorbed by the four springs and so the valve is protected. The Anti-Phonic Valve Holder is 2¼ ins. in diameter and just over 1 in. in height.

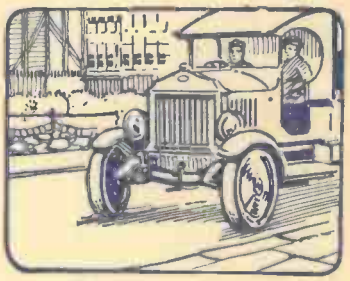
No. 401. Anti-Phonic-Valve Holder, for panel or base mounting, in carton with screws. 5/-

SOMEONE slams a door—a heavy lorry passing by makes the house shake—somebody races upstairs, stamping his feet—the children jump about in their playroom—when you are using dull-emitter valves such actions as these may cause ear-splitting microphonic noises and render tuning almost nerve-racking. The best way to eliminate microphonic noises is by means of Burndept Anti-Phonic Valve Holders. When they are fitted no vibration of any kind will make your dull-emitter valves "howl." Moreover, Anti-Phonic Valve Holders will prolong the life of your valves. The valve sockets are countersunk and thus the risk of short circuits is eliminated.

If you are building a portable set, you should certainly fit Anti-Phonic Valve Holders. Whatever type of valves you use in the instrument will then be safely protected against damage in transit.

Go to the local Burndept Agent and ask him to show you the Anti-Phonic Valve Holder. He has other Burndept Components which will interest you, too.

Someone slams a door—



—a heavy lorry passes by—

—someone races upstairs—

—the children jump about in their playroom—these are common causes of microphonic valve noises.

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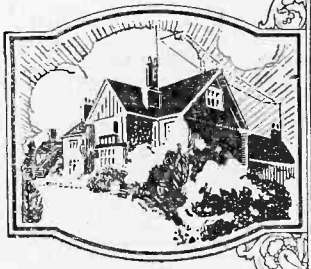

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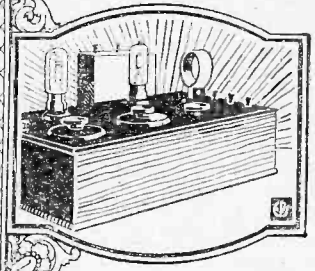

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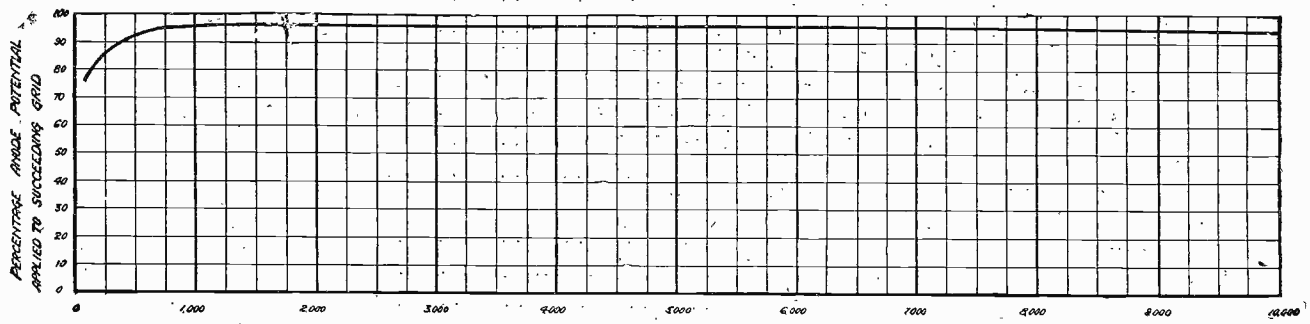
Resistance-Capacity Coupling and its merits

RESPONSE OF POLAR R.C.C. UNIT AT VARIOUS AUDIO FREQUENCIES



THE performance of R.C.C. Units, at all frequencies audible to the human ear, has already been described (April, May and June issues of "Modern Wireless").

It has been shown that the degree of response given by the Units is so nearly the same at all frequencies that amplification of speech and music can be carried out with very little distortion indeed.

If you are interested in the technique of Broadcast amplification you may have seen the earlier notes to which we refer, and you may have appreciated our arguments.

If you are not interested in this technique you are probably, at any rate, desirous of making your Loud Speaker sound as clear and realistic as possible.

It is surprising to find how frequently this or that device is advertised as giving "perfect results" or "complete freedom from distortion"—this is all nonsense, and merely induces a feeling of contempt for the advertiser on the part of discerning readers.

Only when we have reached the ideal are we entitled to say that we have attained perfection.

If our ideal is a true one, we find that the harder we strive the nearer we approach to it without actually getting there.

It is therefore not strictly possible to claim that any method of amplification is "*free* from distortion," but it can be claimed that when R.C.C. Units are properly used, the distortion in the amplifier is very very small—so small in fact, that it is quite negligible compared with that taking place in other parts of the installation (*e.g.*, Valves, Telephones and Loud Speaker)

If you use R.C.C. Units in your amplifier you can have real confidence in that part of your equipment.

It is a good insurance for the future to use R.C.C. Units, because, in the event of better valves, telephones or a more aperiodic Loud Speaker being brought into use, the distortion in your amplifier will not even then be apparent, and hence it will not be necessary to face the expense of a new amplifier.

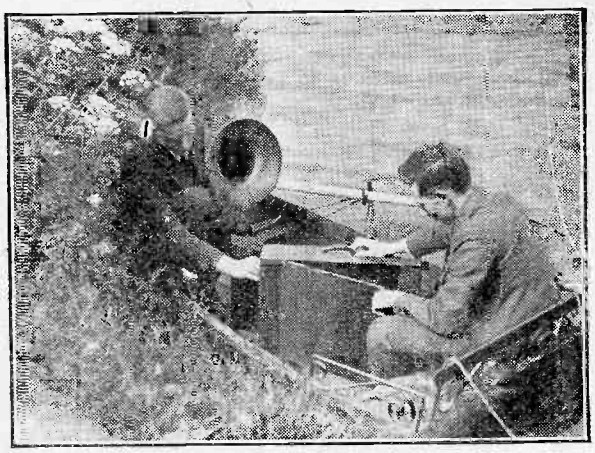
It is feasible to obtain bad service even from a Rolls-Royce, if it is badly driven—therefore, when using R.C.C. Units do not employ unsuitable circuits or valves.

A circuit diagram is enclosed in the carton of each R.C.C. Unit.

R.C.C. Units are inexpensive—they cost less even than poor transformers.

Norman Rea

Chief Engineer,
Radio Communication Co., Ltd., London, W.C.2.



An All-enclosed Super-Heterodyne Receiver

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

This interesting receiver has been designed to achieve a measure of portability, whilst at the same time being an entirely self-contained set suitable for general use.

NOW that so many good and dependable types of general purpose, and really low consumption valves are available, the super-heterodyne receiver of seven or eight valves becomes extremely attractive from the point of view of the would-be designer of a portable set capable of a really good performance upon a frame aerial of the integral type.

To what extent real portability can be achieved in a super-heterodyne receiver is something of a debatable point, since it must be remembered that something like seven or eight valves seem desirable to ensure really satisfactory results upon a small portable frame aerial, and so large a number of valves involves considerable weight. The weight of eight anti-vibratory valve sockets alone is no small matter, and to this we must add the weight of four or five high frequency intervalve coupling units, at least two variable condensers, one or more low-frequency intervalve coupling units, the necessary potentiometers and rheostats, to mention only the more important components, and the total weight must in the nature of the case be somewhat considerable.

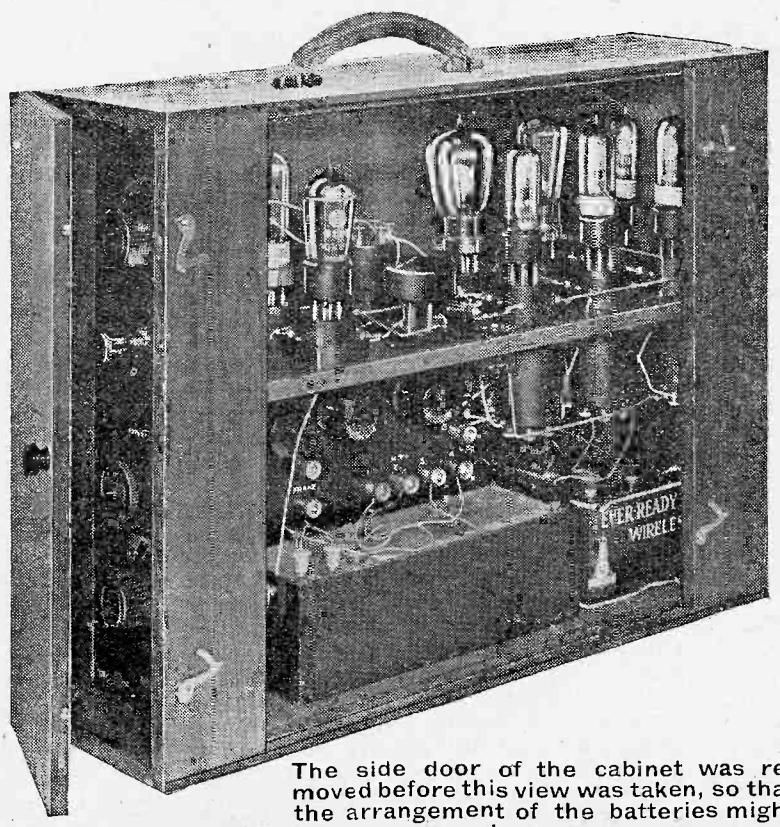
Practical Limits

Again, the high-tension battery must be of fairly robust capabilities, and the filament battery also must be able to give at least half an ampere and preferably rather more, so that small dry cells are ruled out. Using components of the readily obtainable standard type, it therefore seems to me that it is scarcely practicable to reduce the super-heterodyne to such limits of portability as will make it possible for it to be added with any comfort to the impedimenta of, say, a pedestrian picnic party.

None the less, it is quite possible, and not really difficult to reduce a super-heterodyne to such limits of portability as will render it a most valuable adjunct when motoring, on the river, or on holidays. Provided that the idea of portability is not carried too far in the design of the set, it is quite possible to produce an instrument which possesses the attractions we have just been considering, and which can in addition be regarded as an all-enclosed instrument for general reception, giving entirely satisfying results, and with the additional advantage of no external accessories in the way of batteries, or aerial and earth leads, so that it can readily be taken from room to room as may be desired.

A Useful Combination

The receiver to be described in this article represents an attempt to comply with the requirements which we have just been considering, in combining a satisfactorily portable instrument with one for general reception, so designed as to be capable of being carried about with the minimum of trouble, since everything is enclosed in the cabinet, with the exception of the loud speaker. This latter has been omitted for the reason that if it were built in, serious increase in the weight of the instrument would result, and, furthermore, it is not desirable to limit the choice



The side door of the cabinet was removed before this view was taken, so that the arrangement of the batteries might be seen.

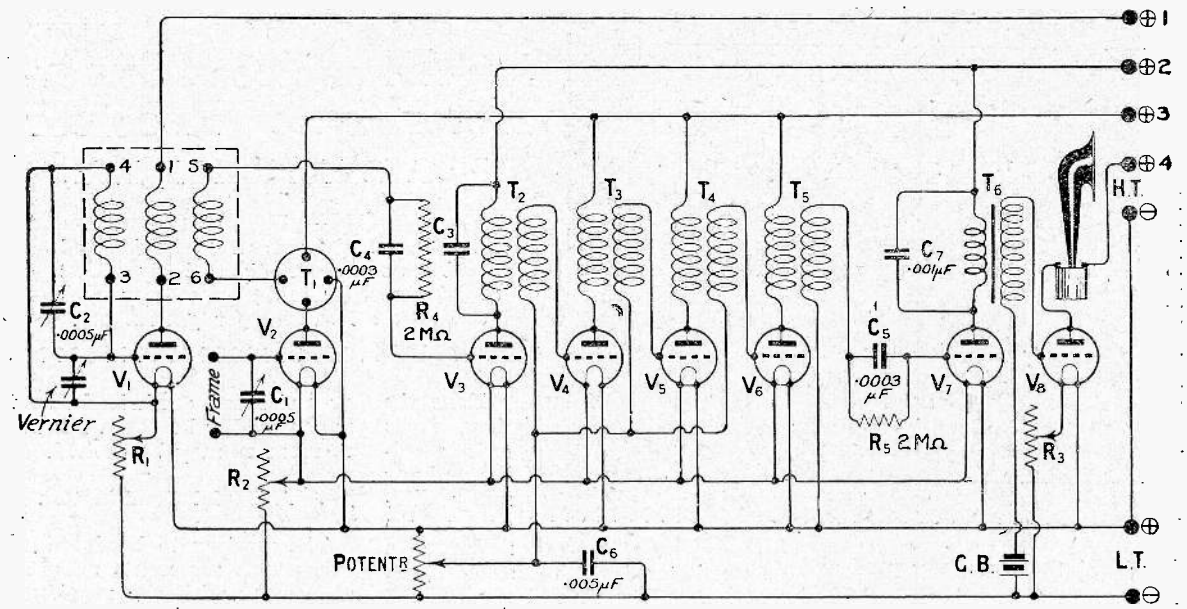


Fig. 1.—This circuit diagram will make clear the connections of the oscillator coupler.

of the user to any one make of loud speaker.

Aims

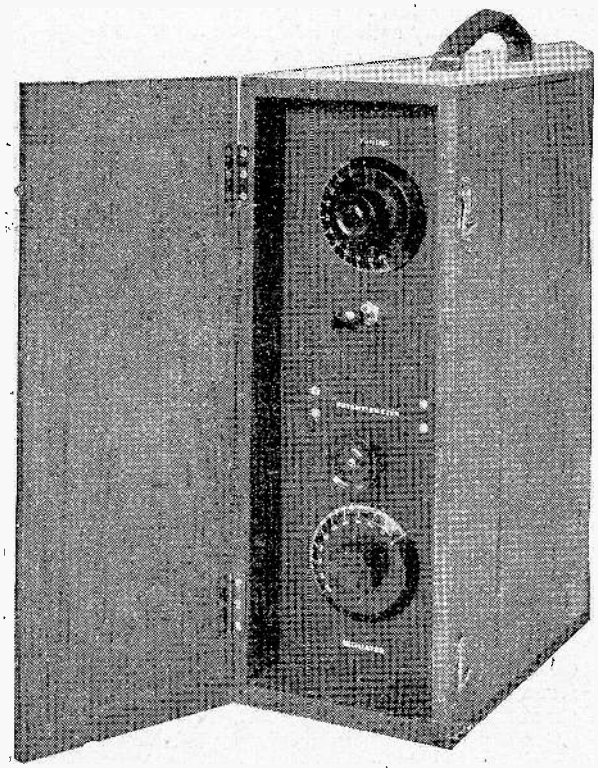
At the outset, it was decided that it would not be possible to achieve dependable loud speaker results under the worst of daylight conditions from all stations, regardless of the locality in which the set was used, bearing in mind that a frame aerial of quite small size was to be employed. The minimum standard of performance therefore decided upon was that of dependable loud speaker results under the worst of daylight conditions, from one main station, in practically any locality in which the set might be used, and good headphone signals from the remaining stations. These results, furthermore, were to be obtained with a frame aerial with a maximum size of 26 inches square, this being arbitrarily fixed by the fact that I happened to possess a folding frame of this size, which struck me as being a very reasonable one for portable purposes.

The testing has all been done in London, the stations adopted as the standard being Birmingham and Bournemouth, adequate and reliable daylight reception of these two on the loud speaker being aimed at, since they represent something like the maximum distance at which one is likely to be situated from one's nearest station in most parts of Britain. As a matter of fact, a set which will render these two stations upon the loud speaker with reasonable dependability in daylight in the summer under the unfavourable local conditions in which I work, is one which will also give loud-speaker results from all the B.B.C. stations at night time under any moderately good conditions.

Eight valves were finally decided upon, the first being the high-frequency amplifier on the short wavelengths (a separate oscillator being used), three intermediate amplifiers, and one note magnifier. It is probable that I have erred somewhat on the side of over-generosity in the provision of valves in order to cope with possible unfavourable conditions. An inspection of Fig. 1 will show how the eight valves are arranged in circuit before we proceed to consider the actual construction of the set. In this diagram V_1 is the separate oscillator valve, V_2 is the high frequency amplifying valve for the short-wave signals, V_3 is the first detector, V_4, V_5 and V_6 are the long wave or "intermediate frequency" amplifiers, V_7 is the second detector, and V_8 the note magnifier.

The Circuit

Immediately above the oscillator valve V_1 will be seen three coils whose ends are indicated by numbers from one to six, and it should be explained that these three



To operate the set it is only necessary to open the end door.

windings are all contained in a single unit, called the oscillator coupler, the one which I have employed being of Bowyer-Lowe make. As indicated by the dotted line round these coils, they constitute one boxed-in component. One of these windings is tuned by the condenser C_2, which is of .0005 μF capacity and its associated vernier, the only other tuning control being the condenser C_1, which is provided for the purpose of tuning the frame aerial, which is connected to the two terminals indicated.

H.F. Coupling

Immediately above the high-frequency amplifying valve V_2 will be seen a component with four connections, which is marked T_1. This is an aperiodic high-frequency

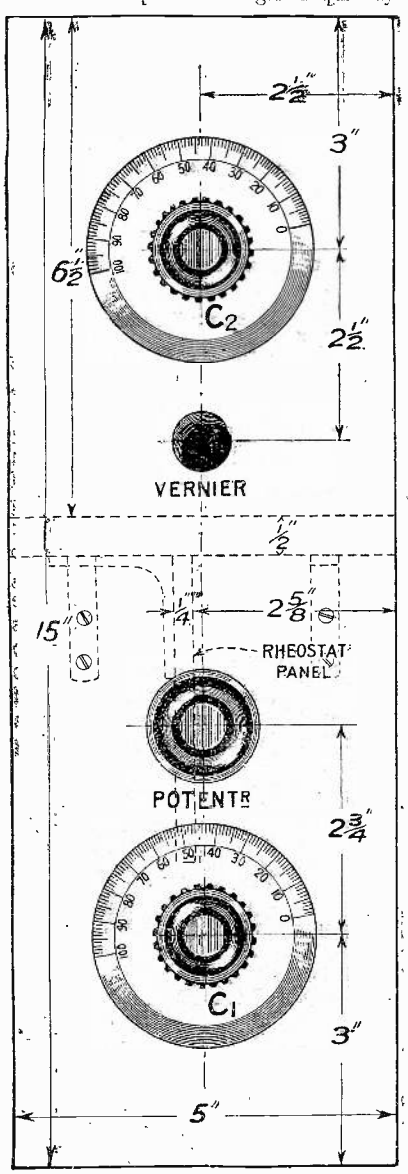


Fig. 3.—The vertical ebonite panel carries the main tuning controls.

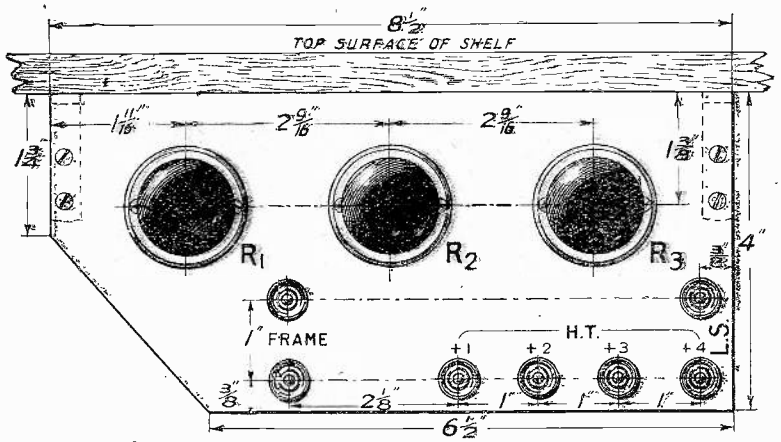


Fig. 2.—The small panel carrying the rheostats and terminals.

intervalve coupling unit, produced by Messrs. Peter Curtis, Ltd., under the name of the "Constant-Tuned" unit. This couples the high-frequency valve to the first detector, interposed between them being the "pick-up" winding 5 to 6 of the oscillator coupler. The usual grid condenser and leak is provided for the first detector, the remainder of the intervalve coupling units being marked T_2 to T_6. T_2 is what is known as the input filter, and this together with T_3, T_4 and T_5 are all of Bowyer-Lowe make, each coupling unit being one complete component, which is boxed in and fitted with terminals. These coupling units operate upon a fixed wavelength, no tuning arrangement being necessary. Across the primary of the input filter will be found a fixed condenser C_3, and it must carefully be noted that this is the condenser supplied by the makers of the units, which must on no account be replaced by any other condenser which the constructor may chance to have.

Stability Control

T_6 is the low-frequency intervalve transformer, and it will be observed that a fixed condenser of .001 μF is connected across the primary winding of this, which I have found a very desirable aid to stability upon the long wave side. It will be observed that a potentiometer is provided which controls the grid potentials of the three long wave amplifying valves, and in practice this provides a control of the amount of natural reaction in the intermediate frequency amplifier. A fixed condenser of .005 μF is shunted across the slider of the potentiometer and the negative end of the filament circuit.

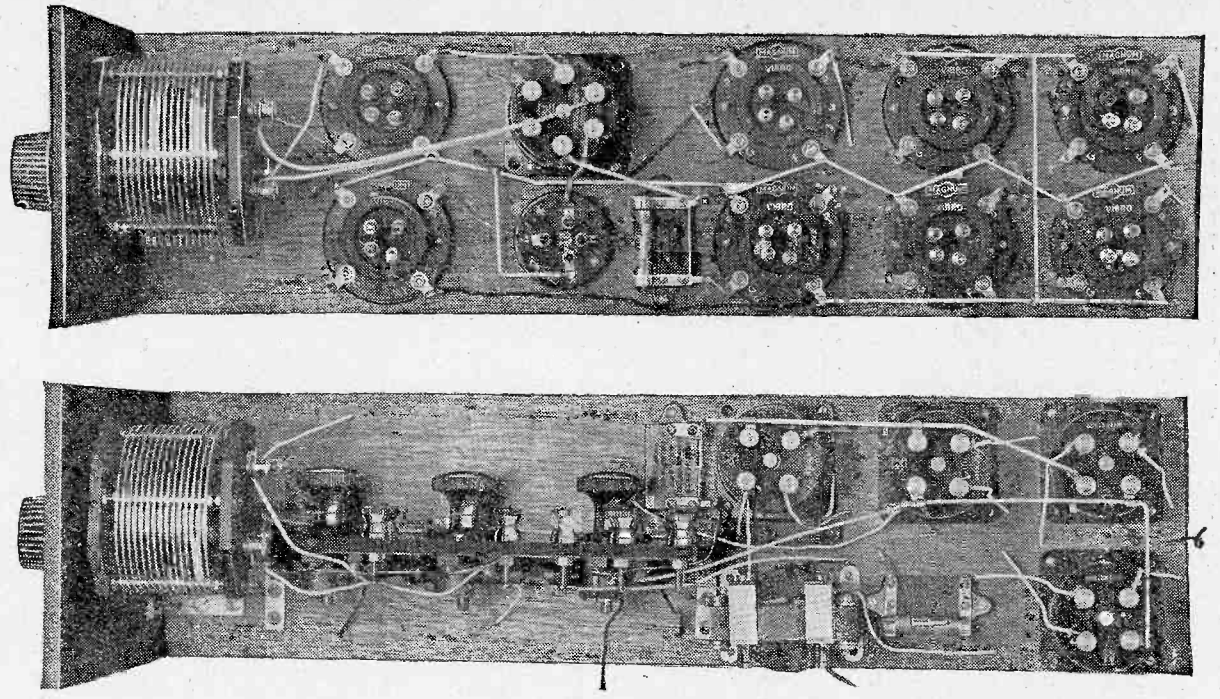
The Cabinet

The receiver is built into a light wooden cabinet of the shape of a suitcase, and a few notes upon the desirable features of this box may perhaps be useful. Its internal dimensions are 5 in. by 15 in. by 21 in. The large door is 15⅜ in. by 15 in. wide, and if these sizes are given to a cabinet maker no doubt a satisfactory case will be obtained, provided that the cabinet maker is warned to reduce weight as much as possible, and to adopt some finish which will stand a good deal of knocking about without being spoiled, such as a dull oil-finish.

The cabinet is provided with two doors, one in the side which gives access to the interior of the set, the battery compartment and certain of the controls, the other opening in the end, and disclosing a narrow vertical ebonite panel upon which are mounted the two tuning condensers, the potentiometer which controls the long wave side, and a small vernier condenser, which is placed in parallel with the oscillator tuning condenser C_2.

Panel Fitting

When ordering the box, due care should be taken to specify that the fillet upon which the vertical ebonite panel rests, leaves proper space in front of the panel for the knobs of the condensers, in order that the door may be shut; while the dimensions of the larger door must be adhered to carefully, since this door will form at a later date the basis for the winding of a frame aerial. Inside the box is arranged a wooden shelf, approximately half-way between top and bottom, which slides in and out upon a ledge and is fastened to the vertical ebonite panel by means of two brass brackets, so that shelf and panel may be pulled out together, the set being assembled upon these two as a base. This wooden shelf carries the eight valves arranged in two rows of four



These views of the upper and under sides of the shelf will serve as a key to the wiring diagram.

and all the components except those which have been mentioned as being mounted upon the ebonite panel.

Rheostat Panel

To the underside of the wooden shelf is attached a second small ebonite panel by means of two brass brackets, and this second panel carries the three filament rheostats, the two terminals for the frame aerial, the two for the loud-speaker and the various high-tension positive terminals. These terminals, reading from left to right as one looks into the cabinet from the side, are the frame aerial pair, H.T. + 1, which supplies the oscillator valve, H.T.+2, which is the terminal for the two detector valves, H.T. + 3, which supplies all the high-frequency amplifying valves, and H.T. + 4, which supplies the note magnifier. The latter terminal is also a common terminal for the loud speaker. Thus, it is both the high-tension positive terminal for the note magnifying valve, and the lower terminal of the pair to which the loud-speaker is attached.

The batteries are arranged at the bottom of the box, and it will be found that there is exactly space for a "Siemens'" 108 volt high-tension battery, which is a convenient size when its weight is permissible. If, however, the set is to be much used for carrying about a 72 volt unit will suffice, and for this there is ample room. (More on this subject at a later point in this article.) A small grid bias battery may be placed on the right of the high-tension battery, and at this point can also be inserted the filament battery. This, in my opinion, should be a small 4-volt accumulator rather than a dry battery, since the latter must become exceedingly bulky and heavy to feed so many valves. One of the almost miniature 4-volt accumulators sold for running model electric launches will be found very suitable, especially if it is of the unspillable variety. One of five ampere hours actual capacity output will just suffice if .06 valves are used, one of ten ampere hours being a convenient and desirable size.

Battery Leads

No other terminals for batteries than those mentioned are provided, a pair of leads soldered directly on to suitable points on the wiring being arranged for the low-tension supply, the negative socket of the high-tension battery being connected directly to the positive terminal of the accumulator, no special terminal on the set being provided for this; while the positive socket of the grid bias battery is connected directly to low-tension negative. From the appropriate secondary terminal of the low-frequency transformer a short flexible lead is taken, bearing

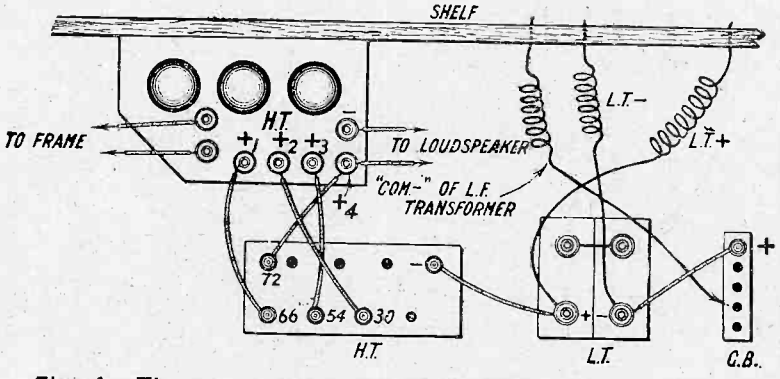


Fig. 4.—The connections of the batteries, frame, and loud-speaker.

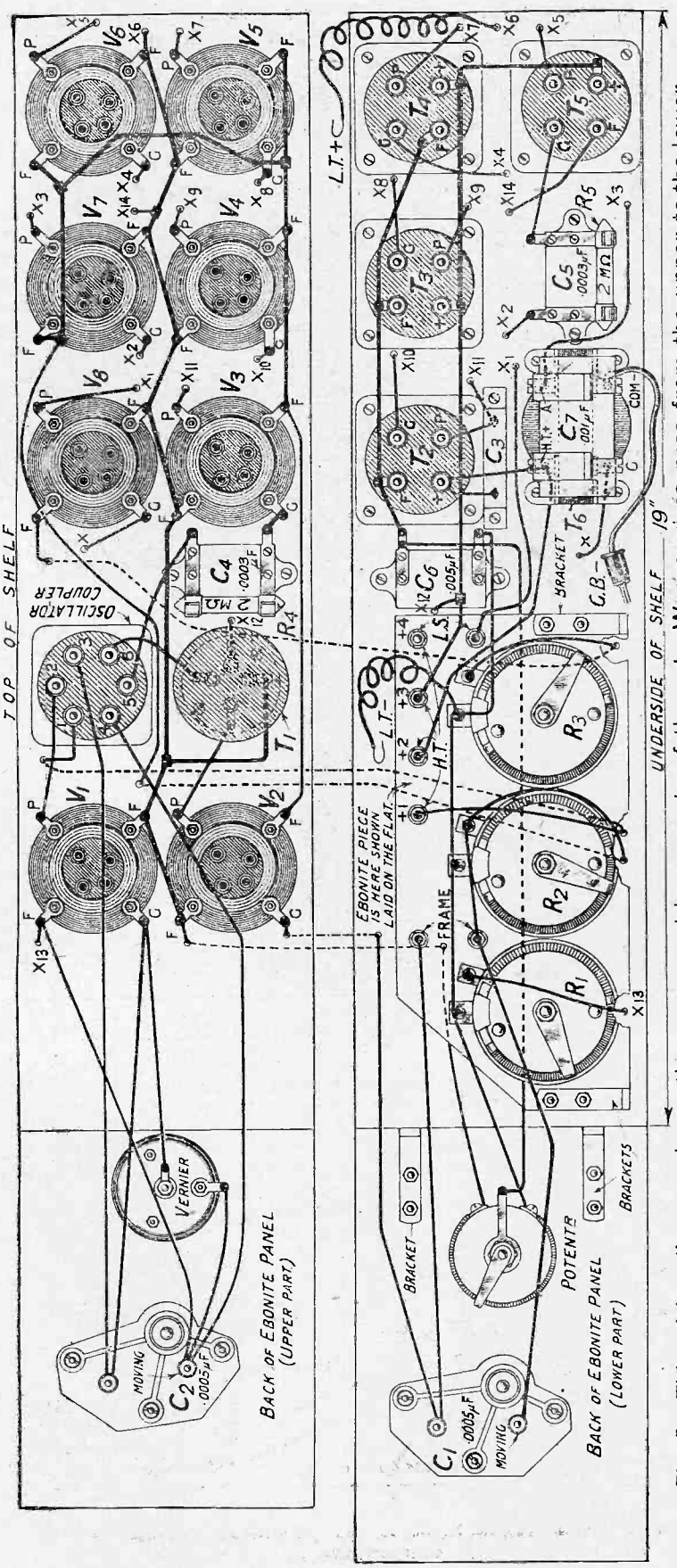


Fig. 5.—This wiring diagram shows the upper and lower parts of the set. Where wires pass from the upper to the lower side of the shelf through a hole, that hole is marked, *e.g.*, x 10, both above and below, for identification. To make the point clearer, on the left dotted lines indicate the correspondence of holes. Thicker lines represent stiff square wire.
Blueprint No. 122, Post Free, 1s. 6d.

upon its end the usual battery plug, and this is inserted into a suitable negative socket of the grid bias battery. The various battery connections are thus completed with a minimum number of terminals.

The actual components used in the orginal set are given in the following list, and with this aid the constructor will be able to collect the necessary materials.

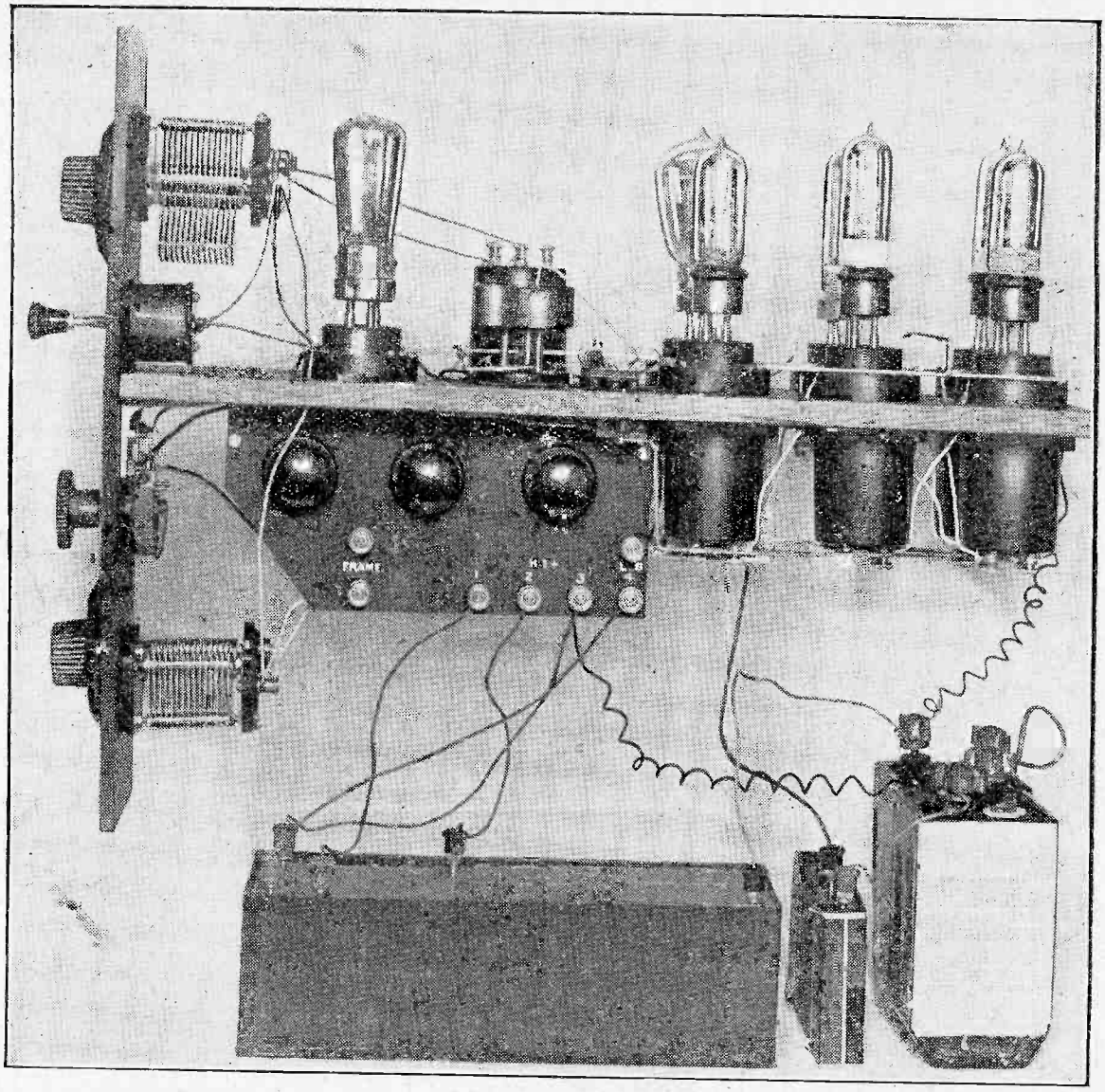
- 1 cabinet (Burne-Jones & Co., Ltd.).
- 1 ebonite panel, 5 in. by 15 in. by ¼ in. (Burne-Jones & Co., Ltd.).
- 8 shock-absorbing valve holders (Burne-Jones & Co., Ltd.).
- 1 ordinary base-board mounting valve socket (Burne-Jones & Co., Ltd.).
- 2 fixed condensers .0003 μF capacity (Dubilier Condenser Co., Ltd.).
- 2 grid leaks of 2 megohms (Dubilier Condenser Co., Ltd.)
- 1 fixed condenser .005 μF. capacity (Dubilier Condenser Co., Ltd.).
- 1 fixed condenser .001 μF (McMichael clip-in type).
- 1 low-frequency transformer (L. McMichael, Ltd.).
- 1 potentiometer (Sterling).
- 2 variable square law condensers of .0005 μF capacity (Collinson's Precision Screw Co., Ltd.).
- 3 dual rheostats (Burndept Wireless, Ltd.).
- 1 "Constant-Tuned" intervalve coupling unit (Peter Curtis, Ltd.).
- 1 oscillator coupler (Bowyer-Lowe Co., Ltd.).
- 1 input filter with condenser (Bowyer-Lowe Co., Ltd.).
- 3 intermediate frequency transformers (Bowyer-Lowe Co., Ltd.).
- 7 terminals.
- 1 piece of ebonite 4 in. by 8½ in. by ¼ in., with one corner removed by a slanting cut.

Radio Press panel transfers.

- 1 vernier condenser (Burne-Jones, Ltd., enclosed type)

Construction

Little need be said of the actual attachment and assembly of the parts, since I think this is quite clearly shown by the diagrams and photographs, and such constructional work as is involved is of a very simple nature. Care should be taken in working to the dimensions and arrangement given, since the whole set has been packed into as small a space as seems desirable, and the exact spacing to within quite small limits is somewhat important, as I found to my cost in the preliminary experimental work.



In this view of the set removed from its cabinet, the position of the rheostat panel may be clearly seen.

Therefore endeavour to copy the layout very accurately, and take careful note of the fact that the valves are arranged in two rows, running along one row in one direction and then back along the other in the opposite direction, so that the last valve, viz., the low-frequency amplifying valve, is that which is side by side with the first detector.

Wiring

The wiring probably represents the most difficult part of the construction of this set, since there is not very much space available in which to carry it out, and a good deal of it runs from components on the lower side of the shelf to others upon the upper side of it. This involves drilling holes in quite large numbers in the shelf. The wiring was actually carried out partly with the ordinary square tinned wire, and partly with Glazite, which proved extremely convenient for the purpose. The wiring diagram is marked to indicate which type of wire is used for certain connections, and it will be observed that most of the wiring which runs through the shelf, or which unites components separated by some considerable distance, is done with Glazite, the shorter wiring which does not run through the shelf being done with the square wire.

Points for Care

Points to which particular care should be directed in the wiring operation, are the connections from the "Constant-Tuned" coupling unit, and more particularly those to the oscillator coupler. These must be carried out with due care to see that the right connection is taken to the proper numbered terminal, since a mistake may result in failure to oscillate on the part of this valve, and, of course, the breakdown of the whole set.

Presuming that the wiring of the set is now finished, we come to the testing and operation of the instrument, and after the completed panel and shelf have been slipped into the box, the first question which confronts us is that of the type and arrangement of the valves to be used. In a set employing so many valves, and in which it is desired to use quite a small filament battery, we are limited almost definitely to the type of dull emitter taking .06 amp. for the filament, with possibly one of slightly larger consumption for the last (note-magnifying) valve. The

oscillator is provided with a separate filament rheostat, and practically any type of general purpose valve will serve here. For the first detector, first high-frequency amplifier, three intermediate frequency amplifiers, and second detector, it is necessary to use valves requiring the same filament voltage, since these are all controlled from the one filament rheostat. A good combination, for example, is to use three general purpose ·06 ampere valves for the first H.F. and the first and second detectors, while the three intermediate frequency amplifiers can be of the D.E. 3.B. type, which has a high amplification factor and gives good results here.

Suitable Valves

Alternatively, of course, five valves of the same type can be used, such as the D.E.3, B.5, D.06 general type, to mention the three examples of this type made by Messrs. Marconi-Osram Valve Co., Ltd., the B.T.H. Co., Ltd., and Mullards Radio Valve Co., Ltd. Practically any type of general purpose low-consumption valve can be used here, and I have obtained quite good results from imported Continental valves of the ·06 type.

H.T. Values

The high-tension supply may be a 108-volt battery, and the plugs should be inserted so that terminal number 1 receives 102 volts, terminal number 2, 30 volts, terminal number 3, 54 volts, and terminal number 4 the whole 108 volts. When only a 72-volt battery is used terminal number 1 is brought down to 66 volts, and terminal number 4 to 72 volts, the others remaining at the same values as those just given.

Assuming that all the batteries have now been connected up properly and the valves turned on to an approximately correct degree of brilliance, we must deal with the question of the operation of the set. First connect a pair of telephones to the loud-speaker terminals, and a frame aerial to the frame terminals. Now experiment with the potentiometer, and discover at what point upon its range the long-wave side breaks into self-oscillation. When the valve filaments have been correctly adjusted, this should take place when the slider of the potentiometer is approximately one-third of the way round from positive to negative; that is to say, that it should be two-thirds of its travel away from the negative end and one-third away from the positive end. This is merely a very rough rule to give a general idea as to whether the set is working correctly. Remember that in general if the set oscillates too freely it can be stabilised by brightening the valve filaments, but this must not be carried too far, or the valves themselves may be injured.

Testing the Oscillator

Set the potentiometer so that the long-wave side is just oscillating, but no more, and proceed to revolve the dial of the oscillator condenser C_2. At several points upon the dial you should hear chirping noises like carrier waves, which should disappear when you turn the potentiometer towards the positive end so as to stop the long-wave side from oscillating. The presence of these chirps may be taken as an assurance that the oscillator valve is functioning more or less correctly, and one can then proceed to search for signals. Set the potentiometer so that the long-wave side is on the verge of self-oscillation, and proceed to search for signals by manipulation of the two tuning dials.

A Warning

Operating a superheterodyne for the first time is no very simple matter and you must not expect to obtain anything like the full results for a time. Next month the question of operation, types of valves to use, adjusting the set to obtain the best results, and so on, will be considered fully. Meanwhile space compels me to leave the constructor to acquire skill in manipulating the two dials and the potentiometer with a few final practical notes.

The First H.F.

It will have been noted that no potentiometer is provided to control the grid potential of the first high-frequency valve, and a few words of explanation are desirable as to the methods of controlling any natural tendency to self-oscillation on the part of this valve. The aperiodic intervalve coupling employed does not produce any strong tendency to self-oscillation, but it is possible with a valve which oscillates readily, by turning down the filament current, to produce self-oscillation upon a small frame aerial. No difficulty should be experienced with this, so long as the following points are borne in mind. If you find that signals are apparently poor and distorted, and if you hear noises like carrier waves upon revolving the frame aerial condenser, it is probable that the first valve is oscillating, and the remedies to be adopted are an increase in filament brilliancy of the group of valves controlled by the middle filament rheostat, and possibly a slight decrease in the high-tension voltage applied to H.T. +3. If the difficulty is very pronounced, try a different valve in the first socket. If the only available valves are such as to produce self-oscillation here (an extremely unlikely state of affairs), a temporary remedy which will serve until a more suitable type of valve can be obtained, is to break the lead which connects one of the secondary terminals of the "Constant-Tuned" unit to filament positive, and take this lead to the slider of the potentiometer.

When the set is used for portable purposes, a folding frame aerial is extremely desirable, and unless the set is to be used in very close proximity to a broadcasting station, I would recommend that as large a frame as possible should be employed. (The only objection to a large frame is that when used very close to a main station the interference problem is rendered somewhat more severe.) A separate frame aerial is most desirable, but for use upon comparatively local stations quite good results can be obtained upon a small frame wound upon the large door of the cabinet, and details will be given next month as to the construction of this frame.

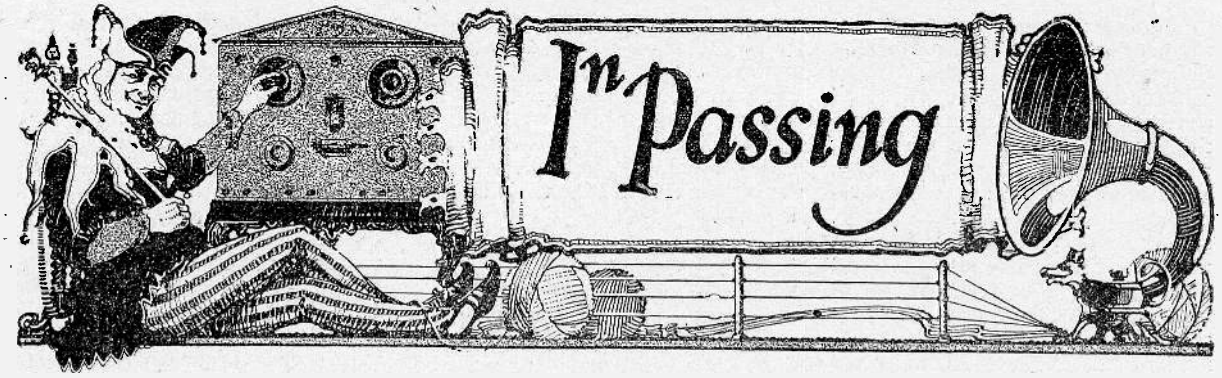
Results

To give a preliminary idea (to be expanded in a later account) of the results to be expected from this set, I may mention that the following stations were received one afternoon in June at satisfactory loud-speaker strength:—Birmingham, Bournemouth, Hamburg, Toulouse and Glasgow. Madrid was heard at good phone strength on the same occasion, all on the 26-in. frame, and in particularly summery (and hence unfavourable!) conditions.

After dark I have had loud-speaker results from all the main B.B.C. stations (and two relays) except Cardiff, Manchester and Aberdeen (phones only), but of course results vary from night to night and in the different localities in which the set has been tested.

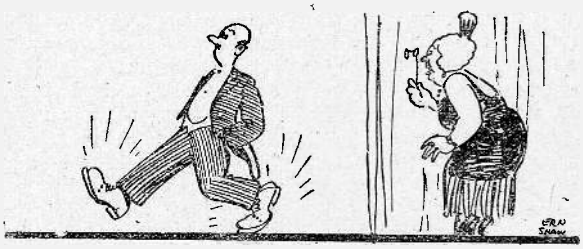
NEXT MONTH

The conclusion of this article will appear in our next issue, with full instructions for operating the set, notes on possible troubles, and details of the built-in frame aerial.



Inspiration

POSSIBLY you noticed, and possibly again you did not, that in a recent lecture upon the motion of electricity in metals, Dr. H. A. Lorentz referred to the fact that when conductors are cooled below a certain critical temperature their resistance is what the vulgar would call a washout. In polite words, it ceases to exist. Now, even if you had seen this statement, would it have suggested anything to you? I doubt it, reader. On the other hand, when I came across it a whole train of possibilities presented themselves to what *I* call my brain, though I must admit that others describe it in less flattering terms. Would it not be possible, for instance, to keep one's earth plate in a refrigerator and so obtain enormously increased signal strength? You think that it would not? Well, well, perhaps you are right. Still, you see how the idea sets one thinking. The great trouble is that of reaching the critical temperature, which is always somewhere round about absolute zero. And what is absolutely zero temperature? You are puzzled at once. Various figures return from your distant schooldays and group themselves before you. Is it 644? No, that is the number of ounces in a square hundredweight or something of that kind. It is not 98·4 or 30¼ or 1728. You give it up? I will put you out of your pain. It is -273 degrees Centigrade. I am able to speak with a certain amount of certainty because I have just looked it up.



In glad rags minus a collar and plus brown boots.

Frigidity

Now this is the kind of temperature that takes a bit of getting down to. It is simply of no use at all to ask the ice-cream man to help you. It is sometimes approached at meetings in Scotland in the chilly silence which succeeds the chairman's announcement that a silver collection will be taken at the door as the audience leaves, but one could hardly incorporate chairman, hall and audience in the average receiving set. Again, I have known a frigidity not far above absolute zero occur in my own feet when called upon to perform some dangerous task. You see the obvious objection to this method of producing a low temperature. A prolonged coldness in the pedal extremities leads infallibly to chilblains, if not to frostbite. You can, of course, produce a remarkably chilly atmosphere by appearing at a dinner party without your collar, or even by wearing brown boots with your otherwise perfect evening garments. No one, however, wishes to go through life perpetually garbed in glad rags minus a collar and plus brown boots. Further, the requisite coldness cannot be produced unless there is a dinner party, and no one, I imagine, would care to give one of these every evening during broadcasting hours. If it were necessary to do this, the use of temperatures in the neighbourhood of absolute zero in the receiving set would be too costly to be a sound commercial proposition.

Fighters

I have outlined first of all the difficulties, just to show you how great was the task to be faced by myself and by Professor Goop to whom I at once communicated the inspiration that had come to me. Our joint motto has always been *Super ardua ad astra*, which may be freely translated: "The higher you go the fewer." Difficulties make some people tear their hair, or burst into tears, or pay their tailor's bills, or take some other desperate action. It is quite otherwise with the Professor and myself, who, when confronted with difficulties, are at our very happiest. I will just give you one example to show you what I mean. The other night, wishing to receive KDKA's short wave transmission, the Professor took down from a shelf the special open-work solenoid coil that he keeps for this purpose. You may gather something of his surprise when I tell you that he found that a lady mouse had made her little home within it and that about a dozen healthy youngsters, snug in the warm nest, were asking loudly if it was not nearly breakfast time. Now here was a real difficulty. It has been amply proved that the presence of mice in the field of any coil enormously increases both its inductance and its self-capacity.

Difficulties make some people tear their hair.

The Difficulty Solved

Professor Schnitzelwurst has in fact produced a formula which

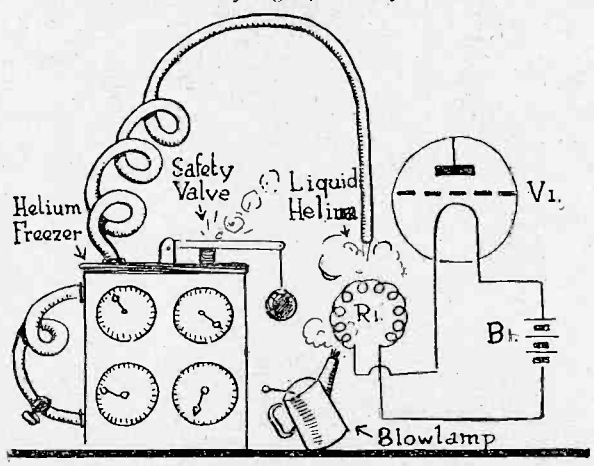
will be found most useful should this occur to you. In case you do not know it, it is $x = \frac{\sqrt{M \pm 2LO}}{I.O.U.}$ where M is the number of immature mice, 2LO may or may not be 365 metres, I.O.U. is a scrap of paper, and x is an unknown quantity. Even with the help of this formula the Professor found himself no nearer to receiving KDKA. Something had to be done. It was obviously impossible to remove the nest bodily from the coil, for that would have been the kind of rank cruelty that is foreign to any real Englishman. The only possible solution was to remove the coil from the nest, and this the Professor did, placing the little creatures and their home in Mrs. Goop's Sunday hat. You will see at once how great minds can rise to the occasion in times of stress. It was a real stroke of genius, and I can assure you that Mrs. Goop told the world about it for three whole days almost without stopping.

I Tell the Professor

Having once got this absolute zero idea, I went, as I said, to see the Professor about it without any delay. As I entered his study I found that the kindly man, in the absence of his wife, had the latest Gooplet upon his knee and was engaged in charging him to capacity with a feeding-bottle. Seeing me, he rose at once, depositing the infant in the coal scuttle, and advanced with outstretched hands. Having greeted him, I remarked that, to judge from his howls, the child appeared to be in a state of violent oscillation that must be causing considerable interference in the neighbourhood. "Child," said the Professor, "what child?" I indicated the Gooplet. "Ah, yes, of course," cried the Professor, picking up his now somewhat begrimed offspring and re-seating him on his knee. He then plugged in the transformer, which silenced the howls and produced smiles and gurgling noises.

The Thermorheostat

I outlined my idea, and as Mrs. Goop luckily appeared and removed the encumbrance, we were able to get on with it at once. Why should we not, I suggested, produce eventually a receiving set controlled by the varying resistance obtainable from the use of slight rises and falls in temperatures approaching absolute zero? We agreed at once that there was a great deal in this project, but resolved for the moment to confine ourselves to something straightforward and simple. What we decided to do was to produce a Thermorheostat, and this we have done. What is a rheostat? It is a thing whose thingmejig comes loose whenever you turn the knob in the hope of lighting up your valve filament. It is a thing whose contacts are always so placed that you have to stand on your head to solder wires to them. It is a thing whose spiral squishes when you hold it firmly in order to be able to drive home the fixing screws. It is a thing pierced with 5 B.A. holes, which you buy on Saturday night, when you have no 5 B.A. screws and have lost your No. 26 drill. There is obviously a vast demand for a super-rheostat which has none of these defects. That is why we have developed the Thermorheostat, which will meet the requirements of even the most exacting. The *modus operandi* of this wonderful new filament regulator will be gathered at once from the diagram which is given herewith. The components required are simply a helium liquefying apparatus, a blow-lamp, and a resistance coil with a value of 100 ohms. The helium thingmebob may be obtained very reasonably from dealers in disposals goods, rag and bone dealers or other merchant princes. Its cost as a rule will not exceed four or five thousand pounds, and it is therefore comfortably within the purchasing powers of any reader of MODERN WIRELESS. The blow-lamp may be borrowed from any painter (house, not picture), whilst the resistance wire can be bought for a few pence. Let us see exactly how the apparatus works.



The Thermorheostat operating.

How It Works

When we make a start the total resistance in circuit is 100 ohms. The valve therefore does not light up. We now bring the helium liquefier into action, squirting a spray on to the coils of wire. Before you can say "knife" or "Jack Robinson," or any of the other things that nobody ever wants to say, down goes the resistance to zero, and unless you are pretty nippy, up goes the valve in a blue flame. It is just this nippiness that is the crux of the whole question. It is essential that the blow-lamp should be brought into play just at the right moment in order that the desired amount of resistance may be obtained. When the Thermorheostat is first operated, it is as well to borrow half a dozen valves from friends for experimental purposes. They will quite understand when you return them with burnt-out filaments and explain that you were engaged in really important experiments. Once the requisite deftness with the blow-lamp has been acquired, perfect control of the filament is assured. For multi-valve sets it is perhaps best to provide one liquefier and one blow-lamp per valve, though this is not absolutely essential, since the former may be furnished with a multiple nozzle, whilst the latter is easily manipulated, after a little practice.

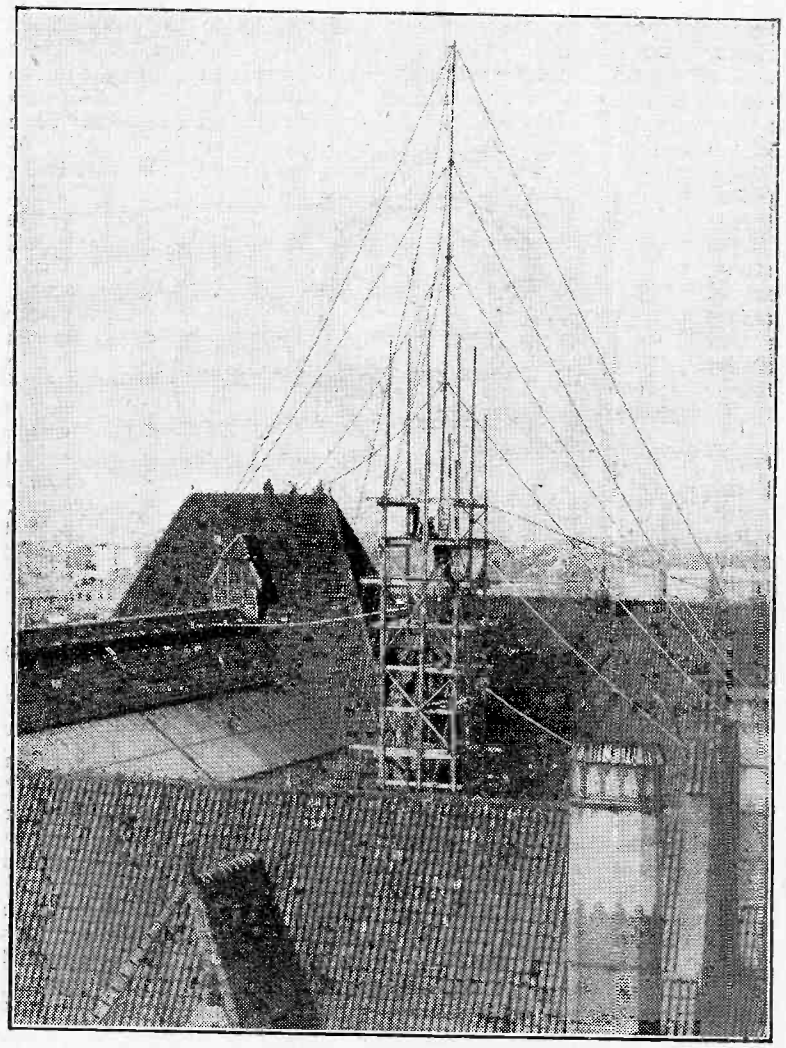
Test Report

A complete Thermorheostat was despatched for test to Mr. A. D. Snooper per goods train. His report, which is most encouraging, is as follows: A sample of the Goop-Wayfarer Thermorheostat has been submitted for test. This is a neat and compact little device which will appeal specially to those to whom space is a consideration. We had no difficulty in installing the apparatus in our own drawing-room after removing the furniture. On test it was found that the resistance obtainable varied between 100 ohms maximum and .000000162593 ohm minimum. Though the minimum is rather higher than we care about for serious experimental work, the Goop-Wayfarer resistance can be recommended to any who require a reliable component with a fair degree of quantitative accuracy. It will recommend itself especially to those who are constructing portable sets for summer use.

The Hamburg Broadcasting Station

By Capt. L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S.

An interesting account by our Continental Broadcasting Correspondent of his visit to the well-known German station now so familiar to listeners in this country



The aerial at the Hamburg Station is located on the General Telephone Office building.

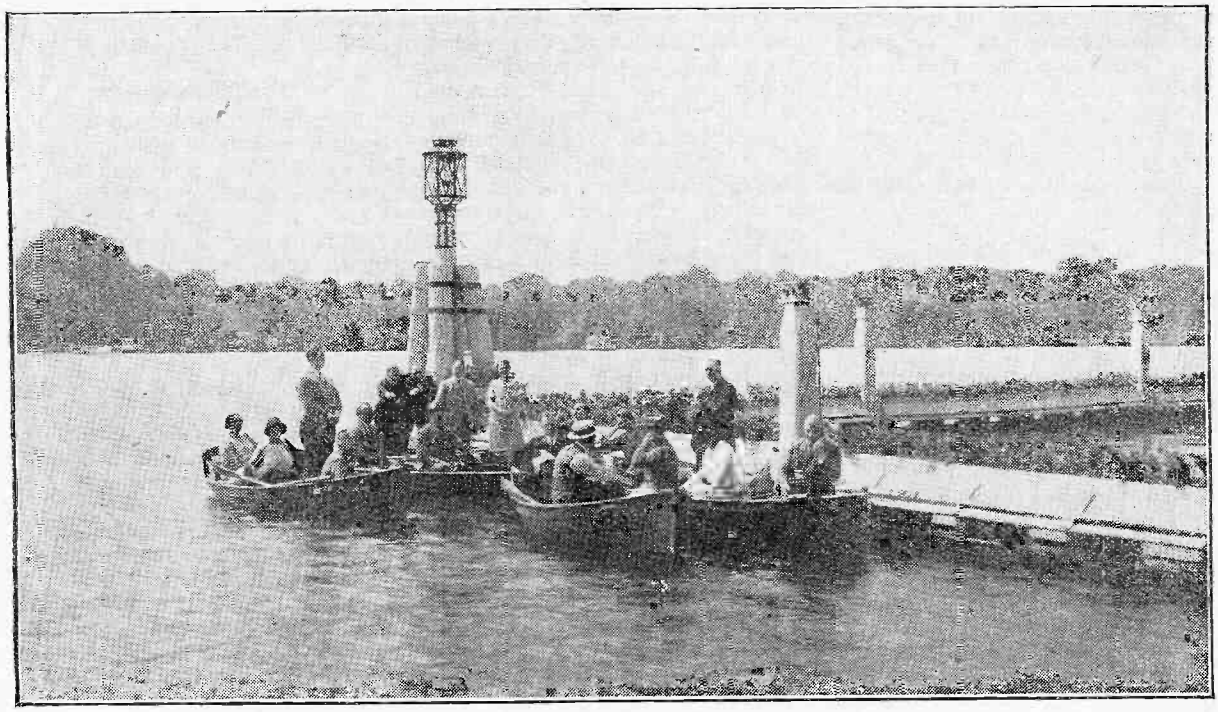
THE Hamburg Station is regarded as one of the most important in Germany. Hamburg is a great intellectual centre and has at all times formed a republic of its own. As a great port in the days before the war, vast wealth was accumulated with that consequent intellectual development.

As a typical example of the weight the Hamburg Station holds with regard to other German broadcasting stations, it might be mentioned that when the general broadcasting committee of Germany was formed a few months ago, with a representative for each broadcasting station in Germany, Herr Blonck, Chairman of the Hamburg Company, was unanimously elected Chairman to the General Committee.

The station is owned by the Nordische Rundfunk A-G., and is generally referred to as "The Norag," which it will be noted, is coined with the aid of the initials of the Company's name. The transmitting station is housed in the Post Office building above the Telephone Exchange. It is the law in Germany that the Post Office should hold 51 per cent. of the shares of any broadcasting company. The aerial is of the usual type, erected on the roof of the building. It looks more like an oversized receiving aerial than a transmitting one, and consists of two single wires some 200 feet long, 10 feet apart, towering about 100 feet above the roof. The masts attracted my attention. They appeared to be extremely slender, being formed of a thin steel tube about one foot in diameter and held rigid by a great number of stay wires radiating in all directions.

The studios—three in number—are on the ground floor. Only one, the large one, is regularly used for transmission, one of the others being used for experimental purposes, and the third is at present converted into an office, although its draperies have been allowed to remain. The large studio is capable of accommodating an orchestra of 30 to 40 musicians. The "Norag" orchestra, which forms part of the permanent staff of the station, consists of some 20 musicians conducted by Herr Kapellmeister Schink. The latter is a brilliant pianist and does not conduct his orchestra in the orthodox fashion, but occupies his position at the piano and beats time with his head in a manner which might be described as acrobatic.

Many of my readers who have tuned in this station have no doubt noticed the great number of complete plays and also operas which have been transmitted by



Broadcasting an open-air play entitled "A May Night on the Alster."

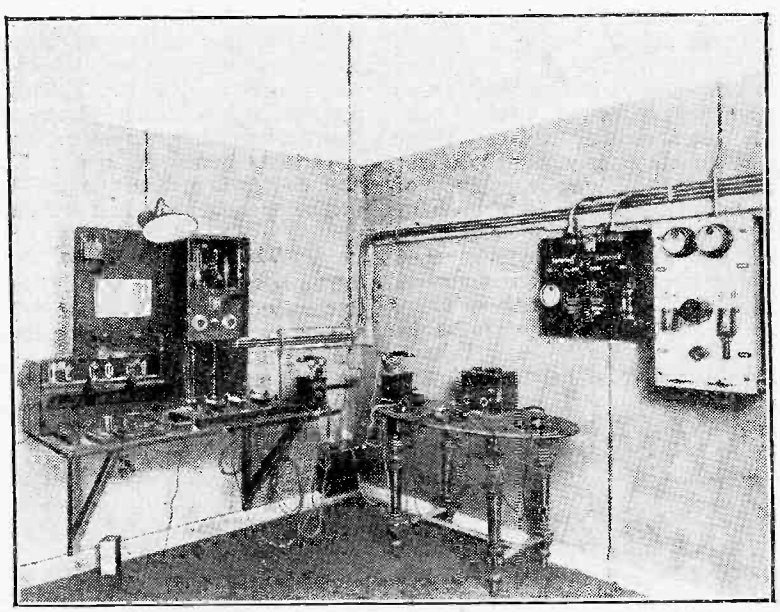
the "Norag." Some time before my visit, an open-air play was specially staged to be transmitted by this station; it was called "A May Night on the Alster," and is claimed to be the first radio play produced in the open for the special purpose of being broadcast. The Alster is a large lake situated in the midst of Hamburg, and is an excellent place for sailing, punting and canoeing.

The Microphone

The microphone which up till now has been in use at the Hamburg broadcasting station is of a type not far removed from the magnetophone used in this country. It is not suspended on sponge-rubber but rests on a pedestal and is enclosed in a wooden box. The mechanism consists of a thin strip of corrugated aluminium ribbon which is lightly stretched between the poles of an electro-magnet. The ribbon is free to vibrate, and these small vibrations produce changes in a magnetic field. Currents generated by these changes are amplified and applied to the modulating valve in the usual manner. This microphone is what might be described as the old one, but is still used for ordinary transmissions. A new microphone called the "Reis" microphone is at present being experimented with. A great deal is being said in favour of it, and it can be seen in the accompanying photograph of the studio. The Reis microphone is very simple in appearance and is enclosed in a solid block of white marble, which, it is claimed, renders resonance impossible. The instrument is subject to patents, and I was not able to find out its exact mechanism, although the engineer in charge kindly offered to take the instrument to pieces for my benefit. A couple of the screws were sealed, so I did not feel justified in allowing him to do this.

The Gong

The Hamburg station is known as the station which rings the gong, and speculations have often been made among British listeners as to what was happening with reference to this "gong-like" sound which has also been described as produced by silver bells. Herr Blankenese, the station director, kindly initiated

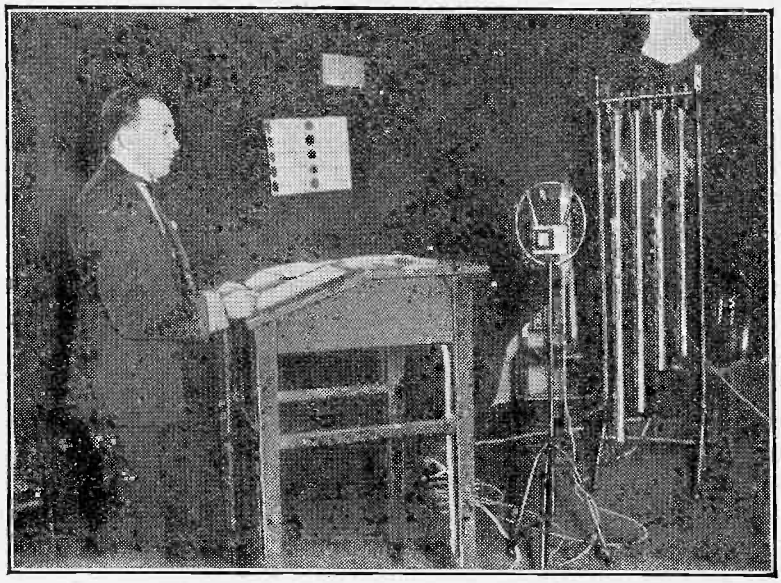


The control room at the Hamburg Station

me into the secrets of the profession, and showed me the champagne glass which produces this sound when rapped on the edge by the pencil of the announcer. I understand that a great number of glasses have been broken during this process since the opening day of the station.

A Unique Method

I think there is something in favour of the gong in the manner used at the Hamburg station. One rap means a minute interval; two raps, two minutes interval. These, however, are not in my mind the important gong signals. The



The author before the microphone on the occasion of his broadcasting from the Hamburg studio.

one of which I am in favour is the one gong which is struck immediately before the announcer speaks. This, I consider, draws the attention of the listener who has been waiting to the effect that something important is about to occur, like the heralding of kings of old. Without such a warning it often occurs, especially on long-distance reception, that the first word of the announcer is missed. The first word is often the most important, such as in "London calling"; and I have often heard from listeners abroad and noticed myself how difficult it is to identify the London station over great distances for this reason.

Striking the Hour

The chimes giving the time signal from the Hamburg station are not produced with champagne glasses but by means of tubular bells. By the aid of these bells a quarter-hour chime is produced and the announcer also strikes the requisite number corresponding to the hour. It may be interesting to note that the hour is struck in a different manner in Germany from the way clocks strike the hour in this country. The hour is always repeated after each quarter chime, and four chimes are given before the hour to denote a full hour.

In the accompanying photograph a certain number of keys will be observed affixed to the announcer's desk. These keys form part of a very elaborate mechanism which has recently been evolved by one of the Hamburg Post Office engineers. By means of this it is possible for the announcer to ring the chime desired. The whole mechanism is controlled electrically and acts on the instrument which has just been described. This new device is not yet in use, but will be operating within a few days.

The Control Room

The control room is adjacent to the studio. There the amplifiers can be seen for the station itself, the land-line running to the relay stations and also for simultaneous broadcast.

A noticeable feature might be mentioned with regard to the resistance utilised with the valves of all amplifiers in the station. This consists of what might be described as an auxiliary valve which contains a filament enclosed in hydrogen gas. The filament glows at a low red heat, and it is claimed that this maintains an absolutely constant current in the filament of the operating valve.

The Transmitter

The transmitting gear itself is housed on one of the top storeys of the building and employs one large Telefunken transmitting valve which is capable of handling approximately 4 kilowatts, but which is loaded to 1.5 kilowatts for the purpose of transmission. The filament takes 16 volts, and 1,500 volts are applied to the plate, which glows dull red when in operation. A small modulating valve is situated in the same panel and this alone forms the transmitting equipment. It is very much in the experimental stage. It is not proposed to change it for the present, as a new station is now under construction by the Nordische Rundfunk A-G., which it is hoped will be operating within the next three months. The same studio, will be used for this new station, but the transmitting gear will be installed some five miles outside the city, and 8 k.w. will be used.

The Generators

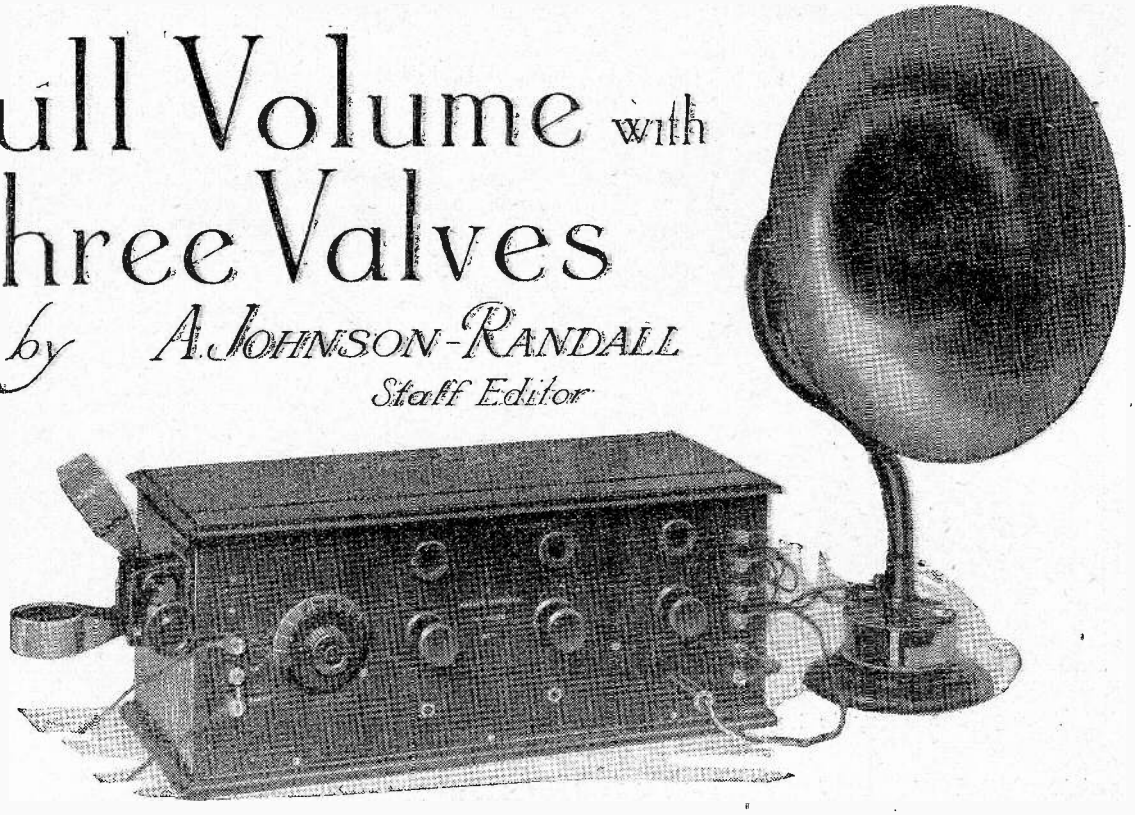
The generator room is on the second floor in the Post Office building. Current is obtained from a motor and two generators running on the same shaft. One of the generators produces 750 volts and the second 25 volts, the latter being used both for charging the accumulators and exciting the field of the high-tension generator. There are three such generator sets, two being in constant use and coupled in series in order to produce the 1,500 volts required for the plate current. The third group is spare. The low tension current for the valve filaments is supplied by a battery of large glass laboratory accumulators supplying twenty volts. There are two such batteries, one in use and one on charge.

Aerial Arrangements

The aerial is brought into the transmitting room by an ordinary ebonite leading-in tube, and the earth connection is made to the water mains. From the general aspect of the gear itself it can be described as exceedingly simple and unpretentious. It is obviously the original experimental gear which is still in use, and the results which will be obtained from the new high powered station will no doubt give a better idea of what the Nordische Rundfunk Gesellschaft A—G. is capable of doing with the backing of the Hamburg citizens.

Full Volume with Three Valves

by A. JOHNSON-RANDALL
Staff Editor



An attractive receiver in which, by means of a simple method of switching, one, two or three valves may be used as desired.

IN the March issue of MODERN WIRELESS I described the "Resistance Four," a four-valve receiver consisting of a detector and three stages of resistance-capacity coupled L.F. amplification. For the benefit of those who prefer transformer coupling I have decided to describe a receiver following a similar lay-out and capable of giving the same, or perhaps slightly less, volume and at the same time utilising a method of switching one, two, or all the valves into operation without the necessity for any alteration in the adjustments of the set. The constructor will therefore find it an easy matter to tune in a station on the 'phones using the detector valve only, to increase the strength of signals if necessary by adding a stage of low-frequency amplification, or to use all three valves for working a loud-speaker. The receiver is simple to manipulate, and the beginner will have no difficulty in operating it in an efficient manner. The problem of the best type of switching to employ is not easy to solve; but everyone will agree, I think, that the actual act of switching should be as simple as possible and that the complication in wiring should be as small as possible. I have constructed a very large number of sets, and in so doing I have tried practically every type of switching device, my conclusion being that the American plug and jack method is very difficult to improve upon for switching in low-frequency circuits. No readjustment of H.T. voltage is required, and it is so convenient to be able to add another stage or two of magnification by the insertion of a plug attached to the telephone or loud-speaker cords. Transformer coupling lends itself in particular to this method, for in the case of resistance-capacity coupling efficient switching is not so easy to arrange for on account of the readjustment of H.T. voltage so often necessary. With jack switching one may, if one so desires, light the filament of the valve to be used at the instant of inserting the plug, but while this has many advantages, I did not consider that these were sufficient to warrant the inclusion of a refinement of this nature in the receiver I am describing in this article. After all, it is only the matter of a moment to turn the required valve on or off by the

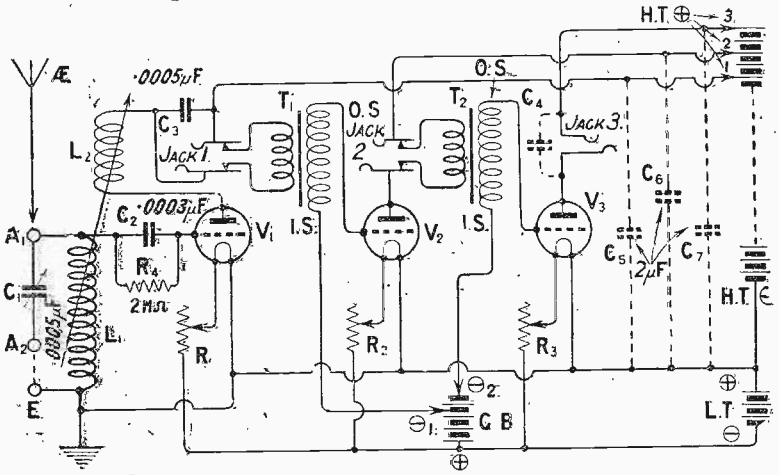
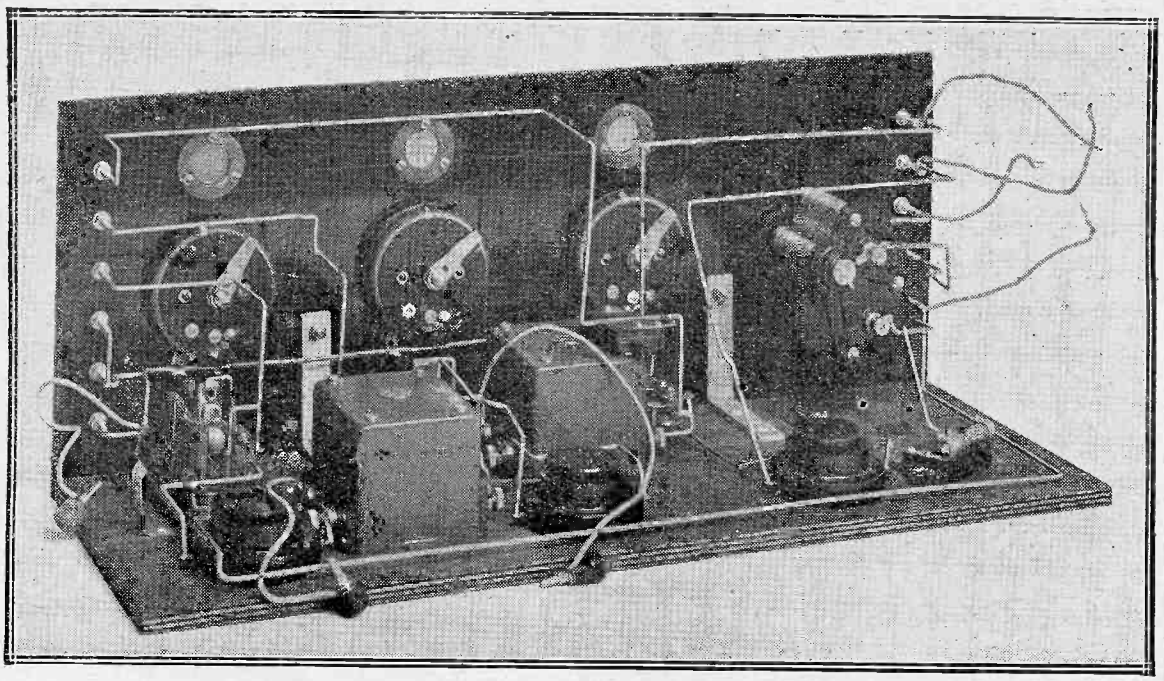


Fig. 1.—The theoretical circuit. The value of the condenser C_4 is best found by experiment.



The grid battery is held between the small spring clip shown on the left of the above photograph, and the cabinet.

partial rotation of the filament rheostat knob, and at the same time any extra complexity in the wiring is avoided.

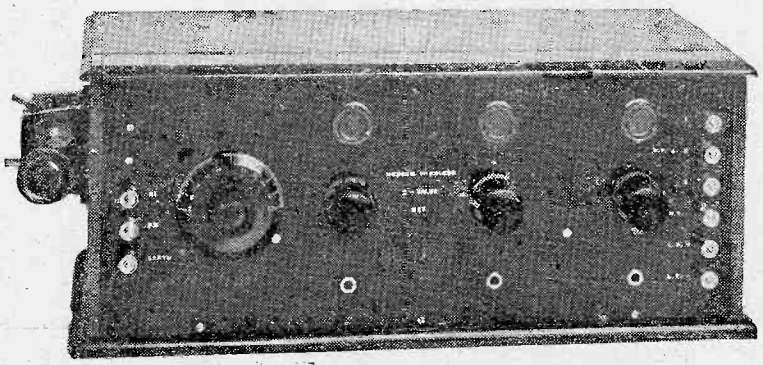
The Circuit

The circuit employed is straightforward in every respect, and it consists of a valve rectifier followed by two efficient stages of transformer coupled low-frequency amplification. The aerial circuit is tuned by a ·0005 μF square law type variable condenser, which may be placed either in series or in parallel with the aerial coil. Three positive tappings are taken from the H.T. battery in order that the correct voltage may be applied to the anode of the particular type of valve used, in accordance with the operating data which the makers in nearly every case supply with the valve. Reaction may be used when necessary. A clip-in condenser is connected across the two contacts of the jack in the plate circuit of the last valve, and is intended to be used as a loud-speaker tone control. The best value should be determined by experiment, and will probably be between ·002 μF and ·01 μF. It is, of course, better to employ an entirely separate tone-control and filter-unit as part of the loud-speaker equipment. In the same way the condensers C_5, C_6, and C_7, which are shown dotted in Fig. 1, should be considered essentially as part of the H.T. battery unit. They have not been included in the set itself.

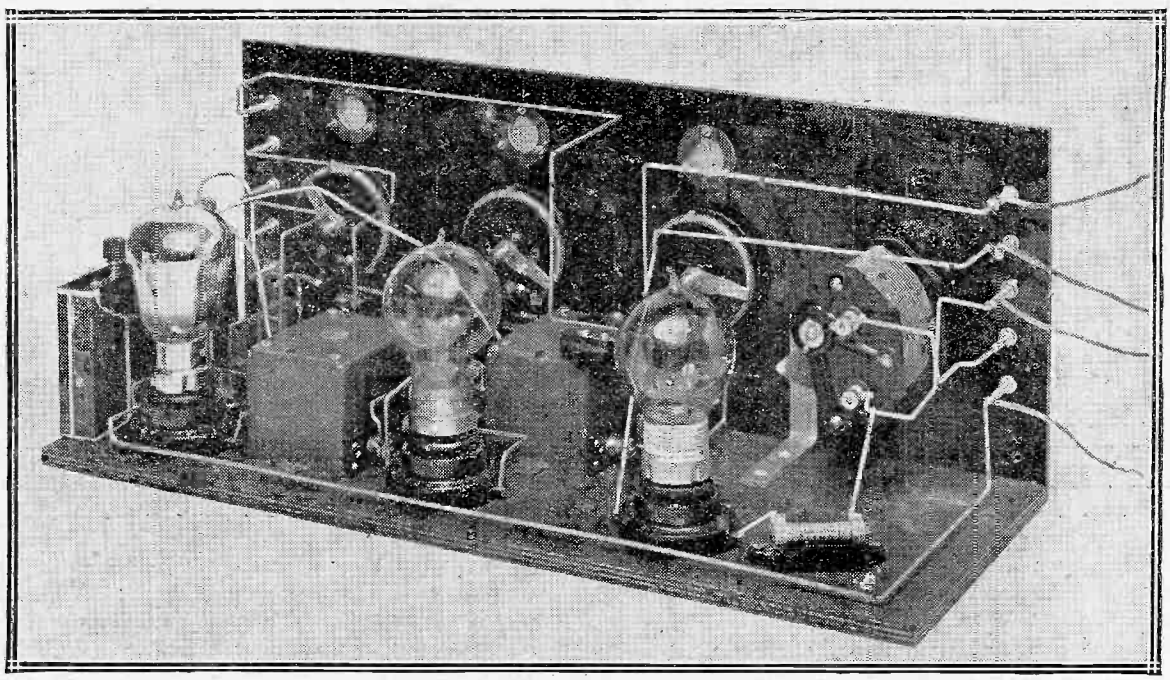
Components

The components actually incorporated in the set are as follows, but these could, of course, be replaced by others of equal quality :—

1 Mahogany cabinet with loose baseboard, size 18 in. by 7 in. by 6¾ in.—inside—(Carrington Manufacturing Co.).
1 Black ebonite panel, 18 in. by 7 in. by $\frac{3}{16}$ in. (Radion).
1 ·0005 μF variable condenser, square law pattern (Collinson's Precision Screw Co., Ltd.).
1 Two-coil holder (Peto-Scott Co., Ltd.).
3 Dual filament resistances, or resistances suitable for the type of valve used (Burndept Wireless, Ltd.).
3 Black nickelled valve windows (Grafton Electric Co.).
2 Double-circuit jacks (R. A. Rothermel, Ltd.).
1 Single-circuit jack (R. A. Rothermel, Ltd.).
1 Plug (R. A. Rothermel, Ltd.).
1 First stage L.F. transformer (Gambrell Bros., Ltd.).
1 Second stage L.F. transformer (Gambrell Bros., Ltd.).
3 "Antiphonic" valve holders (Burndept Wireless, Ltd.).
1 ·0003 μF grid condenser (Dubilier Condenser Co., Ltd.).
1 2 megohm grid leak (Dubilier Condenser Co., Ltd.).
1 ·0005 μF fixed condenser (Dubilier Condenser Co., Ltd.).
1 Clip-in condenser, complete with clips and base (L. McMichael, Ltd.).
2 Angle brackets for securing panel to baseboard (Henry Joseph and Co., Ltd.).



The complete receiver. Note the symmetrical lay-out.



The wiring is extremely simple and should present no difficulties.

9 Nickelled terminals, W.O. type (Burne-Jones and Co., Ltd.).
A quantity of square section tinned-copper wire, about 15 lengths (Sparks Radio Supplies).
A few 4 B.A. and 6 B.A. screws and nuts, and a short length of flex.
A set of Radio Press panel transfers.

Construction

The construction of the receiver is quite a simple matter, and the panel lay-out diagram, together with the wiring diagram, will enable the constructor to reproduce the actual receiver in the easiest possible manner. To carry out the construction efficiently the following tools will be required :—

A 12-inch steel rule.
A scriber.
A pair of dividers.
(These are necessary for marking out the panel.)
A good quality soldering-iron, a quantity of soldering paste or resin and some blow-pipe solder. The soldering bit should not be less than 8 oz. in weight.
An American drill and a set of twist drills.
A carpenter's brace, together with a $\frac{3}{8}$ in. twist drill with a square shank, and a $\frac{3}{4}$ in. drill for the valve windows. (A high-speed drill to take bits of this size would be very expensive, and is, in any case, not really necessary.)
A rose bit for counter-sinking.
A centre-punch and a small hammer or mallet.
A screwdriver.
A pair of side-cutting pliers and a pair of long-nose pliers suitable for wire bending.

These are the essential tools, but in addition a set of B.A. spanners, some files and a supply of emery cloth will be found useful.

Marking Out

First mark out the panel by means of the steel rule and scriber to the dimensions given in Fig. 2. The spacing for the terminals is set off with dividers. The top terminal is placed on the centre line through the valve windows, and the bottom one on the centre line through the jacks. The distance between these two centre lines is divided into *five* equal parts, thus giving the *four* equidistant points for the remaining terminals. The three terminals and the two 6 B.A. screws on the left of the panel are spaced out in a similar manner. The holes for the valve windows are $\frac{3}{4}$ in. in diameter, and drilling should be carried out from both sides of the panel after first running a $\frac{1}{16}$ in. pilot hole through the centres. The fixing screws are spaced equidistant round a 1 in. diameter circle, and it is a good plan to use the metal back-ring as a template. The filament resistances are supplied complete with drilling template, and are therefore easily mounted.

The $\frac{3}{8}$ in. drill used for the spindle clearance hole will also serve quite well for mounting the jacks, although a slightly smaller drill would in some cases be an advantage. The terminals used have 4 B.A. shanks, and a 4 B.A. clearing drill is therefore required. This same drill should also be used for the two holes which secure the angle bracket to the panel.

The two reaction leads are held by means of two 6 B.A. screws and nuts on the left of the panel above the aerial and earth terminals. Two flexible leads are soldered to these screws and taken through the cabinet to the moving socket of the coil holder, the other two flexible leads being taken from A_1 and Earth to the two screws on the fixed socket. Sufficient slack should be allowed for the free movement of the moving socket through its arc.

Mounting Components on the Baseboard

The setting out of the components on the baseboard is quite straightforward, and the lay-out can be followed by reference to Fig. 3. It is as well to mention that the valves are not placed directly behind the valve windows, as this is not convenient in this case, and in practice it is just as easy to view the valves through the windows in the positions in which they are placed as it would be if they were allotted a position in a direct line behind them. The actual wiring of the receiver should be carefully followed from the diagram, especially the connections to the jacks.

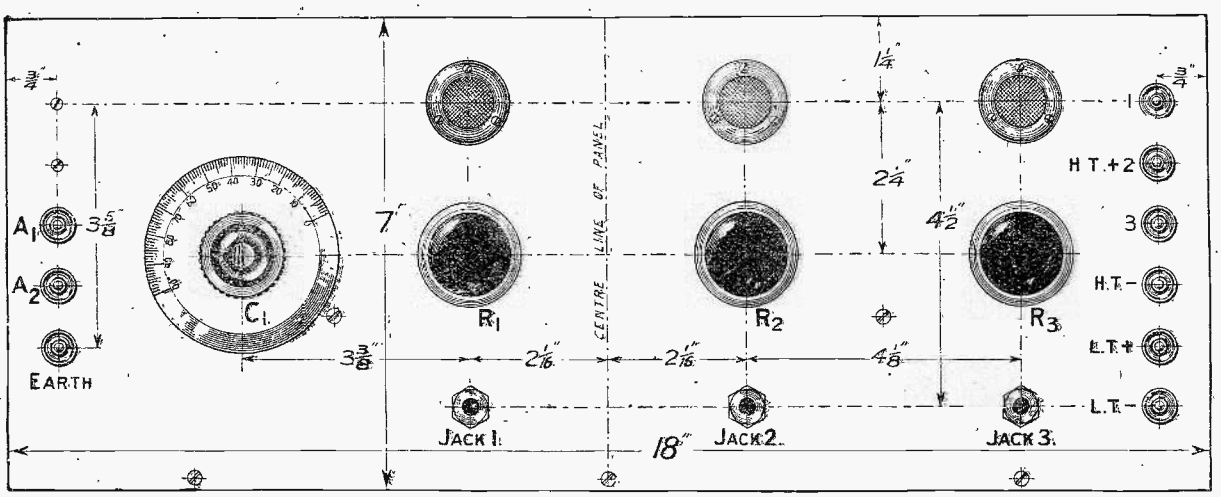
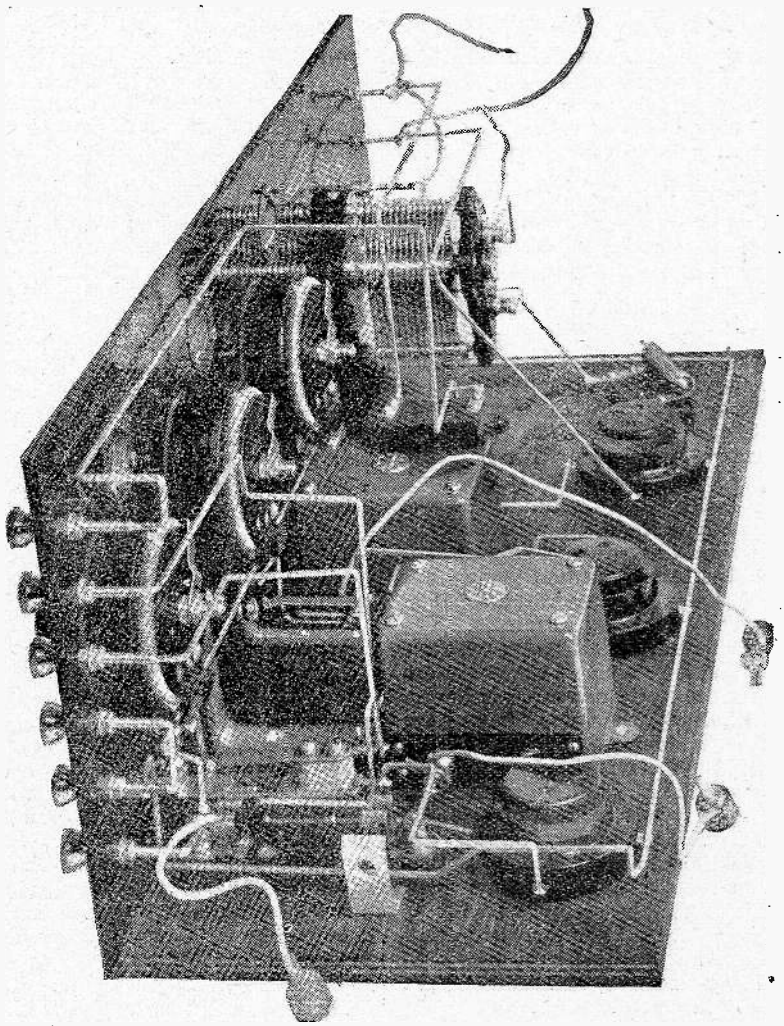


Fig. 2.—The panel lay-out, blue print (full size) No. 121a, price 1s. 6d. post free, may be obtained from the Sales Dept.

It is as well to wire up the filament resistances first and then to place the transformers in position. A good hot, clean iron is essential, and a non-acid flux should be used. A ·0005 μF fixed condenser is connected across the two outside tongues of jack No. 1, and I consider this value to be sufficiently large for the purpose; in fact, it is often possible to use even a smaller size, such as ·0003 μF. In any case the smallest value consistent with adequate reaction control should be used.



The two grid bias negative plugs are joined direct to L.S. terminals of the transformers by means of two short lengths of flex.

Operating the Set

To operate the receiver, connect up the low-tension battery to the terminals marked L.T. + and L.T. – and a high-tension battery of 100–120 volts to the terminals marked H.T. + 1, 2, 3, and H.T. –. Do not insert the three positive plugs until the valves have first been inserted and the filaments lit. To do this, rotate the rheostat knobs clockwise. If bright emitter valves are preferred, I recommend that you use two of the general purpose type for the rectifier and first L.F. and a small power-valve, such as an M.O. D.E.5, D.E.4, B.T.H. B.4, Mullard D.F.A.6, or D.F.A.1 in the last stage. Some of these valves work from a 4-volt accumulator and others are intended for one of 6 volts, but it is solely a matter for the constructor to decide, as all of them will give excellent results. The equivalents of these valves in the 2-volt or ·06 type will be found equally satisfactory. Assuming two general purpose valves and one of the small power type to have been inserted in the valve holders, the following values of H.T. and grid bias should be taken as a rough guide: H.T. + 1 about 60 volts, H.T. + 2, 80 – 120 volts, and 1·5 – 3 volts grid bias, and H.T. + 3, 120 volts and 6 volts grid bias. These values vary, of course, with the type of valve used, and the maker's instructions should be adhered to. Place a No. 50 or 75 coil in the reaction coil socket of the two-coil holder and a No. 35 or 50 in the fixed socket. Place

the aerial tuning condenser in parallel by connecting the aerial lead to A_1, joining A_2 and "Earth" together by means of a piece of wire, the earth-lead being taken to the terminal marked "Earth." Keep the reaction coil well away from the aerial coil and, assuming that the valves are lit to a suitable degree of brilliancy, rotate the aerial tuning condenser dial until signals are heard. Then bring the reaction coil nearer to the aerial coil and note whether signals increase in strength.

When the telephone or loud-speaker plug is inserted in jack 1 the detector valve only is in operation. Upon inserting the plug in jack 2 a stage of low-frequency amplification is added, and the insertion of the plug into jack 3 brings all the three valves into use. As the two stages of low-frequency amplification will only be necessary in most cases for loud-speaker work, provision is made for the tone condenser C_4 across the last jack only.

Test Report

The set was tested on my main aerial in Kent at a distance of about 15 miles from 2LO, and which consists of a single wire 100 feet in length and 35 feet (average) in height. Using a large G.A.V. loud-speaker the local station is uncomfortably loud and the receiver gives adequate volume with the reaction short circuited. The correct coils to use with the A.T.C. in parallel, *i.e.*, with the aerial joined to A_1, and A_2 and "Earth" connected together, are a No. 35 in the aerial socket and a 35 or 50 for reaction. The efficiency of the aerial used largely decides the size of reaction-coil, and in some cases perhaps a No. 75 will be necessary, although this is, of course, an indication of a poor aerial system. Using Gambrell coils an "A" in the aerial and an "a" for reaction should suffice, but in certain cases an "A" or "B" will be required. If a large reaction coil must be used for good results, I would strongly advise the listener to improve his aerial and earth.

No difficulty was experienced in tuning in several Continental stations on the loud-speaker after dark, using all three valves, and the French station at Toulouse comes in on the detector and one stage of low-frequency amplification only. In daylight Birmingham can be received at fair strength, but Bournemouth, although audible, is somewhat weak. At night, when the conditions are favourable, it should be possible to receive several of the other B.B.C. stations, but these would not be called real loud-speaker strength. With the A.T.C. in series, a No. 50 coil will serve for the lower B.B.C. band of wavelengths with a No. 75 for those above 400 metres. A small reaction coil, such as a No. 25 or 35, should be used. I have, using a set of this type, found it possible to receive the American short wave station KDKA, employing as a secondary coil a Gambrell "a/2" in the aerial socket with 5 turns of No. 18 s.w.g. d.c.c. wire wound loosely round the outside to form the aperiodic aerial coil. An "a/2" or "a" will serve for reaction. Tuning, of course, is very critical, and the results are not so good as would be obtained using a low-loss short wave receiver.

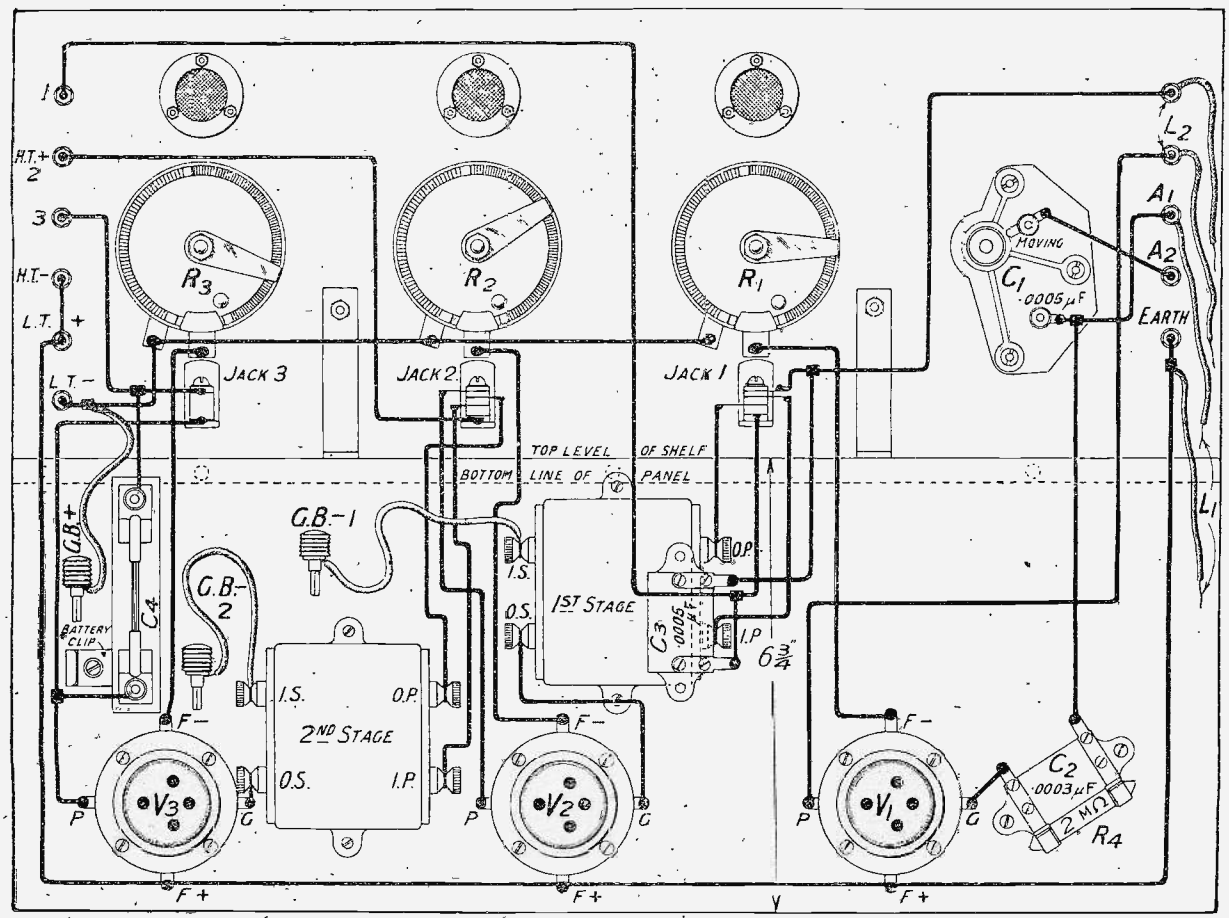
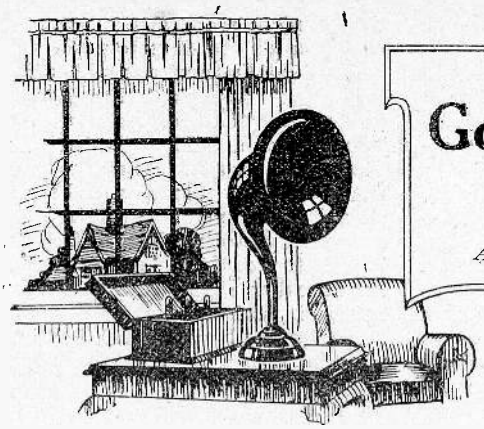


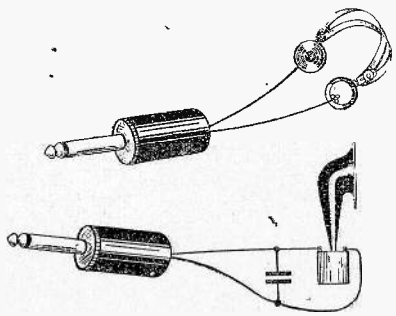
Fig. 3.—The wiring diagram, blue print No. 121b, price 1s. 6d. post free. The inside contacts of jacks 1 and 2 are connected to the primary terminals of the transformers.



Good Ways of Arranging Four Valves

A description of some practical circuits suitable for general loud-speaker work.

NOW that the wireless set has come to be regarded as an indispensable piece of furniture in many homes, there is a demand for a type of receiver which will give consistently good reception of the broadcast programmes. For the man whose main concern is experiment, and by whom broadcasting is regarded as only one type of available transmission among many, circuit arrangements employing one or two valves may suffice. But those who desire rather to reap the full benefits of the programmes provided by the broadcasting stations, not only in Great Britain, but all over Europe, need a type of circuit which can be reasonably certain to fulfil their requirements at any time. When listening to the programmes from their local broadcasting station, they dislike being permanently attached to the set by head-telephones, preferring the complete freedom afforded by the use of a loud-speaker.



The use of plugs and jacks enables the telephones or loud-speaker to be inserted in an instant.

Some, too, wish to hear the foreign transmissions, selecting for preference those that can be reproduced at reasonable strength on a loud-speaker. Finally, many like to feel that their set is capable of bringing in the more distant stations, even though headphones are necessary for this purpose.

Many Circuits Available

The requirements outlined may be filled by a receiver containing four valves. Many combinations of this number of valves are possible, and it is proposed to indicate here a few practical circuits. Receivers constructed in accordance with the diagrams given will not be found unduly complicated to control, a point which will appeal to those who feel alarmed at the sight of a large number of dials and switches on the panel of a receiver. A few

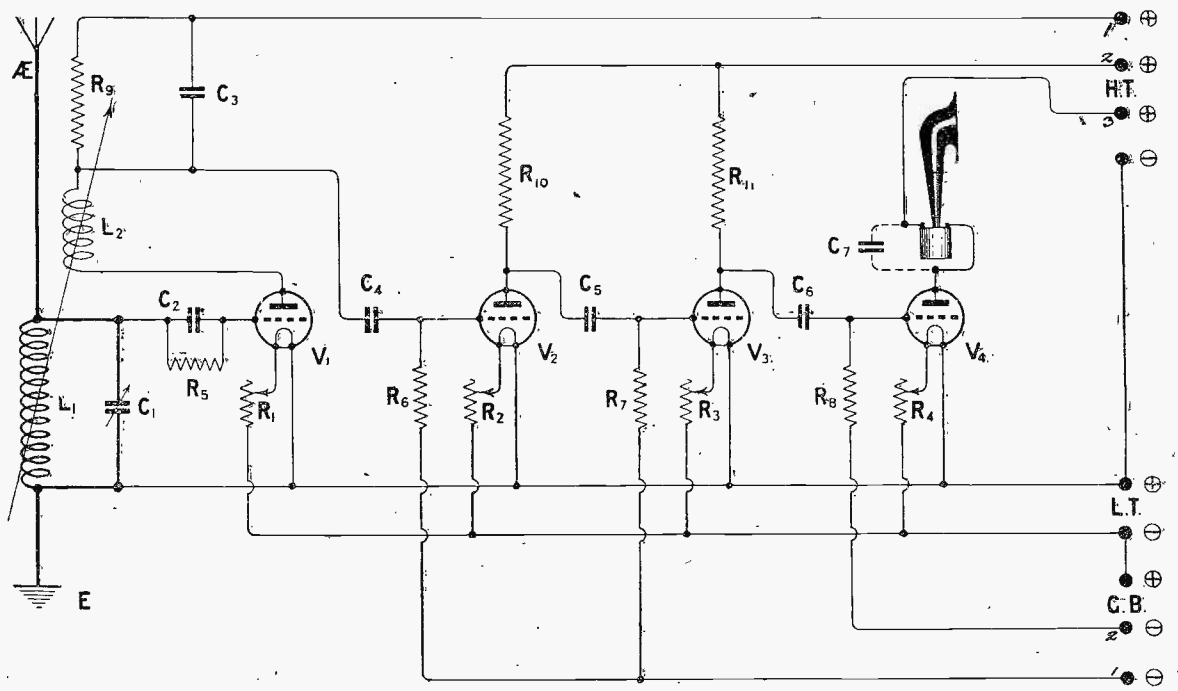


Fig. 1.—A circuit suitable for loud-speaker reception from the local station. Good quality is assured by the use of resistance-capacity low-frequency amplification throughout.

remarks on the peculiar merits of each circuit and the general purpose for which it is suitable will be included.

In all the circuits shown, provision is made for the application of the correct anode potential to each valve separately, enabling valves performing different functions in the circuit to be operated efficiently. Another point to note is that condensers are shown dotted across the loud-speaker terminals: no values are given for these, since the capacity required by any loud-speaker on different types of transmission is a matter for individual experiment.

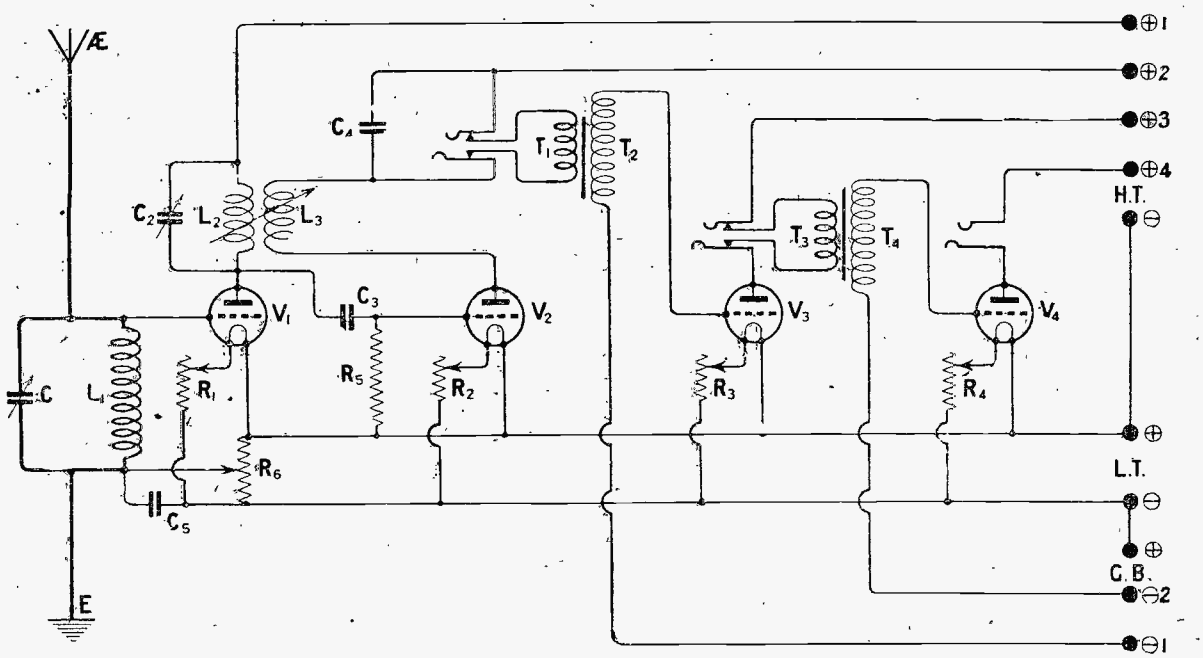


Fig. 2.—This circuit contains a stage of high frequency amplification, and has therefore greater range than the previous circuit. Two stages of transformer coupled low frequency amplification are employed.

Local Reception

Referring to the circuit diagram of Fig. 1, it will be seen that this consists of a detector valve, followed by three stages of resistance-capacity coupled L.F. amplification. The operation of this circuit may be briefly summarised as follows:—The circuit L_1 C_1 is tuned to the incoming oscillations, and varying potentials are applied between grid and filament of the detector valve V_1, the usual grid condenser C_2, and leak R_5, being provided. The coil L_2, in the anode circuit of V_1, may be coupled to L_1, to produce reaction effects; but care should be taken not to couple the coils so closely as to cause self-oscillation and consequent interference with other listeners. The rectified currents in the anode circuit of V_1 set up varying potentials across the resistance R_9, by which means they are communicated to the grid of V_2 via the condenser C_4; the grid of this valve is maintained at the correct potential by means of the leak R_6, which is connected to the filament via a suitable grid bias battery. The condenser C_3, which may have a value of about ·0005 μF, is shunted across R_9 in order to bypass the high frequency component present in the anode circuit of the detector valve.

The remaining L.F. amplifiers V_3 and V_4 operate in a similar manner. The anode resistances R_9, R_{10}, and R_{11} may be of the order of 100,000 ohms, and it should be noted that there will be considerable voltage drop across these resistances, so that a higher value of H.T. than the normal must be used to compensate for this. A suitable value for the grid condensers C_4, C_5 and C_6 is ·25 μF, while .5 megohm leaks will serve for R_6, R_7 and R_8.

By means of the separate grid bias terminal for V_4, the use of a suitable power valve in this position with full anode voltage is made possible. This applies also to the circuits which follow. No provision is made in the circuit of Fig. 1 for altering the number of valves in use, this circuit being intended for use on local broadcasting in a situation in which quality and good volume are the principal needs.

Volume and Range

Where, however, the nearest broadcasting station is at a greater distance than, say, 30 miles from the receiver, it becomes advisable to use one or more stages of high frequency amplification before the detector, in order that the variations of potential applied to the grid of the detector may be large enough to ensure its efficient working. In the circuit of Fig. 2, V_1 functions as high frequency amplifier and V_2 as detector, two stages of transformer coupled amplification being added to provide sufficient energy for a loud-speaker. As in the previous circuit, coil L_1 may be a No. 35 or 50 for the broadcasting wavelengths; L_2 may each be a No. 50 or 75, the smaller size being used as the reaction coil. Values of ·0005 μF and ·0003 μF will serve for the tuning condensers C_1 and C_2 respectively.

In this circuit the varying potentials applied to the grid of V_1 by the incoming oscillations present in L_1 C_1 produce amplified oscillations in the anode circuit of V_1, in which the circuit L_2 C_2 is also tuned to the desired frequency. The consequent varying potentials across L_2 C_2 are applied between the grid and filament of V_2, which acts as a detector, the usual grid condenser C_3 and leak R_5 being provided. When the circuit L_2 C_2 is tuned to the same frequency as L_1 C_1, self oscillation of V_1 may occur, due to the inter-electrode capacities of the valve. To counteract this, a potentiometer, R_8, of 400 ohms resistance, is connected across the filament

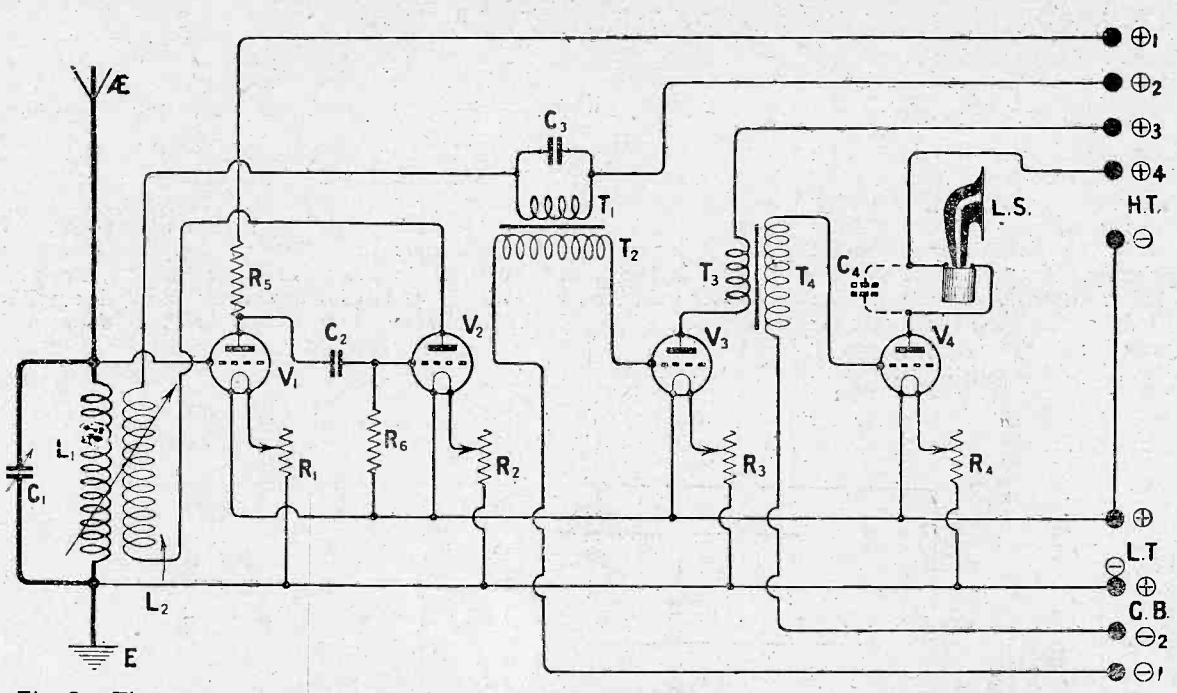


Fig. 3.—The above circuit is very simple to handle, requiring only two adjustments—variation of C_1, and the coupling between L_1 and L_2. Similarity will be observed between this circuit and that of Fig. 2.

battery, and the grid of V_1 is connected via L_1 to the sliding contact, thus enabling a suitable potential to be applied to the grid to damp out self-oscillation.

In the anode circuit of V_2 the coil L_3 is coupled back to L_2 to produce reaction effects. In series with L_3 is the primary T_1 of the L.F. transformer T_1 T_2, by means of which the energy is transferred to V_3. The condenser C_4 serves the same purpose as C_3 in Fig. 1, and may have the same value.

Plugs and jacks enable the loud-speaker to be placed in the anode circuit of V_3 or V_4. Telephones may be inserted in the anode circuit of V_2 for tuning purposes, after which the L.F. stages are brought into circuit.

Simplicity of Operation

Simplicity of control is a feature which makes a wide appeal: the diagram of Fig. 3 shows a circuit which has only two main tuning controls, the tuning condenser C_1 in the aerial circuit L_1 C_1, and the reaction control provided by coupling the coil L_2 to L_1. Care is necessary in the handling of this form of reaction coupling, or the aerial will be energised to the annoyance of other listeners. The operation of this receiver is essentially similar to that of the circuit of Fig. 2 described above, with the exception that for the "tuned-anode" system employed in Fig. 2 there is substituted an anode resistance R_5, whose value may be

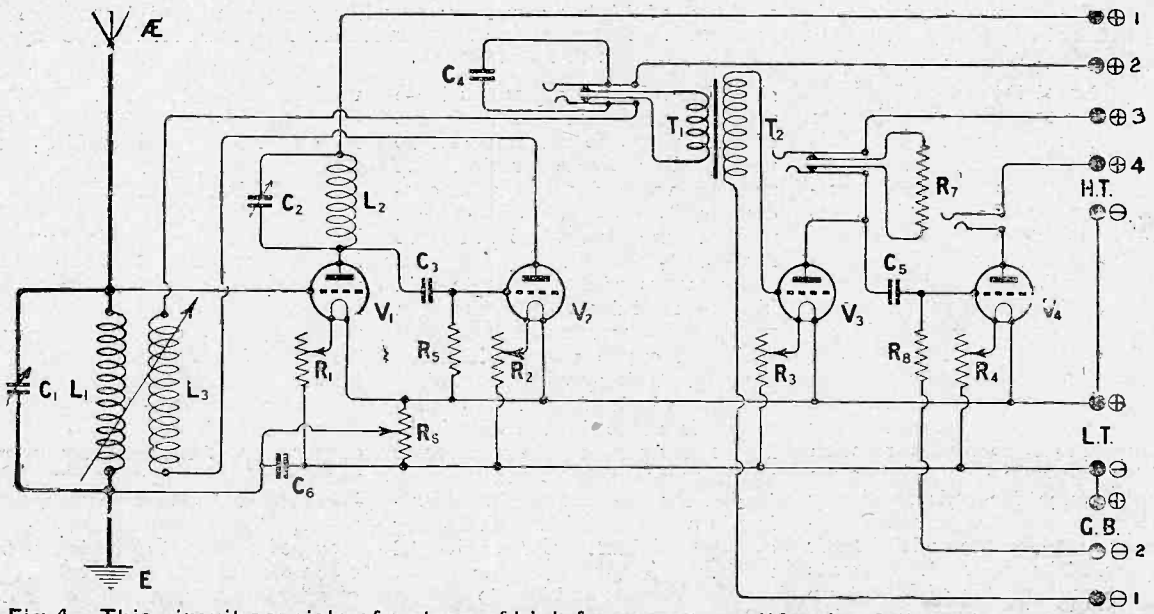


Fig. 4.—This circuit consists of a stage of high frequency amplification followed by a detector and two low-frequency amplifying valves. Good quality is obtained without great sacrifice in volume by the combination of transformers and resistance-capacity couplings.

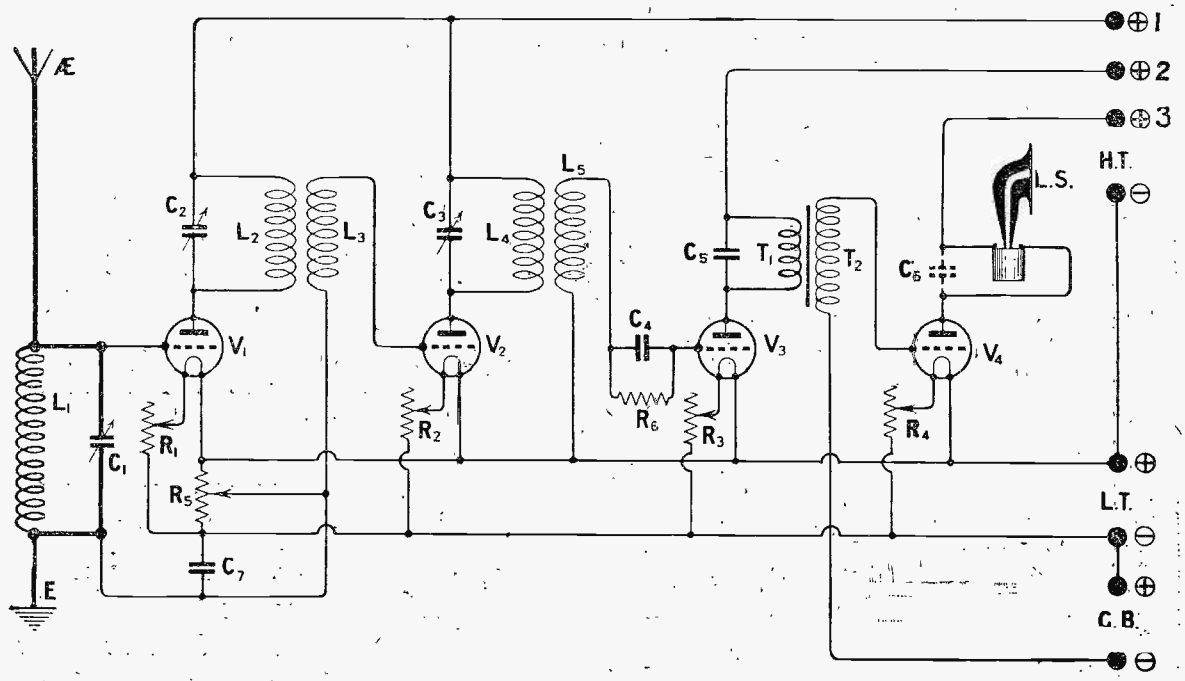


Fig. 5.—Considerable range is possible with this circuit, two stages of high frequency amplification being employed, followed by a stage of low-frequency amplification for loud-speaker working.

80,000 ohms. The remainder of the circuit is similar to Fig. 2, and the values of components may be the same as those given for that circuit. This resistance-capacity method of high frequency coupling will function over a wide band of frequencies, no tuning adjustment being required, but it is not efficient on wavelengths below about 1,000 metres. This circuit therefore is recommended for the reception of the long-wave broadcasting stations, such as Chelmsford and Radio-Paris. For this purpose L_1 may be a No. 150 coil, and L_2 a No. 200, C_1 having a value of ·0005 μF.

Quality with Volume

The circuit depicted in Fig. 4 is again essentially similar in operation to that shown in Fig. 2, with the exception that reaction is provided by coupling the coil L_3, in the anode circuit of the detector valve V_2, to the aerial coil L_1, instead of to the anode coil L_2 of the high frequency amplifying valve V_1; also resistance-capacity coupling is substituted for transformer coupling in the second stage of low frequency amplification. Resistance-capacity coupling is to be preferred for the second stage of L.F. amplification, when really good quality of reproduction is desired: the volume of sound obtainable in this manner is not so great as that given by transformer coupling, but comparative freedom from distortion is assured.

A suitable valve, designed specially for resistance-capacity coupling, should be used for V_3, in order to obtain the best results. As in Fig. 2, provision is made in this circuit for using 2, 3 or 4 valves as required, the telephones and loud-speaker being permanently connected to jacks which can be plugged in at the desired point.

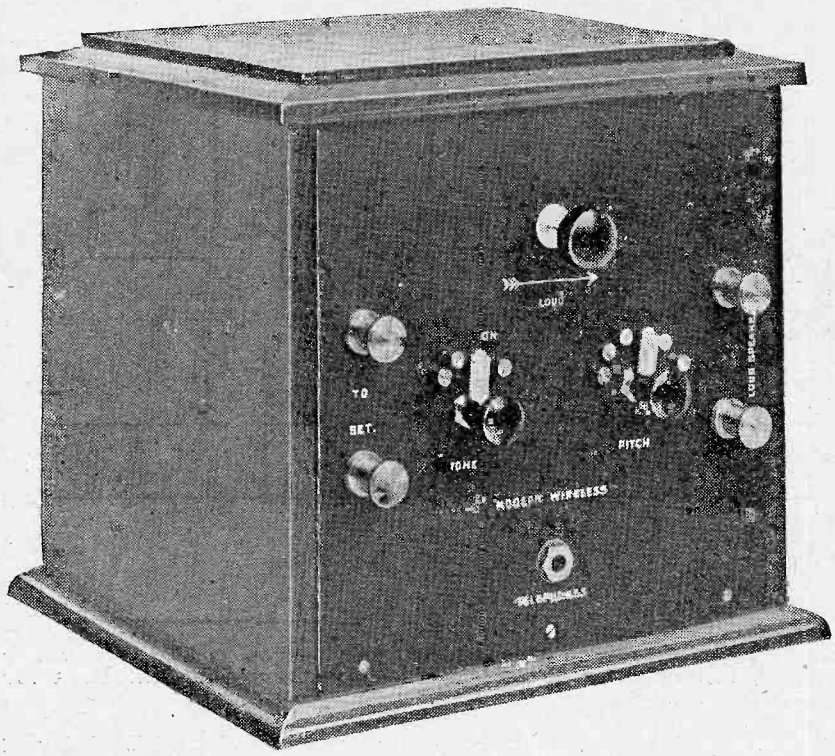
Greater Range

Some people are unfortunate enough to be situated in districts which are somewhat remote from a broadcasting station, or which are "blind" from the point of view of reception. For them, and for those who wish to receive some of the Continental stations at moderate loud-speaker strength, the circuit of Fig. 5 will be found suitable. Two stages of H.F. amplification precede the detector, so that weak incoming oscillations are considerably amplified before rectification, enabling the detector to operate efficiently. A single stage of L.F. amplification provides sufficient energy to operate the loud-speaker.

The operation of the H.F. stages in this circuit is in principle similar to that of Fig. 2, except that no reaction is provided. The amplified oscillations in the tuned circuit $L_2 C_2$, L_2 being the primary winding of a high frequency transformer, cause varying potentials to be set up across the secondary winding L_3, since this is in a position of fixed close coupling to L_2, these varying potentials being thus applied across the grid and filament of V_2. The operation of the second transformer L_4 L_5 is similar. As high frequency amplifying valves used in this manner are prone to self-oscillation, the grids of both V_1 and V_2 are connected to the slider of the potentiometer R_5, the resistance of which may be 400 ohms; by suitable adjustment of the slider sufficient damping can be introduced into the grid circuits of V_1 and V_2 to stabilise their operation.

The coil used for L_1 in this circuit may be a No. 35 or 50 for British broadcasting, while the H.F. transformers should be suitable for the wavelength band to be covered.

For use in conjunction with those circuits in which plugs are incorporated for inserting the telephones or loud-speaker, a suitable arrangement of these components is shown in the small diagram. The telephones and loud-speaker are permanently attached to the plugs, the value of the condenser across the loud-speaker being best determined by trial. Care should be taken in connecting the leads to the plugs to see that the positive lead from the telephones or loud-speaker is connected to the H.T. + lead when the plug is inserted; if all the jacks also are connected up the same way round, there will be no fear of injuring the permanent magnets in the ear-pieces.



A Filter and Tone-Control Unit

By

C. P. ALLINSON.

This unit will be found particularly valuable by those who desire to obtain the best results from their loud speaker.

Almost desirable addition to any multi-valve receiver working a loud-speaker is a filter circuit which isolates the loud-speaker so that the steady current flowing in the plate circuit of the last valve does not pass through its windings. With the present small power valves so frequently used in L.F. amplifiers the actual steady plate current may have quite a large value, and by the use of a filter circuit all possible risk of injury to the delicate windings of the loud-speaker is eliminated.

Further, in order to get the greatest possible purity of reproduction, a very real consideration to all listeners with a critical ear, some form of tone and volume control is needed.

A Convenient Size

The unit here described combines the various requirements set out above, and also in order that telephones may be substituted for the loud-speaker with the least trouble, a jack is used.

The photograph shows the neat appearance of the unit, and its symmetrical lay-out will be readily appreciated. Contained in a mahogany or an oak cabinet, it can be made to match with the receiver in use, and the one shown will match very well with a receiver built into an "All Concert" cabinet.

Fig. 2 shows the theoretical circuit diagram. The choke coil L_1 and the condenser C_1 combine to form an efficient filter circuit, effectively isolating the windings of the telephones or loud-speaker

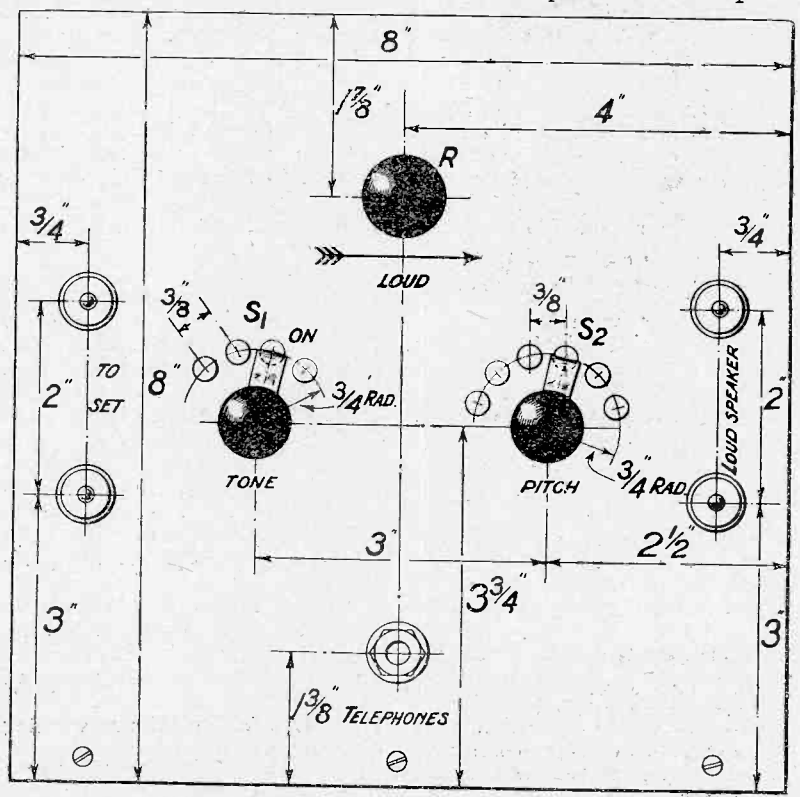
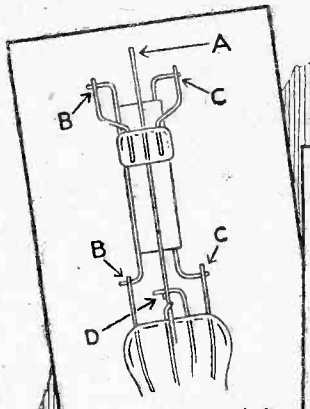
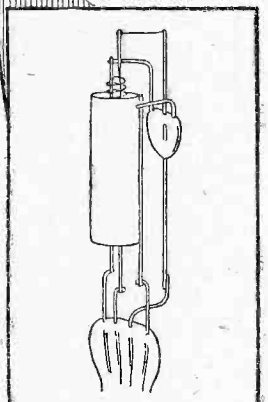


Fig. 1.—The panel lay-out. The loud speaker is automatically cut out when the telephone plug is inserted in the jack.

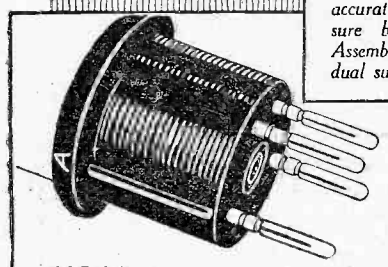
Get the *best* out of your set!



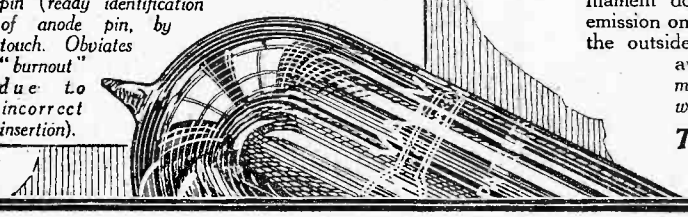
D.E.3 electrode system, front view. Spot welded at A (filament support), B (anode support), C (grid support), and D (filament support).



D.E.3 electrode system, side view. All parts accurately made to measure by machine jigs. Assembled under individual supervision.



All-Bakelite base. Low self-capacity. Wide collar at top (firm grip for inserting and withdrawing valve). Moulded rib on same side as anode pin (ready identification of anode pin, by touch. Obviates "burnout" due to incorrect insertion).



To get the best out of your set, put the best into your set. Fit the right valve for your individual needs.

The most efficient electrode system for one type of valve is not necessarily the best for other types. The electrode system of each type of the "*Valve in the Purple Box*" is the result of scientific determination of the best design for the conditions under which it is to be used.

A noteworthy example is

TYPE D. E. 3.

a general purpose valve for use with dry batteries, or 4-volt accumulators.

REDUCED PRICE 16/6

Outstanding features :—

FILAMENT.

Although current consumption is only .06 amp., electron emission equals that of bright emitter taking over twelve times the current. The filament does not depend for its emission on a substance coated on the outside which rapidly wears away in use. The *active material* permeates the *whole* of the filament.

GRID.

Special machinery provides for abnormally high exactness of manufacture. Spiral grid, each turn welded to grid support. Full control over electron emission ensured.

PLATE.

Most rigid construction employed (spot welding). Active portion of filament *entirely* enclosed.

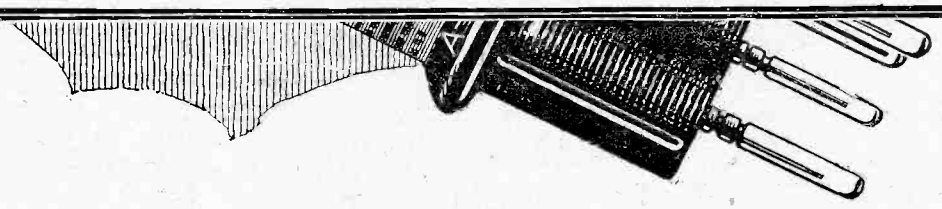
The most economical valve in the World!

MARCONI VALVES

MADE AT THE OSRAM LAMP WORKS

SOLD BY WIRELESS AND ELECTRICAL DEALERS, STORES, ETC.

Get the Valve in the Purple Box!



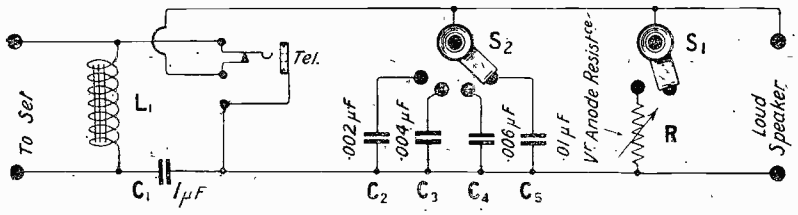


Fig 2.—The theoretical scheme of connections.

from the steady plate current. This choke, however, offers a very high impedance to all fluctuating currents.

It is important, of course, that the choke should have a high impedance, or else a loss in signal strength may result.

By means of the switch S_1 it is possible to connect a variable resistance across the loud-speaker (a variable anode resistance is used), thus giving control over volume as well as helping to reduce any resonance effects that may be present in the loud-speaker windings.

The switch S_2 allows one of four condensers (C_2, C_3, C_4 or C_5) to be connected across the loud-speaker terminals, thus giving a very effective control of pitch. The values of these condensers are: C_2, .002 μF, C_3, .004 μF, C_4, .006 μF, C_5, .01 μF, and different values will be found best under different reception conditions. With very loud signals, the large size condenser may be used with advantage, especially with some loud-speakers. Different types of received signals will require different capacities according to their tone and strength.

Different Values Should be Tried

Speech, for instance, will be most clearly received with one value, an instrumental solo with another, and orchestral items with another; while the use of clip-in condensers allows further values than those given to be tried.

The loud-speaker being connected to the terminals marked L.S., telephones may quickly be substituted by plugging them into the jack shown in the circuit diagram, and on withdrawing the plug the loud-speaker is automatically placed in circuit.

The following components are required, and for the information of constructors who may wish to follow the design of the unit described in every detail the makers' names are given:—

1 Ebonite panel, 8 in. by 8 in. by ¼ in. (Paragon).
1 Cabinet for same with loose base board, 7½ in. deep (W. H. Agar).
1 L.F. choke (Grafton Electric Co.).
1 1 μF condenser (Telegraph Condenser Company).
1 Single-circuit jack (Elwell Wireless, Ltd.).
1 Plug (Elwell Wireless, Ltd.).
2 Sets switch parts (Bowyer-Lowe Co., Ltd.).
1 Variable anode resistance (Bretwood, Ltd.).
4 Clip-in condensers and mounts. Values required are .002, .004, .006 and .01 μF (L. McMichael, Ltd.).
4 Large lacquered brass terminals (Burne-Jones and Co., Ltd.).

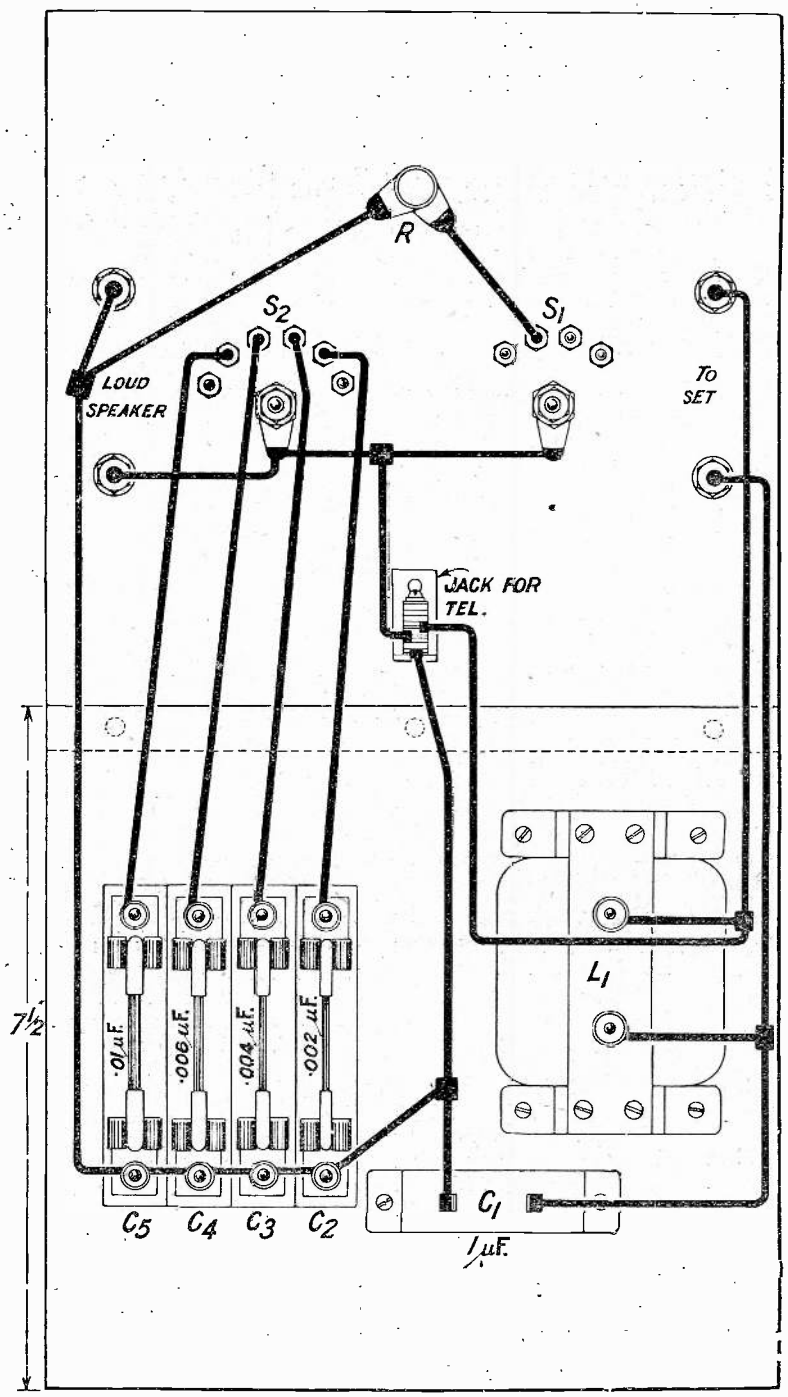


Fig. 3.—The wiring diagram. The values of the clip-in condensers should be experimented with until best results are obtained.

1 Set Radio Press panel transfers. Square tinned wire for connections.

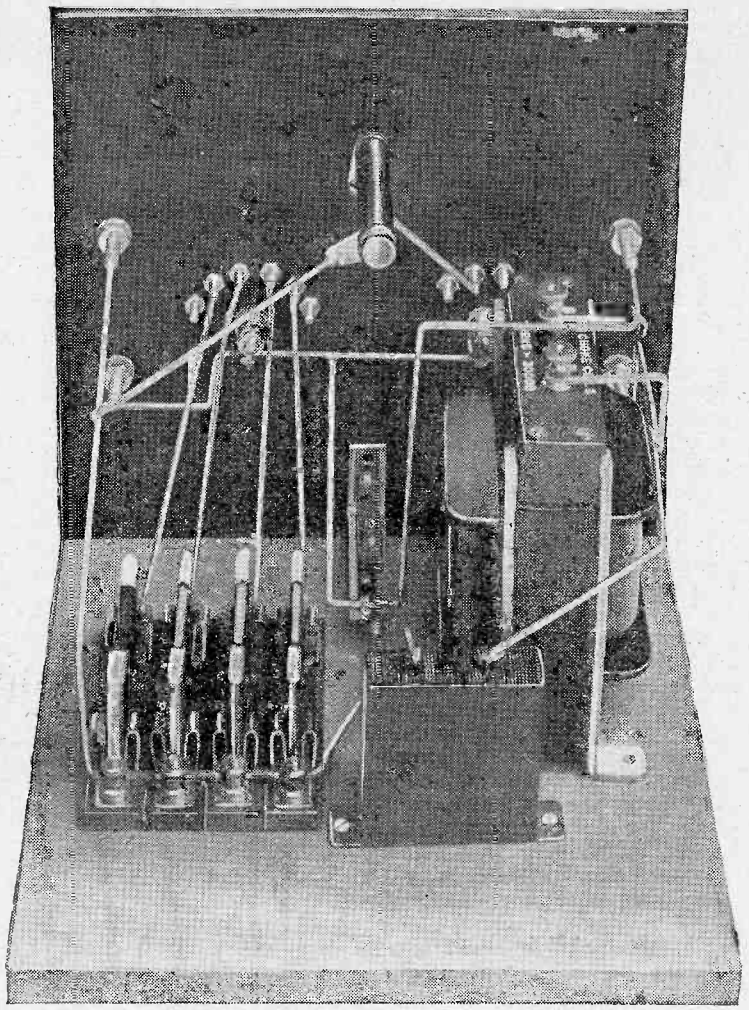
The construction of the unit is a simple matter. If guaranteed ebonite is used time and trouble will be saved that would otherwise have to be expended in removing the surface of the panel and its attendant risk of leakage. If the panel has to be rubbed down, use glass-paper (sometimes called sand-paper) in preference to emery. The latter has the tendency to work into the surface of any material to which it is applied.

The panel lay-out in Fig. 1 will show you where to drill the various holes, and the wiring diagram shows the lay-out of the base-board. Having mounted the two switches, jack, variable anode resistance, and terminals on the panel, fix this to the base-board and screw down to the latter the components which are to be carried thereon.

The connections to be made are clearly shown in Fig. 3, and should present no difficulty.

To connect up the unit, join the two terminals marked "To set" to the output or loud-speaker terminals of your receiver. The loud-speaker is then connected to the terminals so marked, and telephone tags are placed into the two screw-down connectors in the plug. When the 'phone plug is inserted in the jack the loud-speaker is automatically cut out of circuit and *vice versa*. A little experiment will soon show the best value of capacity across the loud-speaker for good reproduction.

The completed unit is a refinement that will enable one to obtain added pleasure from wireless reception.



A photograph showing the wiring of the unit. It will be of assistance if used in conjunction with Fig. 3.

The T.A.T. System

SIR,—As requested, I have much pleasure in sending results obtained from the T.A.T. system, using 2 H.F. and Det., reaction on tuned anode. My aerial is 20 ft. high at the house end, and 35 ft. the other, being practically unscreened. The earth is two copper plates sunk 4 ft. under the aerial. The valves are 2 B.T.H. B5, .06 amp., for the H.F. side, and A.R.D.E. for detecting.

These have to work four pairs of 'phones, situated in various parts of the house, and previously were used as 1.v.1. In a few minutes I changed to the T.A.T. system, and was sucessful in tuning in most of the B.B.C. stations right away. The coils are home-made basket coils, and the chokes necessary are 250 for 5IT, and 400 or 500 for 5XX, both No. 36 D.S.C.

On finishing the set off properly, the results were excellent, 5IT and 5XX loud-speaker strength, 5WA, 2ZY, 6BM, 5SC at strong 'phone, and 2BD, 2LO, 5NO at quiet strength. Many German stations come in at loud-speaker strength with one pair, whilst Radio Paris, Ecole Superieure and Eiffel Tower are at moderate loud-speaker strength.

So many stations come in that I can at present give no DX results until I have sorted them out, but I believe Komarow and Seville have been heard. Judging by the above, America should be quite readable, since I have picked it up on one valve on the only two occasions that I have tried, when I sighed for a stable H.F. circuit.

The circuit is a delight to handle and very stable. Components:—Fallon variable and Dubilier fixed condensers, Lissenstat minors, Sterling and Brunet 'phones, H.T.C. valve holders, and Colvern tuning condensers. The last two are excellent additions to any set.

Wishing your paper every success and thanking you for the many good circuits that appear. I may add that I have been a reader since No. 1.—Yours truly,

JOHN A. BENJAMIN.

P.S.—5IT and 5XX come in very quietly on four pairs of 'phones *with no aerial*.

Bridgenorth, Salop.

Watch our Smoke!

The North American Indian "broadcasted" news by means of smoke signals.

A code message was transmitted by alternately lifting and replacing a wet blanket over a fire.

Faulty or unsatisfactory reception is the smoke that spells out this message :—

FOR PERFECT RECEPTION—USE (MH) COMPONENTS.

(MH) Fixed Condensers.

The new improved type (MH) fixed condenser is now available. All capacities are a standard size and instantly interchangeable. Both sides are faced with high-grade insulating material with the capacity engraved on one side.

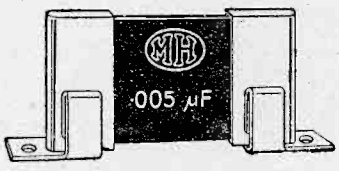
Capacity is within 10 per cent. of its rated value, an important feature especially when condensers are used in critical circuits. They never change their value and will give you everlasting service.

PRICES.

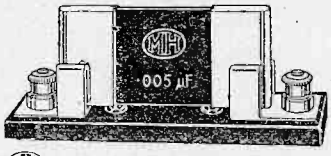
As illustrated, any value.

0.0001 μF to 0.001 μF 1/9 each.
0.002 μF to 0.01 μF 2/3 each.
(Two clips are supplied with each Condenser.)

Mounted on ebonite base, with terminals, any value.
0.0001 μF to 0.001 μF 2/9 each.
0.002 μF to 0.01 μF 3/3 each.

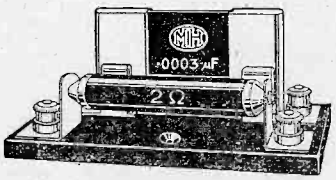


(MH) CONDENSER IN CLIPS



(MH) CONDENSER MOUNTED ON BASE.

(MH) GRID LEAK (MOUNTED).



GRID CONDENSER AND LEAK MOUNTED.

Grid Leaks

and Anode Resistances.

If you would be sure of a Grid Leak or Anode Resistance that does not change its value with use and is always silent in action, be sure to get (MH) resistances. Can be obtained mounted (as illustrated) or unmounted (with two clips).

PRICES.

Grid Leak, all values, 2/- each.
Anode Resistance, all values, 2/6 each.
(Each supplied with two clips.)

Mounted on ebonite base with terminals.
Grid Leak, all values, 3/- each.
Anode resistance, all values, 3/6 each.

Grid Leak

and Condenser.

An extremely useful and efficient unit containing a 0.0003 μF Condenser and 2 MΩ grid leak. PRICE (as illustrated) 4/- each.

You can't go wrong if you specify (MH) Components.

Obtainable from all Dealers.

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L. McMICHAEL LTD
Manufacturers of Wireless and Scientific Apparatus.

London Showrooms:
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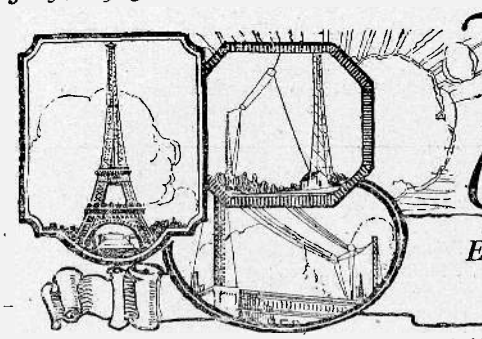
Works: SLOUGH, BUCKS.



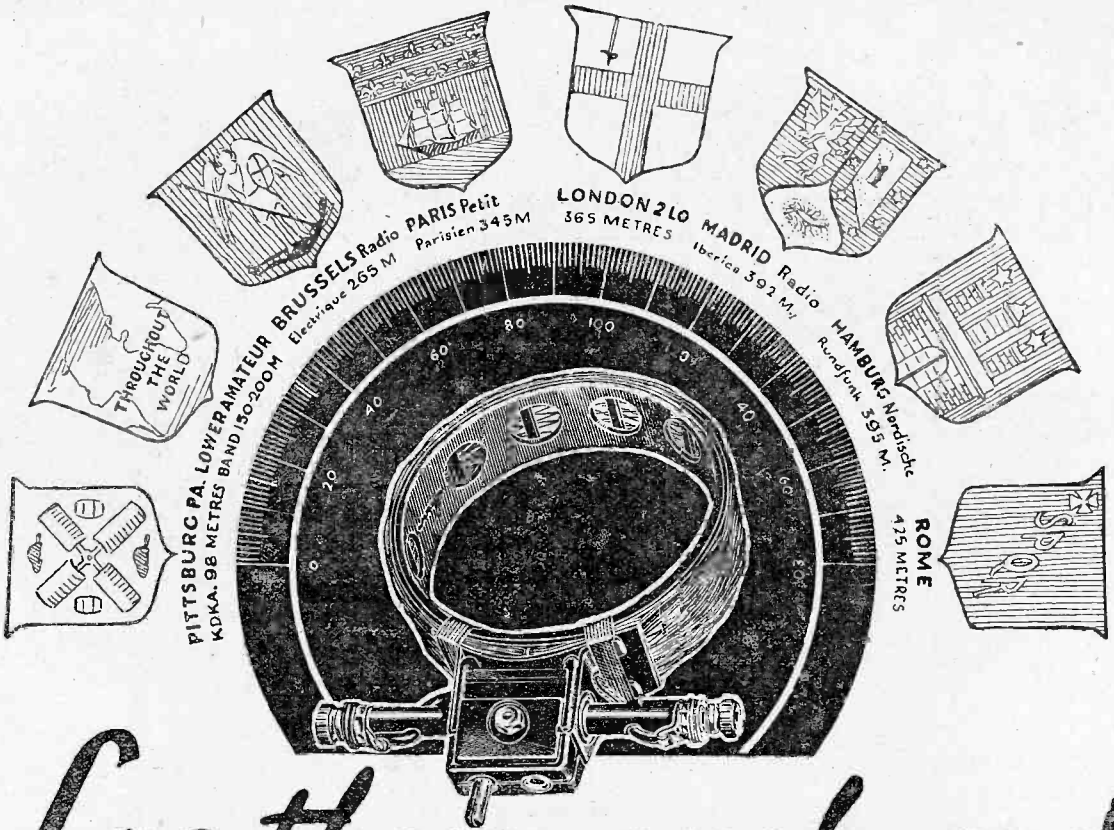
Regular Programmes from Continental Broadcast Stations

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

All Hours of Transmissions reduced to British Summer Time.

Ref. No.	B. S. T.	Name of Station.	Call Sign and Wave-length.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
			WEEK DAYS.				
	a.m.						
1	5.45	Hamburg ..	—— 395 m.	Germany ..	Time Signal, Weather Report.	5 mins.	1.5 Kw.
2	7.40	Eiffel Tower ..	FL 2650 m...	Paris ..	Weather Forecast	5 mins.	5 Kw.
9	7.55	Vaz Diaz ..	PCFF 1950 m	Amsterdam.	Stocks, Shares and News ..	10 mins.	2 Kw.
4	8.05	Lausanne ..	HB2 850 m.	Switzerland	Weather Report	5 mins.	300 Watts
211	9.0	Radio-Wien ..	—— 530 m.	Austria ..	Market Prices	10 mins.	1 Kw.
238	9.55	Vaz Diaz ..	PCFF 1950 m	Amsterdam	Time Signal	3 mins.	2 Kw.
8	10.23	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in G.M.T. (Spark) ..	3 mins.	60 Kw.
10	11.0	Eiffel Tower ..	FL 2650 m...	Paris ..	Time Signal in Greenwich Sidereal Time (Spark)	5 mins.	60 Kw.
180	11.15	Breslau ..	—— 418 m.	Silesia ..	Weather Report—Exchange ..	10 mins.	1.5 Kw.
260	11.40	Hilversum ..	NSF 1050 m.	Holland ..	Political News	10 mins.	5 Kw.
13	11.44	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in G.M.T. (Spark) ..	3 mins.	60 Kw.
14	11.55	Eiffel Tower ..	FL 2650 m...	Paris ..	Fish Market Quotations, Cotton Exchange (Monday excepted)	10 mins.	5 Kw.
15	11.55	Frankfurt ..	—— 470 m.	Frankfurt ..	Time Signal in C.E.T. (Spoken), followed by News	5 mins.	1 Kw.
	Noon.						
182	12.0	Leipzig ..	—— 454 m.	Germany ..	Concert	12.50 p.m.	700 Watts.
184	12.0	Zurich ..	—— 515 m.	Switzerland	Weather Report	5 mins.	500 Watts.
261	12.0 p.m.	Helsingfors ..	—— 370 m.	Finland ..	Weather Report	5 mins.	1 Kw.
249	12.5	Breslau ..	—— 418 m.	Silesia ..	Morning Concert	12.55 p.m	1.5 Kw.
20	12.15	Voxhaus ..	—— 505 m.	Berlin ..	Exchange Opening Prices ..	5 mins.	1.5 Kw.
30	12.30	Stockholm ..	SASA 430 m.	Sweden ..	Weather Forecast, followed by Exch. and Time Sig. from Nauen	1 p.m.	750 Watts.
32	12.30	Radio-Paris ..	SFR 1780 m.	Clichy ..	Concert, followed by News ..	2 p.m.	8 Kw.
31	12.45	Vaz Diaz ..	PCFF 1950 m	Amsterdam	Stocks and Shares	10 mins.	2 Kw.
251	12.45	Lyons	—— 280 m.	France ..	Concert	1.30 p.m.	300 Watts.
23	12.57	Nauen ..	POZ 3000 m.	Berlin ..	Time Signal in G.M.T. (Spark), This Signal is relayed by Zurich and all German stations except Munich and Stuttgart	8 mins.	50 Kw.
157	1.0	Zurich	—— 515 m.	Switzerland	Weather Forecast, Shares&News	5 mins.	500 Watts.
33	1.0	Haeren ..	BAV 1100 m.	Brussels ..	Weather Forecast in French and English.	8 mins.	150 Watts.
27	1.30	Lausanne ..	HB2 850 m.	Switzerland	Weather Report, Time Signal in C.E.T. and News.	15 mins.	300 Watts
34	2.0	Munich ..	—— 485 m.	Bavaria ..	News and Weather Report ..	10 mins.	1 Kw.
202	2.0	Munster ..	—— 410 m.	Westphalia	Concert or Lecture	3 p.m.	1.5 Kw.
37	2.15	Voxhaus ..	—— 505 m.	Berlin ..	Stock Exchange News	5 mins.	1.5 Kw.
35	2.30	Komarow ..	—— 1800 m	Czecho-slovakia	Stock Exchange and late News	10 mins.	1 Kw.
39	2.45	Eiffel Tower...	FL 2600 m.	Paris ..	Exchange Opening Prices (Saturday excepted).	8 mins.	5 Kw.
181	3.0	Breslau ..	—— 418 m.	Silesia ..	News and Exchange Quotations	10 mins.	1.5 Kw.
40	3.30	Munster ..	—— 410 m.	Westphalia	Stocks, Shares and News ..	10 mins.	1.5 Kw.
47	3.30	Eiffel Tower ..	FL 2650 m.	Paris ..	Exch. Quotations (Sat. excepted)	5 mins.	5 Kw.
250	4.0	Munich ..	—— 485 m.	Bavaria ..	Concert	6.0 p.m.	1 Kw.
159	4.10	Radio-Wien ..	—— 530 m.	Vienna ..	News, followed by Concert ..	6 p.m.	1.5 Kw.
239	4.25	Royal Dutch Meteorological Inst.	—— 1100 m.	Utrecht (De Bilt)	Night Frost Reports	10 mins.	2 Kw.
42	4.30	Frankfurt ..	—— 470 m.	Germany ..	Light Orchestra	6 p.m.	1 Kw.
44	4.30	Voxhaus ..	—— 505 m.	Berlin ..	Concert, followed by News ..	6 p.m.	700 Watts.

Ref. No.	B. S. T.	Name of Station.	Call Sign and Wave-length	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
			WEEK DAYS (Contd.)				
	p.m.						
46	4.30	Leipzig ..	—— 454 m.	Germany ..	Concert	6 p.m.	700 Watts.
52	4.30	Eiffel Tower ..	FL 2650 m.	Paris ..	Exch. Closing Prices (except. Sat.)	8 mins.	5 Kw.
240	4.30	Vaz Diaz ..	PCFF 1950 m	Amsterdam	Time Signal, Stocks and Shares	3 mins.	2 Kw.
43	5.0	Konigsberg ..	—— 463 m.	East Prussia	Light Orchestra (Wed. and Sat., Children's Hour)	6 p.m.	1.5 Kw.
158	5.0	Zurich ..	—— 515 m.	Switzerland	Concert by Hotel Baur-au-Lac relayed	6 p.m.	500 Watts.
160	5.0	Breslau ..	—— 418 m.	Silesia ..	Light Orchestra	6 p.m.	1.5 Kw.
226	5.0	Stuttgart ..	—— 443 m.	Wurtemburg	Concert	6.30 p.m.	1 Kw.
54	5.0	Radio-Belge ..	SBR 265 m.	Brussels ..	Concert, followed by News ..	6 p.m.	2.5 Kw.
263	5.10	Hilversum ..	NSF 1050 m.	Holland ..	Concert, followed by News (Mon. excepted)	7.15 p.m.	5 Kw.
186	6.0	Frankfurt ..	—— 470 m.	Germany ..	Lectures	7.30 p.m.	1 Kw.
187	6.0	Hamburg ..	—— 395 m.	Germany ..	Music or Lecture	7.0 p.m.	1.5 Kw.
241	6.0	Warsaw ..	PTR 385 m.	Poland ..	Concert	7.0 p.m.	——
162	6.15	Eiffel Tower ..	FL 2650 m.	Paris ..	Concert, followed by News Bulletin	7.10 p.m.	5 Kw.
161	6.30	Munich ..	—— 485 m.	Bavaria ..	Lecture	7.15 p.m.	1 Kw.
264	7.15	Oslo	—— 475 m.	Norway ..	Time Signal and Concert ..	9 p.m.	1. Kw.
234	7.30	Strassnice ..	—— 550 m.	Prague ..	Concert	10 p.m.	1 Kw.
228	7.50	Hilversum ..	NSF 1050 m.	Holland ..	Concert on Monday, 6.40–8.40 p.m.	9.10 p.m.	5 Kw.
63	8.0	Stuttgart ..	—— 443 m.	Wurtemburg	Lecture, followed by Evening Programme.	11 p.m.	1 Kw.
58	8.0	Eiffel Tower ..	FL 2650 m.	Paris ..	General Weather Forecast ..	8 mins.	5 Kw.
188	8.0	Frankfurt ..	—— 470 m.	Germany ..	Lecture	8.30 p.m.	1 Kw.
61	8.0	Konigsberg ..	—— 463 m.	East Prussia	Concert and Late News ..	10 p.m.	1.5 Kw.
62	8.0	Hamburg ..	—— 395 m.	Germany ..	Concert, Late News and Dance Music.	11 p.m.	1.5 Kw.
66	8.0	Lausanne ..	HB2 850 m.	Switzerland	Concert (Wednesdays excepted)	9.30 p.m.	300 Watts.
73	8.0	Munich ..	—— 485 m.	Bavaria ..	Concert and News	11 p.m.	1 Kw.
74	8.15	Radio-Belge ..	SBR 265 m.	Brussels ..	Concert, preceded and followed by News.	10.10 p.m.	2.5 Kw.
64	8.15	Zurich ..	—— 515 m.	Switzerland	Concert, followed by Late News	10 p.m.	500 Watts.
65	8.15	Leipzig ..	—— 454 m.	Germany ..	Concert and News (3 days a week until 11.30 p.m.)	10 p.m.	700 Watts.
76	8.15	Radio-Paris ..	SFR 1780 m.	Clichy ..	Detailed News Bulletin ..	8.45 p.m.	8 Kw.
242	8.25	Royal Dutch Meteorological Inst.	—— 1100 m.	Utrecht ..	Night Frost Report	5 mins.	2 Kw.
164	8.30	Radiofonica Italiana	—— 425 m.	Rome ..	Concert, followed by News and Dance Music	11.0 p.m.	4 Kw.
67	8.30	Frankfurt ..	—— 470 m.	Germany ..	Concert and News	11 p.m.	1 Kw.
59	8.30	Munster ..	—— 410 m.	Westphalia	Concert, followed by News ..	10.45 p.m.	1 Kw.
72	8.30	Voxhaus ..	—— 505 m.	Berlin ..	Concert, followed by News and Weather Report	10.30 p.m.	1.5 Kw.
69	8.30	Breslau ..	—— 418 m.	Silesia ..	Concert	10 p.m.	1.5 Kw.
253	8.30	Agen	—— 318 m.	France ..	Exchange Quotations and News Bulletin (Concert once a week)	9 p.m.	250 Watts.
69	8.30	Radio-Wien ..	—— 530 m.	Vienna ..	Evening Programme	10 p.m.	1.5 Kw.
77	8.45	Radio-Paris ..	SFR 1780 m	Clichy ..	Time Signal, followed by Concert	10 p.m.	8 Kw.
177	9.0	Radio-Barcelona	EAJ1 325 m.	Barcelona	Concert	11.0 p.m.	650 Watts.
254	9.0	Radio-Toulouse	—— 300 m.	France ..	Concert Tests	5.30 p.m.	400 Watts.
75	9.0	Ecole Sup. des Postes	FPTT 450 m.	Paris ..	Concert, sometimes preceded by Lecture	11 p.m.	500 Watts.
245	9.0	Lyngby ..	—— 2400 m	Denmark ..	Press News	9.15 p.m.	——
252	9.0	Lyons	—— 290 m.	France ..	Concert	10 p.m.	300 Watts.
78	10.0	Radio-Iberica...	RI. 392 m...	Madrid ..	Concert and Advertisements ..	1.0 a.m.	3 Kw.
79	11.0	Eiffel Tower ..	FL 2650 m...	Paris ..	Time Signal in Greenwich Sidereal Time (Spark)	5 mins.	60 Kw.
80	11.10	Eiffel Tower ..	FL 2650 m...	Paris ..	Weather Forecast	5 mins.	5 Kw.
81	11.44	Eiffel Tower ..	FL 2650 m...	Paris ..	Time Signal in G.M.T. (Spark) ..	3 mins.	60 Kw.
82	12.57	Nauen ..	POZ 3000 m.	Berlin ..	Time Signal in G.M.T. (Spark) ..	8 mins.	50 Kw
			SUNDAYS.				
	a.m.						
83	8.0	Frankfurt ..	—— 470 m.	Germany ..	Morning Prayer	1 hour	1 Kw.
85	8.30	Leipzig ..	—— 454 m.	Germany ..	Morning Prayer	10.0 a.m.	700 Watts.
165	9.0	Konigsberg ..	—— 463 m.	E. Prussia	Morning Prayer	9.45 a.m.	1.5 Kw.
212	9.0	Voxhaus ..	—— 505 m.	Berlin ..	Morning Prayer	10 a.m.	1.5 Kw.
265	9.0	Helsingfors ..	—— 370 m.	Finland ..	Divine Service	9.30 a.m.	1 Kw.



Log them—one by one!

The difficulty of "overcrowding on the dial" is not always the fault of the condenser, especially if the latter be the new Igranic Square Law model. There are other factors which determine selectivity, as, for instance, the proximity to your receiver of a high-power station working on approximately the wavelength of the distant station required. Then there is also the method of coupling High Frequency Valves, upon which a lot depends. The surest way to selectivity lies in the adoption of the form of coupling made possible by the Igranic Unitune Aperiodic Fixed Coupler.

This component combines many of the advantages of both direct and loosely coupled methods of tuning without their attendant disadvantages. It is therefore particularly efficient when receiving on short wavelengths.

The aerial coil is aperiodic and is responsive to all wavelengths within certain limits. The secondary winding should be shunted by a variable condenser of ·0005 microfarads, and is calibrated for various wavelengths with given values of capacities in parallel. These wavelengths remain constant no matter what the dimensions of the aerial may be. Both windings are of the Honeycomb Duolateral formation, thus reducing the self-capacity of the coupler to a minimum.

The difficulty of obtaining reaction is also overcome by using the Unitune Fixed Coupler. The Unitune Fixed Coupler may be used in any ordinary receiver employing standard coil holders.

Unitune Minor for 75–180 metres, Price **7/6** Unitune Major for 300–600 metres, Price **9/-**

All reputable Dealers carry stocks.

IGRANIC RADIO DEVICES

include: Honeycomb Duolateral Coils, Fixed Condensers, Variable Condensers, Filament Rheostats, Intervalve Transformers, Variometers, Vario-couplers, Variable Grid-Leaks, Coil Holders, Battery Potentiometers, Vernier Tuning Devices, Switches, etc., etc.

All carry the IGRANIC guarantee.

Write for **List Z 591**

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Works: BEDFORD.

SUNDAYS (Contd.)

Ref. No.	B.S.T.	Name of Station.	Call Sign and Wave-length.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
	a.m.						
214	9.0	Munster ..	—— 410 m.	Westphalia	Morning Prayer	10.0 a.m.	1.5 Kw.
213	9.40	Bloemendaal ..	—— 350 m.	Holland ..	Divine Service	1 hour	——
86	10.0	Komarow ..	—— 1800 m.	Czecho-slovakia	Sacred Concert	1 hour	1 Kw.
256	10.0	Copenhagen ..	—— 775 m.	Denmark ..	Divine Service	11.15 a.m.	1.5 Kw.
87	10.23	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in G.M.T. (Spark) ..	3 mins.	60 Kw.
97	10.55	Eiffel Tower ..	FL 2650 m.	Paris ..	Fish Market Quotations ..	4 mins.	5 Kw.
89	11.0	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in Greenwich Sidereal Time (Spark)	5 mins.	60 Kw.
297	11.0	Oslo	—— 475 m.	Norway ..	Divine Service	Noon.	1 Kw.
90	11.0	Strasnice ..	—— 550 m.	Prague ..	Classical Music	1 hour	1 Kw.
92	11.5	Radio-Wien ..	—— 530 m.	Vienna ..	Concert	12.50 p.m.	1.5 Kw.
94	11.30	Stuttgart ..	—— 443 m.	Wurtemberg	Classical Concert	1 hour	1 Kw.
192	11.30	Munich	—— 485 m.	Bavaria ..	Sacred Concert	1.0 p.m.	1 Kw.
96	11.30	Konigswusterhausen	LP 1300 m.	Berlin ..	Concert	12.50 p.m.	6 Kw.
95	11.44 Noon	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in G.M.T. (Spark)	3 mins.	60 Kw.
98	12.0	Stockholm ..	—— 440 m.	Sweden ..	Divine Service	1.15 p.m.	500 Watts.
273	12.0 p.m.	Breslau ..	—— 418 m.	Silesia ..	Sacred Concert	12.55 p.m.	1.5 Kw.
102	12.45	Radio-Paris ..	SFR 1750 m.	Clichy ..	Concert, followed by News ..	1.45 p.m.	8 Kw.
101	12.57	Nauen ..	POZ 3000 m.	Berlin ..	Time Signal in G.M.T. (Spark)	3 mins.	——
268	1.10	Hilversum ..	NSF 1050 m.	Holland ..	Concert	3.10 p.m.	5 Kw.
104	2.0	Breslau ..	—— 418 m.	Silesia ..	Children's Stories, followed by concert	6.30 p.m.	1.5 Kw.
216	3.0	Lyngby ..	—— 2400 m.	Denmark ..	News	10 mins.	500 Watts.
108	4.0	Munich ..	—— 485 m.	Bavaria ..	Concert	5.0 p.m.	1.5 Kw.
215	4.0	Munster ..	—— 410 m.	Westphalia	Concert	6.0 p.m.	1.5 Kw.
107	4.0	Frankfurt ..	—— 470 m.	Germany ..	Children's Corner	5.0 p.m.	1 Kw.
106	4.0	Radio-Wien ..	—— 530 m.	Vienna ..	Afternoon Concert	6.0 p.m.	1.5 Kw.
169	4.30	Voxhaus ..	—— 505 m.	Berlin ..	Light Orchestra	6.0 p.m.	1.5 Kw.
170	4.30	Leipzig ..	—— 454 m.	Germany ..	Light Orchestra	6.0 p.m.	700 Watts.
217	4.40	Bloemendaal ..	—— 350 m.	Holland ..	Divine Service	5.40 p.m.	——
167	5.0	Zurich	—— 515 m.	Switzerland	Hotel Baur au Jac, Concert relayed	6.0 p.m.	500 Watts.
105	5.0	Stuttgart ..	—— 443 m.	Wurtemberg	Light Orchestra	6.30 p.m.	1 Kw.
171	5.0	Frankfurt ..	—— 470 m.	Germany ..	Light Orchestra	6.0 p.m.	1 Kw.
168	5.0	Konigsberg ..	—— 463 m.	East Prussia	Light Orchestra	6.0 p.m.	1.5 Kw.
111	5.0	Radio-Belge ..	SBR 265 m.	Brussels ..	Concert	1 hour	2.5 Kw.
257	6.0	Hamburg ..	—— 395 m.	Germany ..	Concert	7.0 p.m.	1.5 Kw.
219	6.0	Malmo ..	SASC 270 m.	Sweden ..	Concert	8.0 p.m.	500 Watts.
112	6.15	Eiffel Tower ..	FL 2650 m.	Paris ..	Concert, followed by News ..	1 hour	5 Kw.
189	7.0	Barcelona ..	EAJ1 325 m.	Spain ..	Concert	10.30 p.m.	650 Watts
269	7.15	Oslo	—— 475 m.	Norway ..	Lecture and Concert	9.0 p.m.	1 Kw.
270	7.40	Hilversum ..	NSF 1050 m.	Holland ..	Concert	9.10 p.m.	5 Kw.
237	8.0	Strasnice ..	—— 550 m.	Czecho-slovakia	Concert	9.0 p.m.	1 Kw.
176	8.0	Copenhagen ..	—— 775 m.	Denmark ..	Concert, followed by News ..	9.30 p.m.	1.5 Kw.
114	8.0	Radio-Wien ..	—— 530 m.	Vienna ..	Concert	10.0 p.m.	1 Kw.
118	8.0	Konigsberg ..	—— 463 m.	E. Prussia	Concert	10.0 p.m.	1.5 Kw.
173	8.0	Frankfurt ..	—— 470 m.	Germany ..	Lecture, followed by evening programme	10.0 p.m.	1 Kw.
119	8.0	Hamburg ..	—— 395 m.	Germany ..	Concert, followed by News ..	11.0 p.m.	1.5 Kw.
120	8.0	Eiffel Tower ..	FL 2650 m.	Paris ..	General Weather Forecast ..	8 mins.	5 Kw.
125	8.0	Stuttgart ..	—— 443 m.	Wurtemberg	Concert, Dance Music from 10.0 p.m.	11 p.m.	1 Kw.
174	8.0	Munich ..	—— 485 m.	Bavaria ..	Concert	11.0 p.m.	1 Kw.
124	8.0	Breslau ..	—— 418 m.	Silesia ..	Light Orchestra, Dance Music at 10.0 p.m.	10.30 p.m.	1.5 Kw.
121	8.0	Lausanne ..	HB2 850 m.	Switzerland	Concert or Talk	9.30 p.m.	300 Watts.
128	8.15	Radio-Paris ..	SFR 1750 m.	Clichy ..	Detailed News Bulletin	9.0 p.m.	8 Kw.
122	8.15	Zurich	—— 515 m.	Switzerland	Concert	10.0 p.m.	500 Watts.
123	8.15	Leipzig	—— 454 m.	Germany ..	Symphony Concert	10.0 p.m.	700 Watts.
127	8.30	Radio-Belge ..	SBR 265 m.	Brussels ..	Concert, followed by News ..	10.10 p.m.	2.5 Kw.
116	8.30	Munster ..	—— 410 m.	Westphalia	Classical Concert	10.0 p.m.	1.5 Kw.
220	8.30	Voxhaus ..	—— 505 m.	Berlin ..	Evening Programme	11.0 p.m.	1.5 Kw.
129	8.30	Ecole Superieure	FPTT 458 m.	Paris ..	Concert or Lecture (May begin 15 mins. earlier or later)	10.30 p.m.	5 Kw.
175	8.30	Radiofonica-Italiana	—— 425 m.	Rome ..	Concert, followed by Late News	11.0 p.m.	4 Kw.
130	8.45	Radio-Paris ..	SFR 1750 m.	Clichy ..	Concert, followed by Dance Music	11.0 p.m.	8 Kw.

Ref. No.	B S. T.	Name of Station.	Call Sign and Wave-length.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
			SUNDAYS (Contd.)				
	p.m.						
131	9.15	Petit-Parisien ..	—— 345 m.	Paris ..	Concert (items announced in English as well as French)	11.0 p.m.	500 Watts.
132	10.0	Radio-Iberica ..	RI 392 m.	Spain ..	Concert	1.0 a.m.	3 Kw.
133	11.0	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in Greenwich Sidereal Time (Spark)	3 mins.	60 Kw.
134	11.44	Eiffel Tower ..	FL 2650 m.	Paris ..	Time Signal in Greenwich Mean Time (Spark)	3 mins.	60 Kw.
135	12.57	Nauen ..	POZ 3000 m.	Berlin ..	Time Signal in G.M.T. (Spark) ..	8 mins.	50 Kw.
			SPECIAL DAYS.				
	a.m.						
156	11.0	Radio-Wien ..	—— 530 m.	Austria ..	Tues., Thurs., Sat., Concert ..	12.50 p.m.	1.5 Kw.
	p.m.						
224	4.45	Munich ..	—— 485 m.	Bavaria ..	Wed., Children's Corner ..	½ hour	1 Kw.
142	5.40	Ned. Seintoes-Fabriek	NSF 1060 m.	Hilversum	Mon., Children's Hour	6.40 p.m.	3 Kw.
203	6.0	Gotenborg ..	SMZX 460 m.	Sweden ..	Tues., Concert	8 p.m.	300 Watts.
137	6.15	Lausanne ..	HB2 850 m.	Switzerland	Wed., Children's Corner ..	1 hour	300 Watts.
180	6.30	Belgrade ..	HFF 1650 m.	Serbia ..	Tues., Thurs. and Sat., Concert ..	1 hour	500 Watts.
271	7.0	Helsingfors ..	—— 370 m.	Finland ..	Tues., Thurs. and Sat., Concert	9.0 p.m.	1 Kw.
147	7.0	Stockholm ..	—— 440 m.	Sweden ..	Wed., Thurs., Fri., Sat., Concert	8 p.m.	——
221	8.0	Copenhagen ..	—— 775 m.	Denmark ..	Thurs. and Sat., Concert ..	9.30 p.m.	1.5 Kw.
258	8.0	Ravangen ..	—— 1095 m.	Denmark ..	Tues., Wed. and Fri., Concert	9 p.m.	800 Watts.
151	8.40	Amsterdam ..	PX9 1050 m.	Holland ..	Mondays, Concert	10.40 p.m.	600 Watts.
225	8.45	Le Matin ..	SFR 1750 m.	Paris ..	Sat., Special Gala Concert ..	11 p.m.	10 Kw.
223	9.0	Malmo ..	SASC 270 m.	Sweden ..	Thurs. and Sat., Dance Music	11 p.m.	500 Watts.
154	9.15	Petit-Parisien	—— 345 m.	Paris ..	Tues. and Thurs., Concert (items announced in English as well as French)	11.0 p.m.	500 Watts.
210	10.0	Radio-Wien ..	—— 530 m.	Vienna ..	Wed. and Sat., Dance Music ..	11.30 p.m.	1.5 Kw.
155	10.0	Radio-Paris ..	SFR 1780 m.	Clichy ..	Two evenings per week, Dance Music	10.45 p.m.	8 Kw.
232	10.0	Voxhaus ..	—— 505 m.	Berlin ..	Thurs. and Sat., Dance Music ..	Midnight	1.5 Kw.
272	11.0	Munich ..	—— 485 m.	Bavaria ..	Wed. and Sat., Dance Music ..	Midnight to 1.0 a.m.	1 Kw.

The following are Relay Stations :—

Kassel, 288 m., 1 kw.; relays Frankfurt. Nuremberg, 340 m., 1 kw.; relays Munich.
Dresden, 292 m.; mostly relays Leipzig. Graz, 404 m.; relays Radio-Wien.
Bremen, 330 m., 1 kw.; and Hanover 296 m., 1 kw.; relay Hamburg.

The Long-Range Neutrodyne Receiver

To the Editor of MODERN WIRELESS.

SIR,—I am writing to tell you the results obtained with the Long-Range Neutrodyne Receiver described in the January issue of MODERN WIRELESS, by John Underdown, which I have built.

The set is built into a two-door cupboard, all leads out at the back. The design of the panel is the same except that the top portion from just below the rheostats is bent back at right angles, consequently there are only 3 dials, 2 jacks and 1 push-pull switch on the vertical front.

My aerial is of T-type; the length between insulators 110 ft. and 50 ft. above the ground. The down lead, taken from the exact centre, is 45 ft., so that the effective length from either end is 100 ft. The earth lead is taken to the ground and a wire is buried one foot below the surface and directly beneath the aerial.

Results are as expected. All B.B.C. main stations except 2LO, which is very poor in this district, and Cardiff, which is variable, come in at loud-speaker strength. Leeds, Plymouth, and Edinburgh at good telephone strength. On the frame, Liverpool and Manchester are quite loud enough for a good-sized room.

We have one great difficulty here at the mouth of the Mersey; hundreds of ships and "Seaforth the All Powerful." Anyone living inland cannot realise the perfect medley of morse all around the dial, and the difficulty of tuning in foreign stations. However, one gets used to it.

"Foreign language" stations come in very well, some at loud-speaker strength and one in particular as loud as the local station. The only foreigner I am able to recognise is Radio Iberica.

Selectivity is fair, but, having had experience with Super-Heterodynes and the Cockaday Circuit, is not as I should like it.

However, the set is very simple to handle and most important point of all, it "gets there" every time.

Wishing the Radio Press every success.

Yours truly,
H. KINGHAM.
New Brighton, Cheshire.

We are distributors for the famous

"BECOL"

ALL BRITISH EBONITE

Of finest quality, "BECOL" Ebonite is guaranteed free from surface leakage. Both the black and grained ebonite is highly polished one side and matt finished on the reverse. "BECOL" Ebonite panels are supplied cut to the following sizes, and delivery can be given from stock :—

Size—ins.	Black.	Grained.	Size—ins.	Black.	Grained.
	RE 3/3	RE 3/1		RE 3/4	RE 3/2
6× 6×3/16	2/10	3/–	12× 9×¼	10/6	11/–
8× 6×3/16	4/3	4/4	12×10×¼	11/6	12/6
9× 6×3/16	4/6	4/9	12×12×¼	14/3	15/–
9× 7×3/16	5/3	5/9	14× 7×¼	9/6	10/3
12× 6×3/16	5/9	6/–	14×12×¼	16/3	17/6
12× 9×3/16	9/–	9/6	16×12×¼	18/6	20/–
	RE 3/4	RE 3/2	18× 7×¼	12/–	13/–
6× 6×¼	3/4	3/6	18× 9×¼	15/6	16/8
8× 6×¼	5/–	5/3	18×10×¼	17/6	19/6
9× 6×¼	5/3	5/6	24×10×¼	23/6	25/–
9× 7×¼	6/3	6/9	24×12×¼	26/–	27/–
12× 6×¼	6/9	7/–	24×24×¼	50/–	54/–
12× 7×¼	8/–	8/9			

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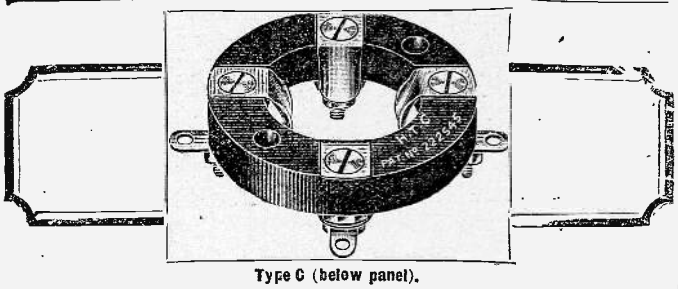
Please order from your local Wireless Dealer :



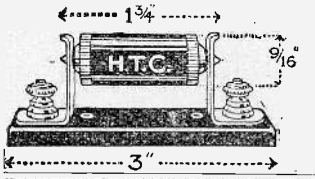
Type C (below panel).

Better parts mean better Results

FOR THAT REFLEX

For such Circuits as the S.T.100, in fact, for all reflex circuits using crystal rectification, the H.T.C. Fixed Detector is ideal. We find the "hot-spot" and test it on actual broadcast. You simply mount it—under the panel if you wish—and it will do the work as no other can do. The H.T.C. Fixed Detector employs a proved mineral crystal combination whichhas held the Admiralty long distance record (over 5,000 miles). Remember, it is a permanent detector.

H.T.C. Fixed Detector .. 3/6
Complete with Ebonite Base, Clips and Terminals 4/6
Detector Clips only .. 3/9



A radio receiver can only be as good as the quality of its components. Best possible results cannot be expected if you incorporate components of doubtful manufacture and efficiency.

It is wise to select radio components that have been proved by popular use to be of the highest radio efficiency. Such components are the H.T.C. products. Experienced experimenters and constructors have, by comparison with components of other makes, proved H.T.C. products to be all that we claim, and have thereby been eminently satisfied.

By incorporating H.T.C. components into your set wherever possible, you definitely ensure its maximum efficiency.

Give your set range by fitting H.T.C. Low Capacity Valve Holders. For mounting the four-pin valve and the popular plug in H.F. Transformer you can only expect the best results if you use the H.T.C. Low Capacity Valve Holders.

Type A (above panel) 1/9
Type B (Board mounting) 1/9
Type C (below panel) 1/6

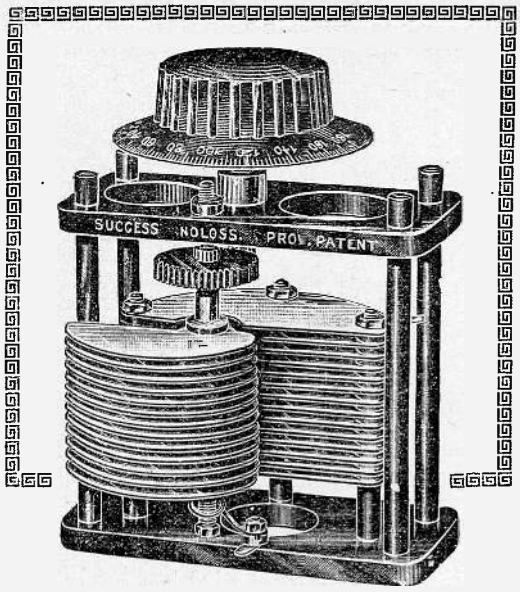
Insist upon H.T.C. Products at your dealers.

H.T.C. Electrical Co., Ltd.

2-2a, Boundaries Rd., Balham, London, S.W.12

Telephone : Battersea 374.

Barclays 1234.



Two Instruments—

THAT WILL POSITIVELY GIVE BETTER RESULTS

SUCCESS NOLOSS CONDENSER

THE Success Noloss Condenser provides a really high grade instrument for the use of serious experimenters and constructors. If you appreciate radio instruments of quality, we are satisfied that the Success Noloss Condenser will meet with your entire approval.

The Success Noloss Condenser is the first variable condenser of British manufacture rightly designated **No Loss.** Has a 4 to 1 Gear, while making a vernier unnecessary also removes all hand capacity effects, since the body has no electrical contact with the moving vanes. Many other superiorities are apparent :—

Rugged Construction.
Skeleton Design.
Pigtail Connection to moving vanes.
Copper Vanes.
Fixed Vanes secured to bottom end plate only.
No backlash.
No vernier required.

AERIAL CONDENSER.

Approx. max. Cap., .0005.
Black ebonite, **27/6.**
Mahoganite, **30/–.**
(with knob and dial 1/6 extra).

ANODE CONDENSER.

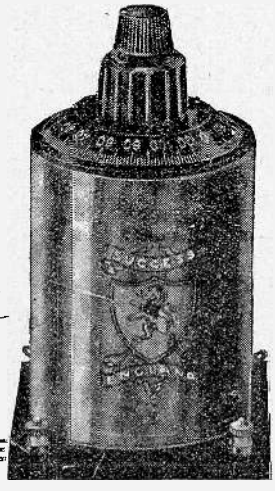
Approx Max. Cap., .0003.
Black ebonite, **25/–**
Mahoganite, **27/6.**
(with knob and dial, 1/6 extra).

SUCCESS MICROTUNE DIAL.

Quick or Vernier at will. Designed for use with the "Success" Noloss Condenser. 80 to 1 Gear. Price **6/6.**

The SUCCESS SUPERFORMA

An Intermediate Frequency Transformer for Super Heterodynes.



The outstanding feature of the "Success" Superforma is the incorporation of a .0003 Variable Condenser as an integral part of the unit.

The fact that it is tunable is a consideration which enables the experimenter to balance up the stages for himself, after the set is built, and to tune out interference. That the "Success" Superforma is tunable considerably increases the selectivity of the receiver, gives greater amplification and generally improves the efficiency of any Super Heterodyne Receiver. By turning the small knob, the tuning condenser may be locked in position.

"SUCCESS" SUPERFORMA
Price **30/–**

If your dealer cannot supply send direct :

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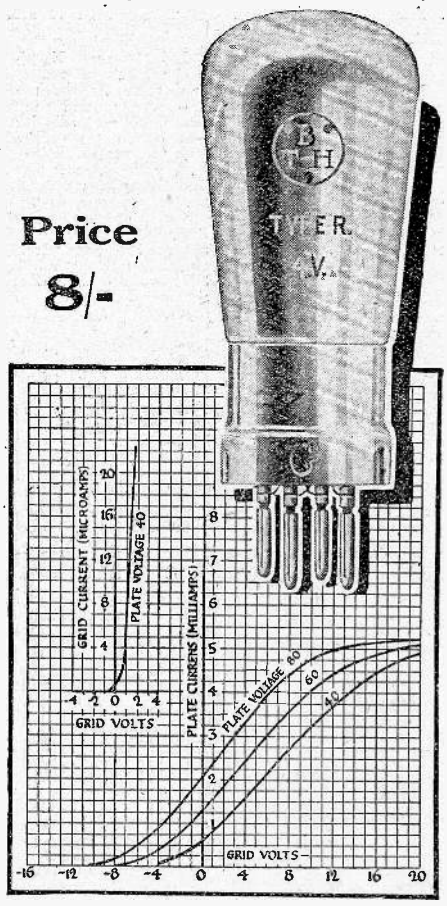
Barclays 1238

The March of Progress

THE new B.T.H. R Valve, now reduced to 8/-, represents yet another stride in the march of progress. It is undoubtedly the finest valve in the bright emitter class.



Price 8/-

Amongst the special features which contribute to the remarkable efficiency of the new B.T.H. R Valve are the following:—

HIGH VACUUM, ensuring silent working and long life.

LOW ANODE CURRENT, with consequent increase in life of H.T. battery.

EXCEPTIONALLY LOW GRID CURRENT, ensuring excellent quality and volume without distortion, even when the means of giving suitable grid bias are not available.

TIPLESS BULB, giving better appearance and reducing risk of accidental breakage.

Filament voltage – –	4 *volts*
Filament current – –	0.7 *amp.*
Maximum anode voltage	100 *volts*
Voltage amplification factor –	7.5
Anode resistance – –	27,000 *ohms.*

B.T.H. R VALVE

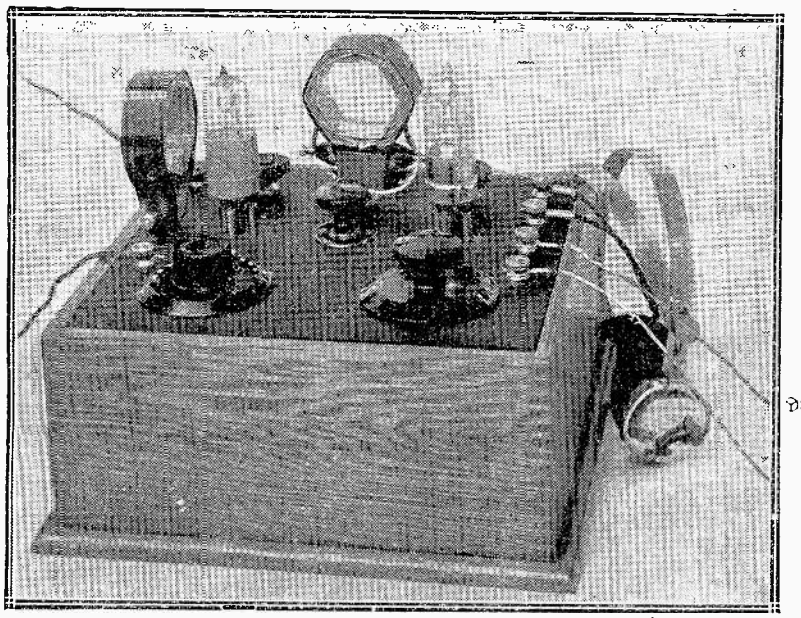
Insist on B.T.H.-the Best of All.

2331

Advert of The British Thomson-Houston Co., Ltd.

An Auto-Coupled Two-Valve Receiver

By JOHN W. BARBER



A description of an interesting receiver employing auto-coupling both in the aerial and the anode circuits

THE question of selectivity is one which has received a considerable amount of attention, and many sets have been described in the technical Press, the sole object of which has been to render the elimination of signals from the local station or from interfering spark stations easy to accomplish. In many cases a loose coupled form of aerial tuning has been incorporated, and in others the split-secondary method of tuning has also been used. The latter certainly gives great selectivity but necessitates the use of more complicated tuning controls, and if a tuned aerial circuit is used, two variable condensers will be necessary as well as two two-way coil holders. This method, whilst being extremely selective, has this one disadvantage, that of being more complicated than many will desire. In order that the aerial tuning arrangement may retain a simple form, whilst at the same time possessing an increased degree of selectivity, some form of auto coupling may be employed, and this can conveniently be accomplished by the use of a special form of commercial plug-in coil made by Messrs. Lissen, Ltd., and known as the Lissenagon "X" Coil. These are made in convenient sizes both for reception of the 300 — 500 metre broadcast band, and also for the reception of the high-power long-wave station and Radio-Paris.

The Anode Circuit

In addition to the employment of such a coil in the aerial circuit of a receiver, a similar coil may be employed in the anode circuit of a high-frequency amplifying valve, in the manner shown in the circuit diagram. As will be seen, this constitutes a modification of the principle of Trap Tuning as explained by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., in the February, 1925, issue of this journal. In the article referred to, circuits were described and illustrated in which a small separate coil was included in the anode circuit of the high-frequency valve, this coil being coupled to a larger coil tuned by a variable condenser to the wavelength of the incoming signals.

Further Details

If this small coil in the anode socket is wound upon the same former as the larger tuned coil, we may replace the two coils by a commercial form of plug-in coil known as the "Unitune" as made by the Igranic Electric Co., Ltd. The present circuit consists of tapping off a portion of the tuned circuit coil and connecting this

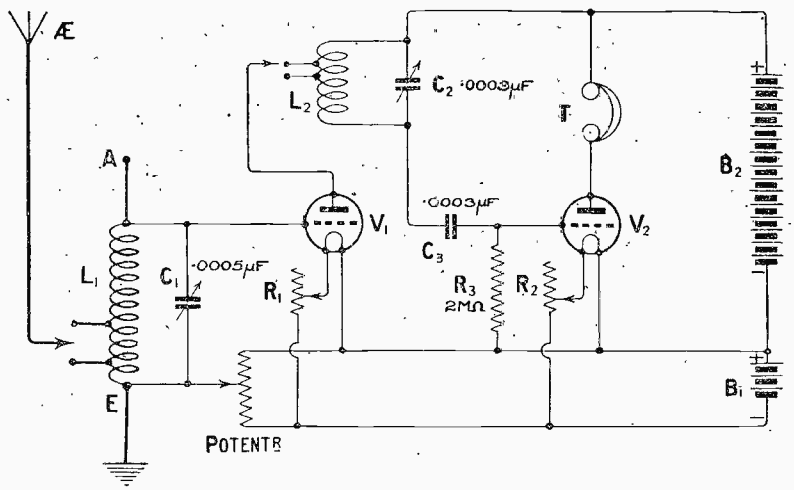


Fig. 1.—The theoretical circuit of the receiver. L_1 and and L_2 are "X" coils

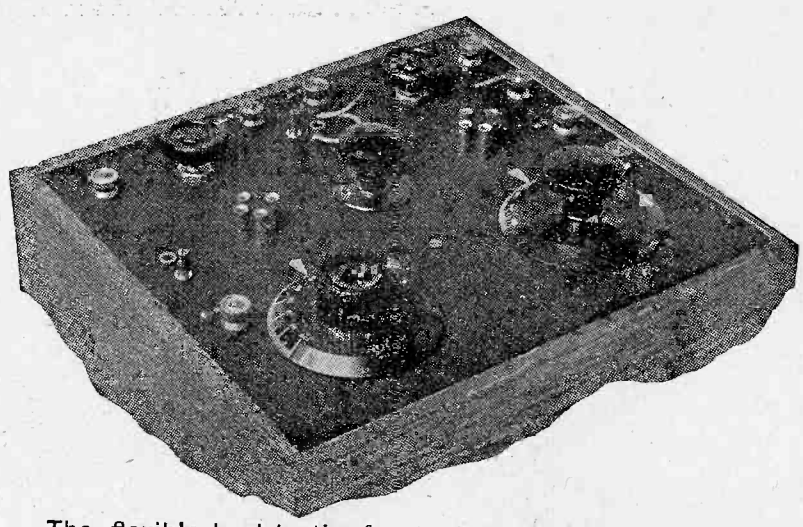
small portion in the anode circuit of the high-frequency valve, while the tuning condenser is placed across the whole of the coil in the usual manner. The remainder of the circuit is perfectly straightforward and needs no comment. Note magnifiers may, of course, be added if desired.

Stabilisation

Owing to the fact that the damping in the aerial circuit has been considerably reduced by the inclusion of auto-coupling, it is necessary that some form of stabilising shall be incorporated, and this is most simply accomplished by means of a potentiometer, which is joined across the accumulator, the slider being taken to the lower end of the aerial tuning circuit and to earth. A terminal, marked " A " in the circuit diagram, has been provided upon the receiver, in order that the ordinary form of direct coupled aerial tuning with parallel condenser may be tried in conjunction with the tapped tuning in the anode circuit. The receiver illustrated in the photographs accompanying this article will be found exceedingly simple to construct.

Components Required

As is customary in a description of receivers in Radio Press journals, a list of components used in the construction of this receiver will be found below. The makers' names have in some cases been given in order that any reader so desiring may exactly duplicate the receiver, but of course, any equivalent make of components of good quality may be substituted without sacrificing anything in the nature of good results.



The flexible lead to the front of the anode coil socket should be attached to one of the terminals on the coil.

One insulating panel, 10 by 9 by $\frac{3}{16}$ or a $\frac{1}{4}$ in. (I have used " Paragon " Ebonite here).

Suitable cabinet. That shown is a Camco box.

One .0005 μF square law variable condenser (Collinson's Precision Screw Co., Ltd.).

One .0003 μF square law variable condenser (Jackson Bros.).

Plug and socket mounting for two coils. I have used the simple plug and socket which require a $\frac{1}{4}$ in. hole to be drilled in the panel with a distance of $\frac{9}{16}$ in. between the centres. They are placed as shown in the panel layout.

One potentiometer (Burndept Wireless, Ltd.).

Two filament rheostats ("Polar." Radio Communication Co., Ltd.).

Two sets of valve sockets, or alternatively two complete valve holders.

Eight terminals.

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

One set of Radio Press Panel Transfers.

One Dorwood condenser and grid leak mounting (Dorwood). This is a one-hole fixing component.

One Dubilier 2 megohms grid leak. (Dubilier Condenser Co.).

In addition to the above a set of Lissenagon "X" Coils will be required for the band of wavelengths it is desired to receive. If it is only desired to receive the short wave broadcasting, the three coils, 50, 60 and 75, will be found sufficient. If, however, it is desired to receive the Chelmsford station and Radio-Paris in addition to the former stations, it will be necessary to purchase two Lissenagon "X" coils of the 250 turn size.

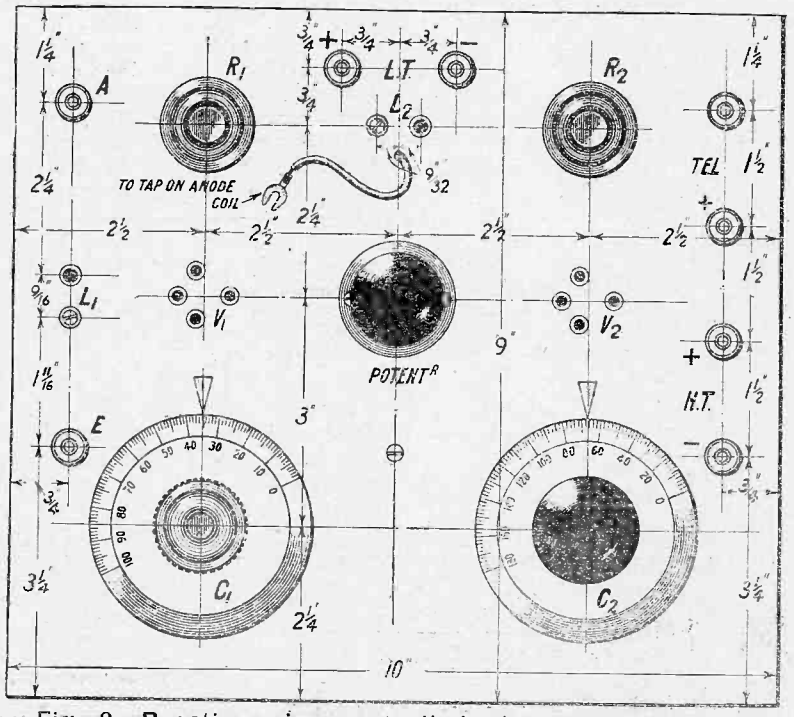
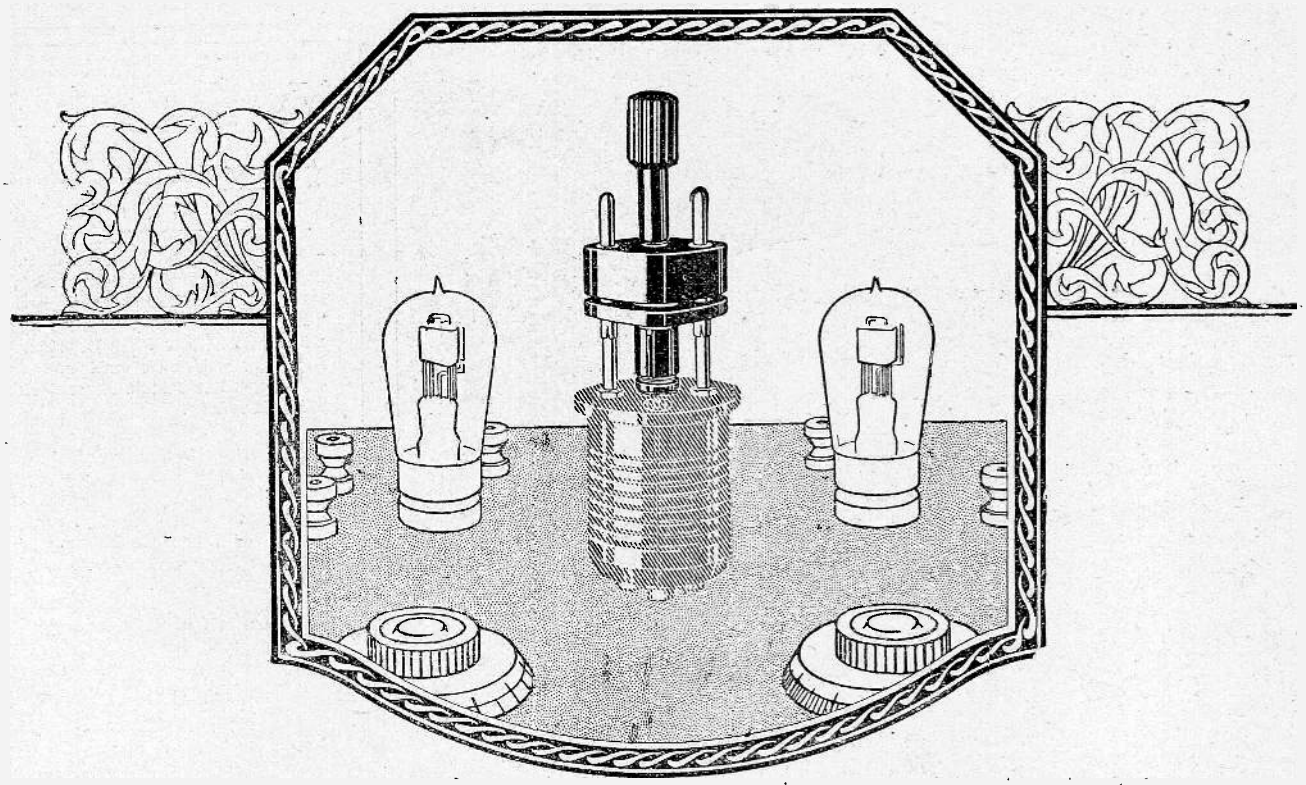


Fig. 2.—Reaction is controlled by adjusting the potentiometer.

Notes on Components

The majority of the aforementioned components are perfectly conventional and require no special comment, with the exception of the filament resistances. These, as has possibly been previously pointed out, in connection with Radio Press sets, are of a very useful design, it being possible by undoing a knurled nut to remove the resistance bobbin from the holder and replace it with another of a different



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V.—Greatest possible Selectivity.
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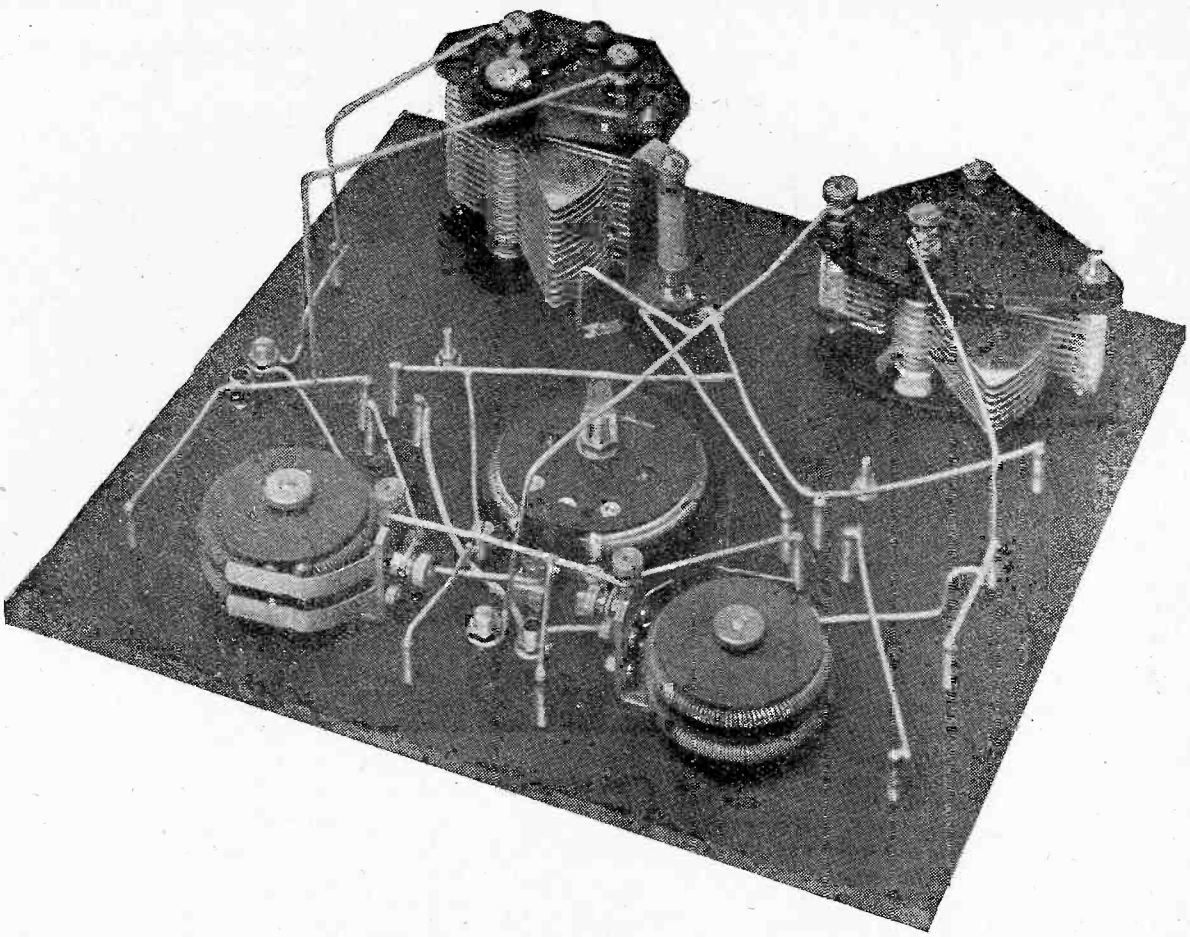


Care should be taken in wiring the grid condenser and leak.

resistance. It is obviously thus possible to obtain the holder for the bobbin and to mount this into position on the panel. Suitable bobbins may then be purchased for the particular type of valve to be used, and if at any time it is desired to change the type of valve, a fresh bobbin may be brought into use by a very simple operation.

The only other component which calls for comment is the Dorwood grid condenser and grid leak mounting. This is of an unconventional design and upon examination will be found to possess three soldering tags, arranged so as to be one above the other. In this particular case the top soldering tag is connected to the grid of the second valve, the middle to the positive low-tension wire, and the bottom connection is joined to the lower end of the anode tuning circuit, $L_2 C_2$.

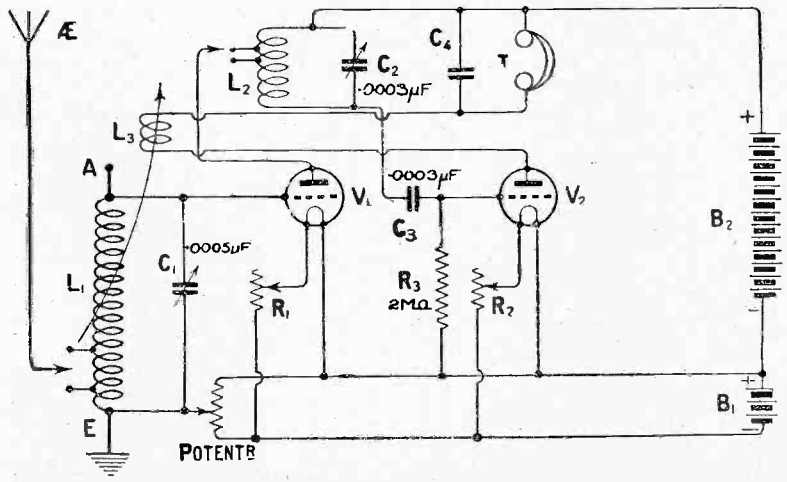


Fig. 3,—It may be necessary in certain cases to use magnetic reaction. In this case a coil L_3 should be coupled by means of a two coil holder to L_1.

Constructional Details

The layout of the components upon the panel has been designed for the utmost simplicity of construction, and it will be found possible by drawing five vertical lines and three horizontal ones in the positions indicated upon the panel layout drawings, to locate the centres of the majority of the components.

Provided that the components used are those given in the specification, or closely resemble those used in the actual receiver, the drawings and the layout may be followed exactly, but should the components used by the constructor vary markedly in any one respect from those used, it may be necessary to alter slightly the layout in order to accommodate the components. It will be noticed in the back-of-panel photographs that no nuts are used upon the shanks of terminals or valve legs. This is because these components are screwed into tapped holes in

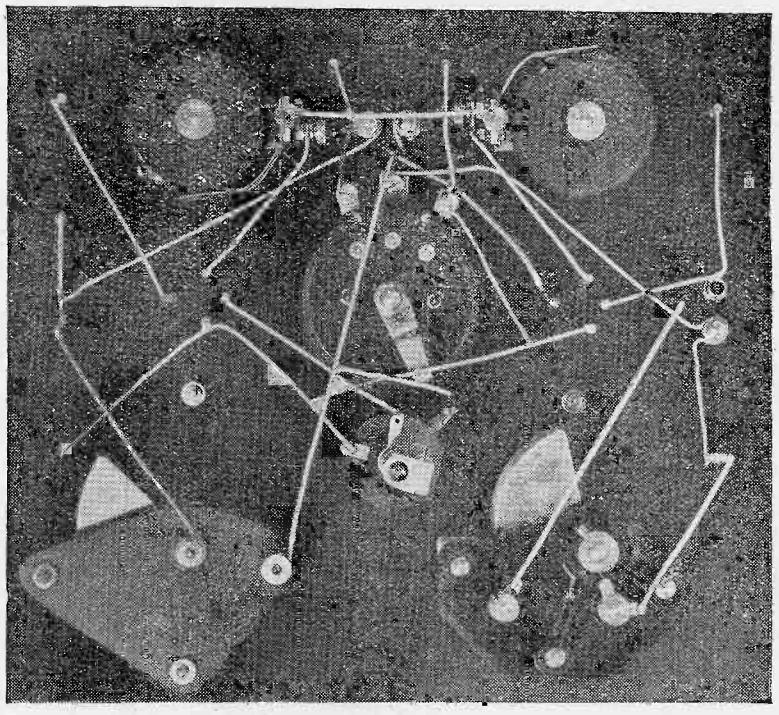
the panel, the writer favouring this method of mounting. If the constructor does not happen to have the necessary taps to hand, it is clear that a slightly larger hole may be drilled in order that the terminal or valve leg may pass easily through this hole and a securing nut may be used upon the under-side of the panel. Only one screw head is visible upon the surface of the panel, this being the securing screw for the one hole fixing grid-leak and condenser.

Wiring

Wiring is carried out using No. 16 tinned copper wire, of circular section, and will be found to be quite simple on reference to the wiring diagram Fig. 4, and the back-of-panel photographs will be of assistance to constructors in determining the relative heights of the connecting wires. Only one flexible lead is used in this receiver, this being the connection from the anode of the first valve through a hole in the panel situated below the anode coil socket and brought out to a spade tag which may be joined to either of the tappings upon the anode coil. The spacing of the filament resistances behind the valves and the low-tension terminals behind the resistances for simplicity of wiring will be appreciated by the shortness of the filament leads.

Operating the Receiver

It is advisable first of all to put in the valves and join up the accumulator. Turn on the filament resistances, and if the valves light correctly turn the resistances to the "off" position, and join up the high-tension battery, telephones and earth. The aerial lead may be joined to either of the tappings of the aerial coil, and in the same manner the anode tapping may be joined to either of the terminals on the side of the anode coil. It is recommended that a 50 or a 60 Lissen X coil be used in the aerial and a 60 or a 75 Lissen X coil in the anode circuit. With these connections made, turn on the filament current and vary the two condensers simultaneously. Provided that the local station is working, this should very soon be picked up, and careful adjustment of the tuning condensers will result in the signals being heard at their greatest strength. Provided that you are situated fairly close to the local station, no difficulty should be experienced in picking this up, but when signals are fairly weak, tuning must be carefully carried out, owing to the selective properties of this circuit. In general, it will be found that louder signals are obtained with the aerial lead joined to the tapping on the aerial coil representing the greater number of turns, and the same remark applies to the anode tap. Selectivity will, however, be greater when the aerial, at all events, is joined to the tap which puts the smaller number of turns into the aerial-earth circuit.



A plan view of the under-side of the panel.

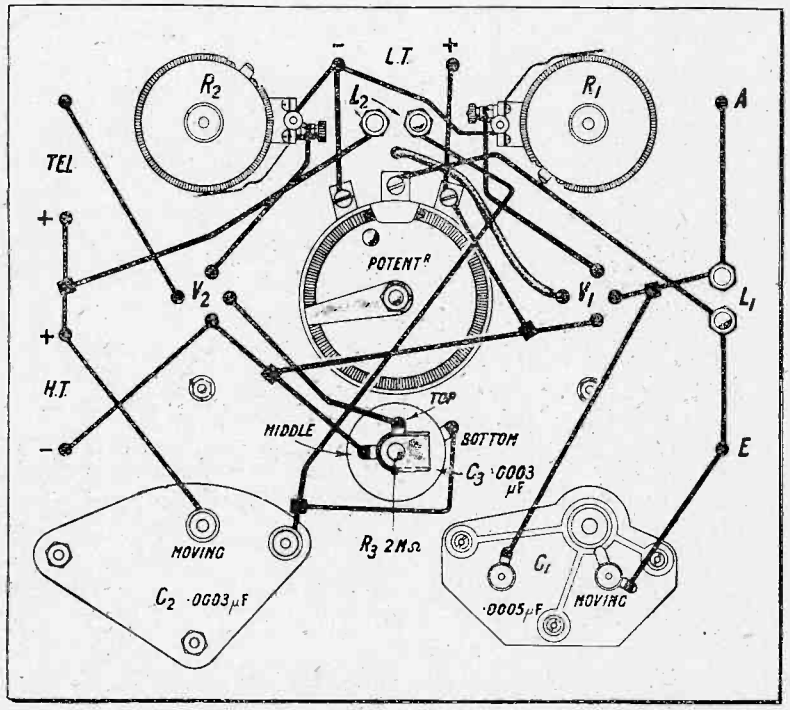
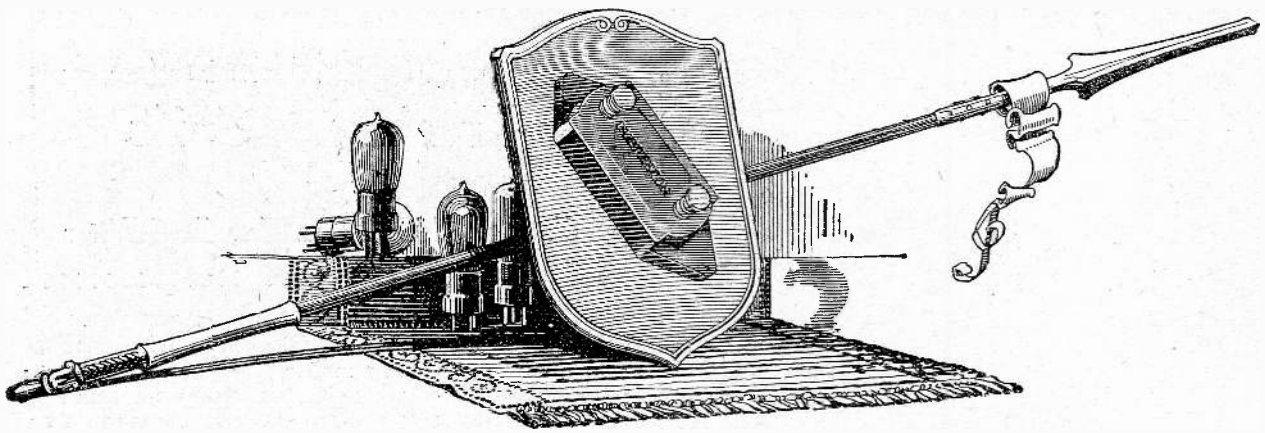


Fig. 4.—The wiring of the receiver is quite simple. Note that the moving plates of C_1 are connected to earth.

Reaction Control

It will, in general, be found, that ample control of reaction is obtained by means of the potentiometer incorporated in the receiver. If the potentiometer is worked towards the negative end, the set

(Continued on page 683.)



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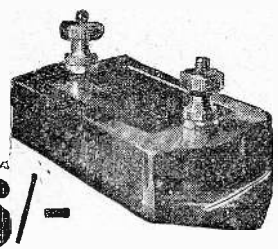

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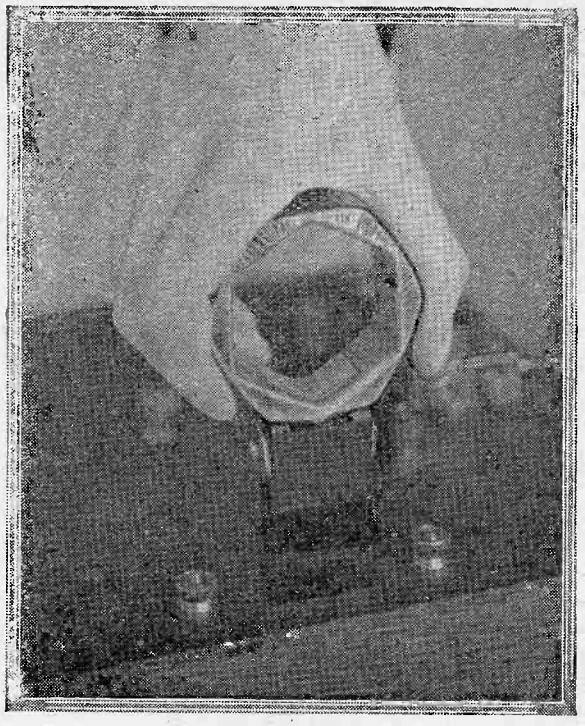


Faults are sometimes caused by handling coils too roughly.

Faults in Tuning Coils

By

G. P. KENDALL, B.Sc., Staff Editor

IT is a curious psychological fact that the detachable accessories to the wireless receiving set, such as plug-in transformers, plug-in coils, and even valves, are some of the last components to be suspected when the whole set goes wrong, and we realise that some fault has developed. Possibly one has a feeling that it is so easy to find out whether any of these units are defective by the simple process of substitution, that one simply does not take the trouble to do so. On the other hand, of course, to substitute a sound high-frequency transformer for a suspected one is not always possible to most of us, since it assumes that we possess an alternative one covering the same wavelength range.

Impaired Selectivity

Now, these detachable units are by no means so trouble-proof as we are apt to assume, and I have often had the experience of being called in to diagnose troubles in quite ambitious sets, which were ultimately traced to such apparently trifling causes as a break in the connections of a tuning coil. It is therefore hoped that it will be of some assistance to the general reader to devote some notes this month to the general question of the faults which are liable to develop in tuning coils, to those which may be found present in defective specimens which may sometimes be purchased, notwithstanding the strict testing carried out by the more reputable firms, and to those which may be found in home-made coils.

One of the variable factors in a coil is the degree of insulation between the turns in the windings, and since this insulation can be impaired to such a point that the result is a quite definite fault, we will consider this first. The kind of thing that may happen is something like this. A set may be giving perfectly good results, eliminating the local station and giving the impression of a satisfactory degree of selectivity, and then possibly as winter approaches the degree of selectivity may be gradually impaired until the user realises that his sharpness of tuning has definitely suffered. The usual investigations as to the condition of the earth connection, joints in the aerial, and so on are all made, and possibly no clue to the trouble is found. In such a case, when attention has been given to the more usual points, suspicion should fall upon the tuning coil, especially if the set is being used in anything which can be regarded as a damp position.

The Effect of Moisture

Readers of *Wireless Weekly* will remember that I have recently carried out some simple tests upon the effect of moisture in coils, and the results showed fairly clearly that it can be, in certain types of windings, an extremely serious factor. For example, I have known the signal strength given by a certain coil to fall to a value of only one-third its correct figure after the coil had been exposed for a few days to the air of a moderately damp room. Coils which are tightly wound and in which many turns cross one another, with considerable pressure at the crossings, are in general very susceptible to the effect of moisture.

Impregnated Coils

At this point I must give a word of warning as to impregnated coils, also based upon the results of experiments described in *Wireless Weekly*. It is not safe to assume that because a coil has been impregnated with some form of varnish that it is therefore proof against damp, and need not be suspected in connection with any mysterious flattening of tuning.

Baking Desirable

Bearing these points in mind, it would seem that a reasonable rule for the set user to adopt is one

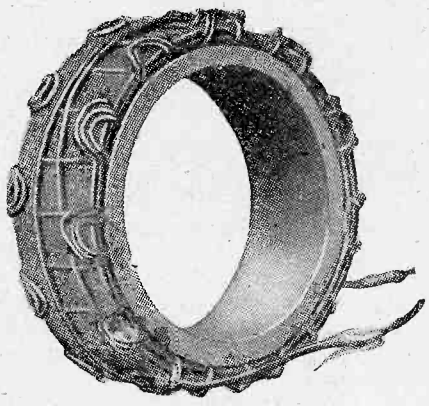


Fig. 1.—An example of a tightly wound coil on which damp may have serious effect.

which dictates that wherever it is possible that trouble is due to dampness in coils, the offending component should be submitted to a prolonged baking at as high a temperature as its construction will permit. Experiment leads me to think that this is a very desirable practice to adopt in the winter months wherever it is not possible to keep tuning coils in a thoroughly

The plug-in components are often the last to be suspected when a defect occurs in the set. In this article the location of faults in coils is dealt with in an extremely simple manner.

Pulling a coil from its socket in this manner is likely to produce faults.

dry position. Certain types of coils, it should, perhaps be stated, are more or less immune to the effects of damp, and these coils are of the general type in which the turns do not cross one another with any degree of tightness, or possibly do not cross one another at all. Such types of these inductances are single layer coils, loosely wound, and the various arrangements of spaced winding upon some form of insulating support. Coils wound with enamelled wire, also, may generally be taken as being to all intents and purposes damp-proof. As an example of the type of winding in which damp has little harmful effect, the reader is referred to the type of "X" coil which is commonly referred to by my name and of which a specimen is illustrated in Fig. 3 herewith.

Another possible source of trouble in tuning coils which must be classed as a fault, is the production of a high resistance at some point in the winding or its connections, in any one of quite a

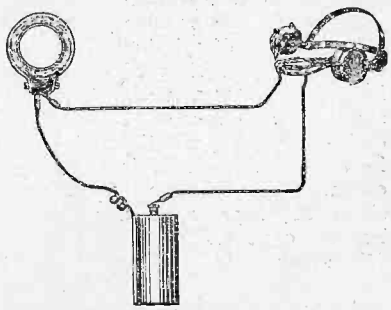


Fig. 2.—How to test a coil for a break in the winding.

variety of ways. Such a fault will probably again show up in abnormally flat tuning, poor signals, and considerable difficulty in making the set oscillate. This latter is quite a good guide, provided that pains are taken to explore all the other possible causes of difficulty in producing self-oscillation. When such symptoms are noticed, the first thing to do is to give the coil a thorough baking, and if this does not remove them, we turn to the next possibility of the production of some defect of the nature of a high resistance in the winding, and obviously the first point to receive attention should be the connections between the ends of the winding and the plug and socket mount.

Defective Joints

In good makes of coils these will be found to be soldered, and the soldered joints should be carefully exposed by partial dismantling of the coil, and given a minute examination. It must be borne in mind that even the most careful manufacturers are to some extent at the mercy of the factory hands who carry out the soldering operations, and if by any chance an unsuitable specimen of flux should be used, it is quite possible for corrosive actions to go on which will in due course produce a partial or complete break where the soldered joint once existed. Upon examination, this trouble will generally present the visible signs of a tarnished or corroded appearance of the metal parts, and if the wire is gently pulled it will probably come away in the fingers. The obvious remedy of course, is to be found in careful cleaning of the parts and re-soldering.

Bad Contact

In some makes of coils it may be found that soldered connections are not made, but merely that the ends of the winding are bared and secured under the heads of the screws which fasten the band or other means of attachment to the plug. In such cases it is desirable to release the ends of the wires and scrape them bright once more, since it is quite possible for tarnish to set in under the screw head (especially if the coil is kept in rather a damp place) of sufficient extent to produce a bad contact.

It is not in general necessary to consider the possibility of an actual break in the windings of the coil, since no reputable manufacturer will permit joints, soldered or otherwise, to exist in the windings of his products, and it is highly improbable that a break could be produced by any other means than the corroding away of a soldered connection. Since the probable points of location of the trouble are to be found at the ends of the windings, if a careful examination here fails to reveal the fault and if it has been ascertained that the plug and socket makes proper contact with the corresponding points upon the coil-holder, it may generally be assumed that the coil is free from the defect of a high-resistance or partially broken contact.

I have not made any mention of the other possible fault, viz.: a complete break, since this as a rule is very easily identified. It generally leads to a complete absence of signals, and very often a buzzing noise in the 'phones. It is, of course, very readily decided as to general nature, by the application of the dry cell and telephones test to the plug and socket of the coil mount, a very

faint or non-existent click denoting a break.

Short circuit

The possibility of an actual short-circuit in a tuning coil may seem perhaps a rather far-fetched one to those who have never experienced such a fault, but it is actually one which is well within the bounds of everyday chances. The symptoms will be a complete absence of signals, inability to make the set oscillate, and no definite result when the telephones and dry cell test is applied to the ends of the tuning coil. Where this trouble is suspected, it is usually necessary to invoke the aid of the substitution test, replacing the doubtful coil by one of the same size, which is believed to be in proper condition, and noting the effect. If the trouble now disappears and if the suspected coil gives quite a strong click when tested through with the telephones and dry cell it is probable that a short circuit exists across the two ends of the windings. This is actually quite a possible trouble, even with a properly-made coil, and one of the ways in which it may happen concerns the arrangement of the two leads to the plug and socket of the mount. If the two wires come out underneath the mount and are taken to the soldering points on the plug and socket portions with a little slack wire to spare, it is quite possible that if too much of the wire has been bared for soldering purposes, when the coil is pressed down upon the top of the plug and secured, the two wires may cross and touch. Such a defect would, of course, be discovered if it developed in the original mounting of the coil, but it may actually develop in the course of use in a coil which responded perfectly to the makers' tests.

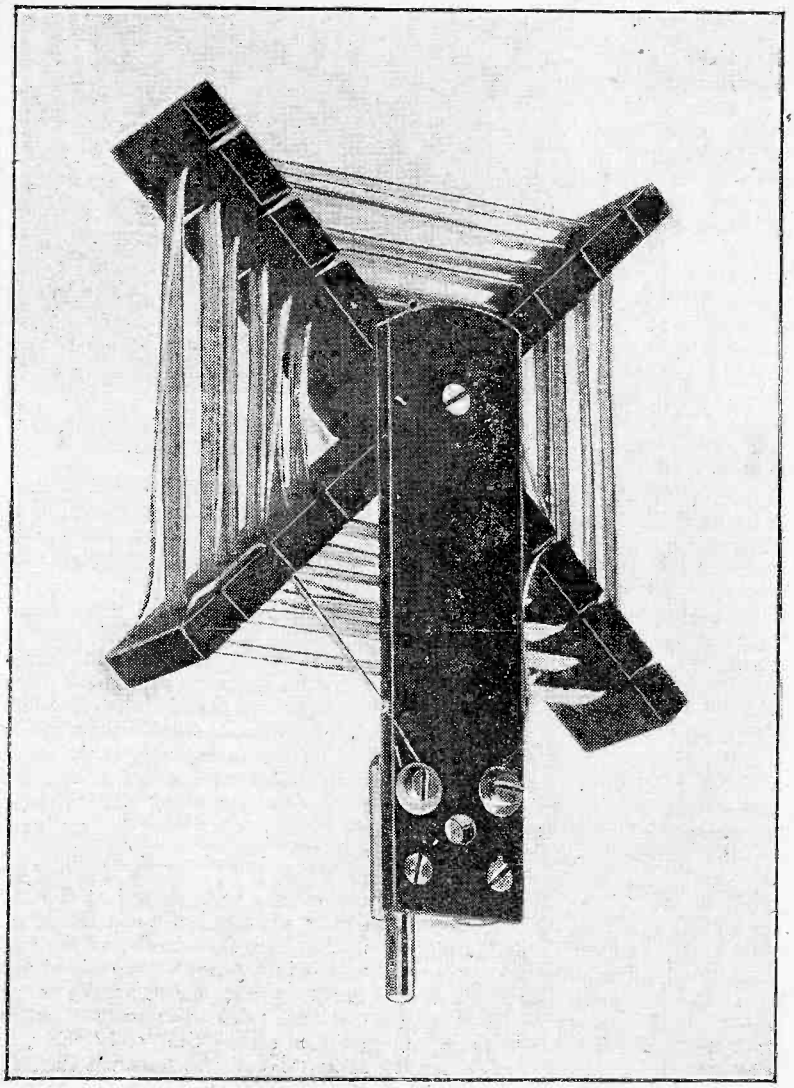


Fig. 3. The type of cross-coil mentioned by the author as being practically immune to the effects of damp

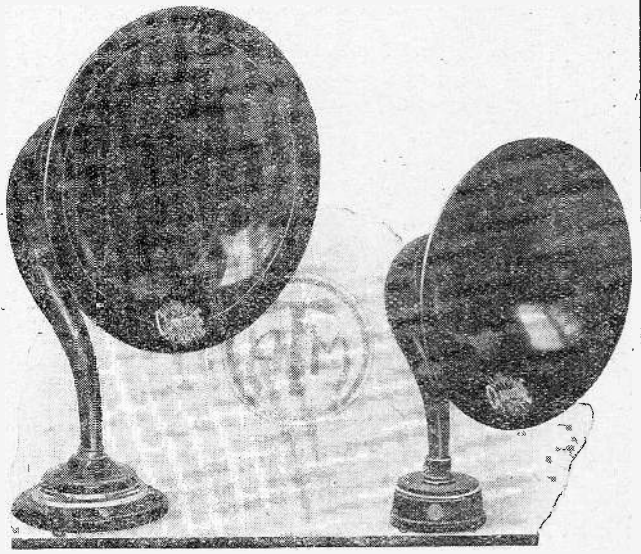
Obscure Cases

Partial dismantling of the coil and inspection will in most cases show that the trouble has taken place in the way which we have just considered, but where it is found that the short-circuit persists even when the coil is dismantled, our suspicions should turn to the plug upon which it is mounted. I have now come across no less than three specimens of plugs in which a definite short-circuit existed inside the moulding, resulting in one case from an actual chip of metal which had lodged between the two plug and socket portions, while in another from over-long screws being employed for securing the band which holds down the coil, and in the third from the presence of a mass of metal filings and soldering paste upon the top of the plug beneath the coil.

The simplest test to adopt in such cases is to take the coil off the plug altogether and test the latter separately with the ever-useful telephone and dry cell.

The only other fault which may occur in home-made or bought coils which I have found at all common is that which is produced by a plug of defective quality.

The symptoms again will be flat tuning and reluctant self-oscillation, with probably some loss in signal strength. To discriminate between this fault and that of dampness in the windings, the precaution should be taken of baking the coil, and noting whether the fault is removed. If it is not, and examination fails to reveal any signs of a poor or a partially broken contact, the plug should fall under suspicion, and the only effective way of testing this without any measuring instruments, is simply to remount the coil upon a sound plug, or better still, to attach to the two free ends separate pin and socket contacts, which can be pushed into the appropriate socket upon the coil-holder. In the case of a particularly bad and leaky plug it is often possible to obtain a quite clear and distinct click between the pin and socket with the telephones and dry cell method, and when this can be done no hesitation need be felt in deciding upon the plug as the cause of the trouble.



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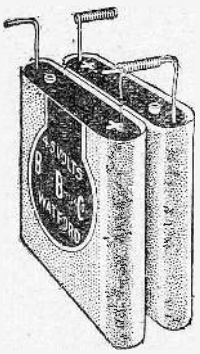

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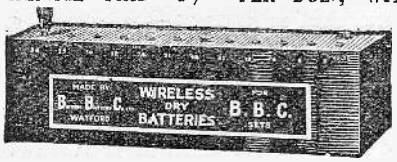

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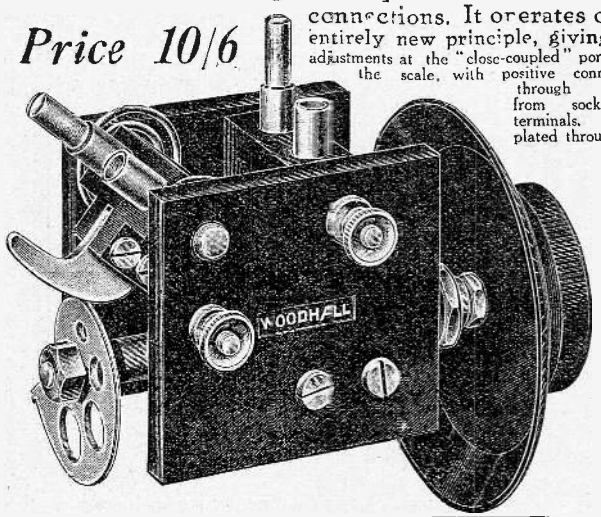

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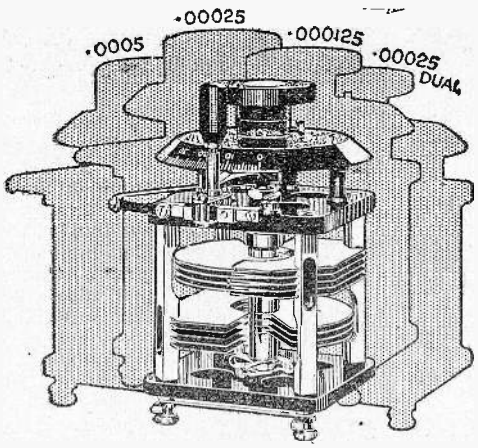

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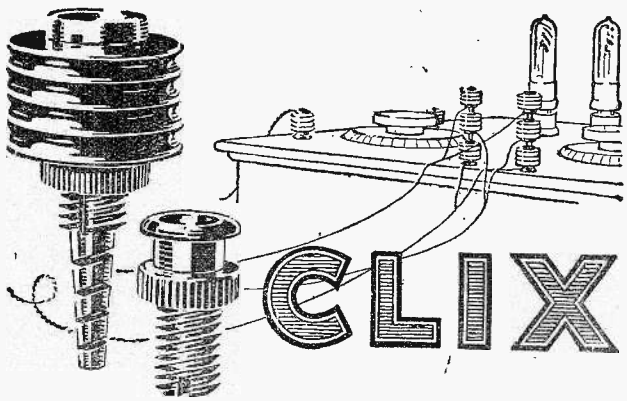

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Adapting the "Simple Selective Set"

By A. D. COWPER, M.Sc., Staff Editor

A description of how to convert the receiver described by Mr. Cowper in the April issue to a Reinartz receiver with a very wide range of reception.

FROM correspondence it would appear as if the little set with Reinartz type reaction and "semi-aperiodic" aerial coupling by means of a tapped coil, described in MODERN WIRELESS for April, 1925, by the writer, has proved quite as successful in other hands. Some correspondents appear to have met the difficulty foreshadowed by the author (p. 377, Vol. IV., No. 3), that certain types of valves will require a size larger reaction coil throughout. The smallest coil that will give certain oscillation on demand should be used; and the mistake should *not* be made of trying to get over the difficulty of a low-powered valve by using a larger reaction-condenser. A large part of the charm of the Reinartz arrangement, in its refined form, would then be lost, as with a ·0005 μF reaction-condenser the shift of wavelength with reaction-coupling becomes very marked. The same phenomenon will be noticeable if the radio-choke is inadequate (as in the early American versions of the circuit)—particularly on the long waves. Some correspondents appear to have failed to take to heart the suggestions as to elimination of oscillation overlap, by careful adjustment of H.T., filament-temperature, and gridleak value, for DX work, especially with soft valves.

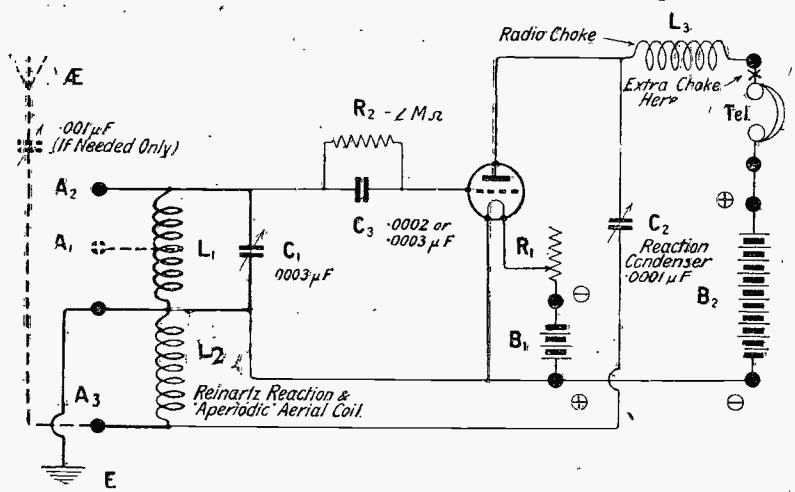


Fig. 1.—The theoretical circuit of the receiver as modified. An extra radio-choke may be inserted at X if necessary

Easily Adapted

A simple alteration is suggested here, for those who have already constructed the set and wish to launch out on to a wider sea than that charted by the B.B.C. By the addition of a single terminal and altering two wires one obtains a "straight" Reinartz receiver with reaction and aperiodic aerial coil in one, which can be used with plug-in coils either of the purchased or home-made variety, to cover an enormous range of wavelengths in the simplest way possible. This does not interfere with the use of the original tapped coil, when desired.

The slight alteration is indicated in the figures. Taking the wiring diagram on p. 374 of the article in the April number of MODERN WIRELESS, an extra terminal is put in between the coil holder plug L_1 and the existing (alternative) aerial terminal A_2. The wire connecting the coil holder L_1 and the original terminal A_2 is then cut, and connected to this new terminal, now called A_2. The *old* terminal is now connected by a short wire to the lead from the coil holder plug L_2 to the ·0001 μF reaction-condenser, as shown (Fig. 3), and is called A_3.

Reinartz Reaction

Now by putting the aerial-lead on the terminal A_3 we get the reaction-coil (which is plugged into the holder L_2) in series between aerial and earth, *i.e.*, it acts as an "aperiodic" aerial-coil; whilst at the same time it is connected to the reaction-condenser and performs as an ordinary Reinartz reaction-coil, as shown in the circuit diagram. By plugging suitable coils into holders L_1 (grid

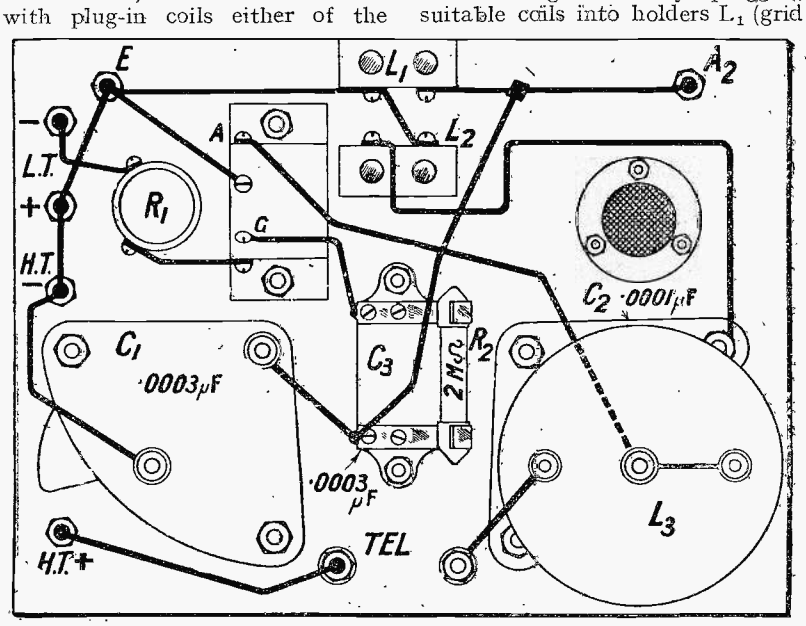


Fig. 2.—The original wiring diagram of the "Simple Selective Set"

coil) and L_2 (aperiodic-aerial and reaction combined), we can obtain practically any range of wavelengths. The aerial-and-reaction-coil must (*a*) be sufficient to give oscillation with the valve in use, (*b*) if possible, not tune the aerial up to the wavelength in question; the aerial must have a natural frequency with this coil inserted in series with it, rather *above* the working frequency. Otherwise the set becomes dead, or unmanageable. On the longer waves the small radio-choke fitted may prove inadequate, and the obvious remedy is to insert a large choke-coil, *e.g.*, a No. 400 or larger, in series with the existing choke and between it and the 'phones. Some queer phenomena may be observed with inadequate chokes.

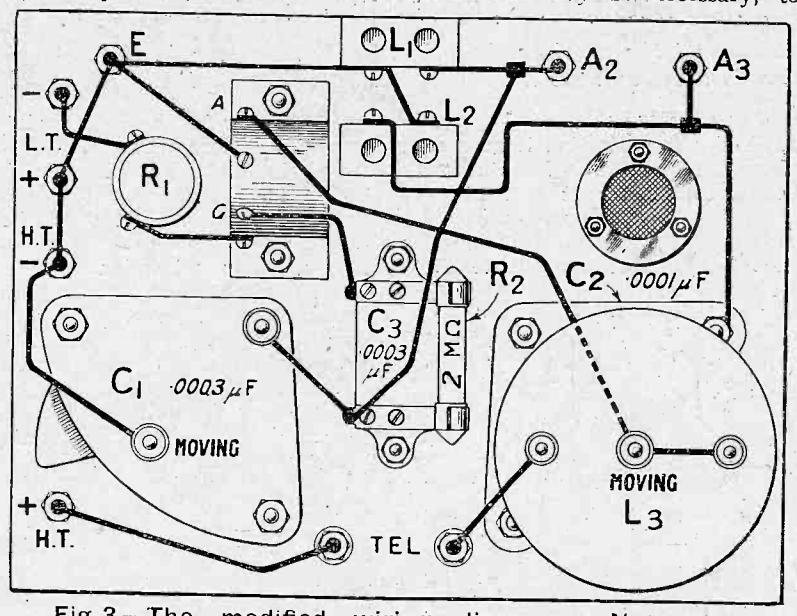


Fig. 3.—The modified wiring diagram. Note that terminal A_2 in Fig. 2 now becomes A_3

Coils

The coils below about No. 35 should be made of stout wire (No. 15-20 d.c.c.) as a plain solenoid or "hank" coil, roughly wound on a 3-in. former, then removed and bunched up lightly and tied with tape. The No. 17 coil was actually of No. 20 d.c.c. on a 3-in. former; the others were as described. In the ultra-short-wave region, success will result only if a suitable valve (one which oscillates readily) be used, such as DE5B or DE3B; together with ample H.T. Some types of tuning-condenser—and some alleged 'ebonite" coil-plugs—will prevent oscillation completely, and therefore any hope of sensitive reception on these wavelengths. The smallest coils were wound with No. 14 d.c.c. (or bare) copper wire, about 4-in. diameter and air-spaced about ½-in. mounted on an ordinary (*ebonite*) coil-plug and entirely self-supporting, of course. No. 12 bare copper wire is better still.

On the shorter waves a ·001 μF variable condenser inserted in the aerial-lead *may* be necessary, to detune the aerial when working near its natural frequency. On the ultra-short waves no direct connection at all is made to an aerial, and at the most a coil of one or two turns is connected between a short single-wire aerial and "earth" (a counterpoise is best) and put somewhere near the tuning inductances. Even then, a ·001 μF series variable aerial-condenser may be needed, to detune this aerial from the point where some harmonic of its natural frequency clashes with the actual operating frequency.

The receiver was not, of course, designed for ultra-short wave work, and the minimum observed, with three and two turn coils in position, was about 19 metres (just under 16,000,000 cycles frequency) by careful comparison with heterodyne wave-meters which had been calibrated, by the harmonic beat method, against longer-wave instruments. Oscillation was fairly precarious on this wavelength, but on 40 metres (7-turn grid coil, 4-in. diameter, of No. 14 d.c.c. spaced ½ in., reaction similar but of 4 turns) the set operated excellently, receiving loud amateur morse on a lead to the 3-wire counterpoise alone (connected to "earth" E); and would also operate as a "grid-leak-howl" super-regenerative receiver on this frequency, with a 2-megohm grid-leak and with an 11-turn coil with centre earth-tap, 5½-turn grid and 5½-turn reaction coils, giving loudspeaker results. The 20-metre point was announced incidentally, by a chorus of motor-ignition noises from passing traffic, especially heavy lorries and motor-omnibuses.

Coil Sizes and Wavelengths.

(With aerial both Maximum and Minimum will be raised somewhat).

Plug-in Coils. (Lissenagon). No. :—		λ : m. (No Aerial).	
L_1	L_2	Min.	Max.
40	No. 17, (. om: mads)	116	330
60	25–35	180	500
75	35	250	700
100	60–75	350	900
150	75	500	1300
250	100	800	2000
*300 (Igranic)	150	1050	2500
Built-up Coils. DE5B Valve.			
Turns :—			
25	17	85	210
17	11	62	153
11	7	44	116
7	4	32	84
3	2	Min. 19	Max. 34 (for oscillation).

* Extra radio-choke required; No. 400 coil in series with 'phones with aerial reaches 2600 m.

Mr. Harris' Investigations in the United States

Mr. Harris' trip to America is proving extremely interesting, and in this article we give a description of some of his experiences, including his visit to WAHG, pending accounts from his own pen.

The presentation of the "Radio Cake" to Mr. Harris by Mr. A. H. Grebe.

A NUMBER of reports have been received from Mr. Harris since his arrival in the United States, and pending the publication of accounts of his experiences from his own pen, the following much condensed version giving the outline of his investigations may perhaps be of interest.

Mr. Harris reached New York some eighteen hours late, as a result of a thick fog and bad conditions on the trip, but his voyage was otherwise uneventful, if we except the fact that he rigged up a short wave receiver on the way across, and found it possible to listen to British transmitters for the greater part of the voyage. He arrived in the middle of a very severe hot spell in New York, which he appears to have found exceedingly trying. Immediately the long-drawn-out formalities of the Customs, etc., were over he appears to have had the usual array of Press photographers to face, and their efforts produced a somewhat amusing result; the portrait which was distributed from one of the American photographic agencies bore upon its back an extraordinary "caption," in which Mr. Harris was described as being "known over the world as the best radio announcer!" A print bearing this remarkable legend was actually sent in to the Radio Press offices in London and was reproduced in *Wireless Weekly*.

An Enthusiastic Welcome

Arriving on the Saturday, Mr. Harris appears to have spent most of Saturday afternoon and Sunday inspecting the windows of the larger radio stores of New York, gaining an impression of the more commonly used apparatus and components, and began his real investigations upon the following Monday. An enthusiastic welcome is being extended to him everywhere, according to the wont of the American wireless man, and during the early part of the week Mr. Harris met a number of the leading wireless editors in New York, with whom he spent a considerable time going over the salient features of American radio conditions, while later he was the guest at a dinner given in his honour by the leading technical writers and editors at the Harvard club, of which he has been given the temporary freedom. A reproduction of a photograph taken at this dinner accompanies these notes, and upon the left of the photograph, reading from the head of the table towards the front of the picture, will be seen the following gentlemen:—

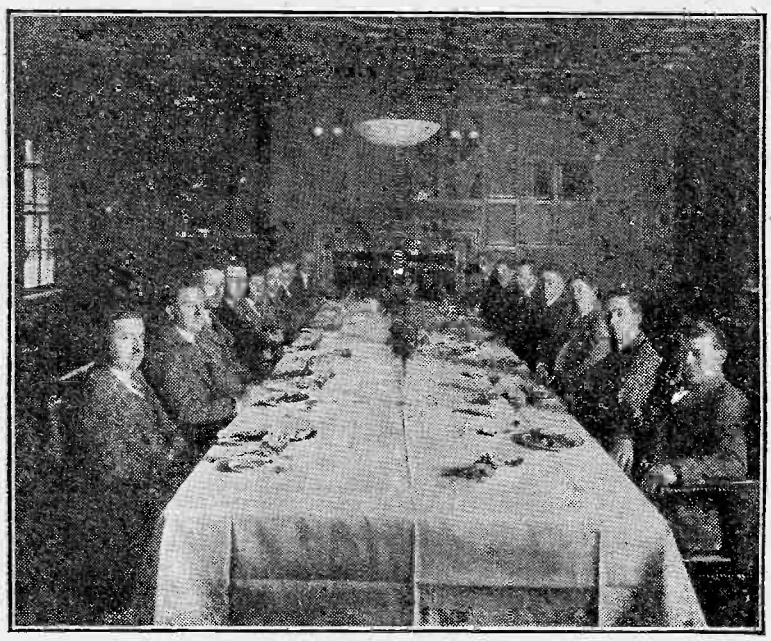
Mr. Casem (*New York Telegram.*)
Mr. Paul McGinnis (*New York Journal*).

Mr. Roe (*Radio News*),
Mr. Arthur H. Lynch (*Radio Broadcast*),
Mr. W. C. Alley (*Radio Retailer*),
Mr. M. Clements (*Radio Retailer*),
Mr. A. B. DeLacy (*Popular Radio*),
Mr. L. M. Cockaday (*Popular Radio*), while upon the right and reading in the same direction are the following:—
Mr. H. C. Bodman (*Radio Merchandising*),
Mr. M. B. Sleeper (*R. & M. Engineering*),
Mr. Nixon (*Radio Dealer*),
Mr. Paul C. Oscanyon (*Amateur Radio*),
Mr. Ch. H. Albrecht (*New York Graphic*),
Mr. Bragdon (*New York Sun*),
Mr. Sylvan Harris (*Radio News*).

Later in the week a visit was paid to the factory of Messrs. Attwater-Kent (one of the leading American manufacturers of sets and components) at Philadelphia, returning to New York the same night.

An Amusing Presentation

Much of the listening-in which Mr. Harris has been doing has been carried out upon Long Island, where also he has been the guest of Messrs. A. H. Grebe, whose factory is situated in Richmond Hill, Long Island. Here he has had many opportunities of testing a variety of the sets produced by the Grebe works, and it was here that he spoke via the Grebe broadcasting station WAHG. His



A photograph taken on the occasion of the dinner given in Mr. Harris' honour at the Harvard Club. Mr. Harris may be seen at the head of the table.

Interesting Disclosures

Mr. Harris is devoting much time to the investigation of actual practical receiving conditions, and he has been listening-in for long periods in positions ranging between nine or ten and about thirty miles out from New York, using a variety of different receivers, including super-heterodynes and the more elaborate neutrodyne instruments. Remarks contained in his letters indicate that he is gaining some rather extraordinary impressions of the selectivity question, and also of the problem of self-oscillation, and some extremely interesting disclosures should be forthcoming from Mr. Harris direct at an early date.

broadcast speech appears to have been an affair accompanied by a good deal of ceremony and an amusing presentation of an enormous "radio cake."

As is usual when someone of distinction speaks from such a station, preliminary notices were sent round to the Press, in which the subject of Mr. Harris' talk was announced to be "Radio from an English point of view," this informal talk taking place at 10 p.m. In these preliminary notices, an explanation was given of Mr. Harris' position as Editor of *The Wireless Constructor* and the designer of so many of the home-constructed British receiving sets, and references were made to

what were described as "the famous Harris Hookups!"

Mr. Harris' actual address from WAHG was a general account of the British broadcasting system, the arrangement of main and relay stations with our system of simultaneous broadcasting, our licensing system, the position of the B.B.C., our troubles with oscillators, and so on; and when he had finished the announcer of the station proceeded to explain to the listeners what was taking place in the studio during the presentation of the "radio cake." The cake in question was described as being as large as a tub, covered with frosting representing the British and American flags and bearing an inscription: "To Percy Harris, Leading Broadcast Authority of the British Empire, from WAHG." The cake was presented to Mr. Harris in person by Mr. A. H. Grebe, the president of the firm and the whole episode appears to have created much amusement.

A Well-Equipped Station

Another broadcasting station which Mr. Harris has visited as part of his investigations is that very old friend, WJZ, where he was given the greatest of freedom to go and see just what he pleased, which he seems to have done extremely fully. He gained the impression that this was a remarkably well-equipped station, and mentions as particularly noteworthy the fact that modulation is constantly checked by watching the trace of an oscillograph. It would seem that the authorities of WJZ realise their responsibility in the influence which their station must have upon the pronunciation of listeners, for all their announcers are University men.

At the end of this, his first week, a visit was paid to the experimental station and laboratory at Garden City, Long Island, of the well-known American magazine *Radio Broadcast*. The impressions gained here should be particularly interesting, since in this laboratory are prepared some of the best of the American designs for the home constructor. Another visit to an establishment of an American wireless magazine followed shortly on this, when Mr. Harris was shown over the new broadcasting station just erected by the *Radio News*, which is to operate with the call sign WRNY. This station, Mr. Harris reports to be fitted with standard Western Electric equipment, giving a choice of powers between 500 and 1,000 watts, but it has not, of course, yet been officially opened.

This is as far as Mr. Harris' letters carry us as regards the progress of his investigations, but cables which have been received during the last few days before MODERN WIRELESS goes to press indicate that he has now visited the Bureau of Standards, where he met Dr. L. W. Austin and Dr. J.H. Dellinger, but no details of this visit are as yet forthcoming.

An Auto-Coupled Two-Valve Receiver.

(Continued from page 670).

will oscillate fairly freely and it will be, in most cases, necessary for the potentiometer knob to be turned somewhat towards the positive end. Cases may arise in which difficulty may be experienced in making the receiver oscillate even with the potentiometer upon the negative end when receiving the high-power long-wave stations such as 5XX and Radio-Paris. In these cases it may be necessary to slightly alter the receiver in order that a reaction coil, which is to be inserted between the anode of the second valve and the telephones, may be coupled to the aerial coil. In this case, the aerial coil socket will be replaced by a conventional two-coil holder, the aerial coil being placed in the fixed socket and the reaction coil in the moving socket. This is, however, an extreme remedy which will only be necessary in extreme cases, upon very bad aerials. In such latter cases, it may be necessary to shunt the telephones with a small fixed condenser, say ·0003 μF capacity.

Results.

The receiver was initially tested upon the writer's main aerial which has an average height of roughly 40 ft. after the London station had closed down. Upon careful tuning, two French broadcasting stations were heard at good strength, and shortly afterwards three French amateurs were heard giving their locations and sending gramophone records.

Subsequently, good signals were received from Bournemouth and Birmingham with no interference from London, whilst several German stations came in, and Radio-Toulouse was excellent in the phones. Radio-Paris was separable from Chelmsford in south-east London, and the concert from the former station was enjoyable to a degree seldom experienced.

Two Letters of Interest from Abroad

Success of T.A.T. in Sweden

SIR,—I have studied MODERN WIRELESS for over a year and I have found this paper to be the most interesting of all on this subject. Mostly all of your different sets have been tried by me and I find your T.A.T. system (as described by Mr. John Scott-Taggart in the November 1924 issue) the most interesting and that it gives the best results, both as regards efficiency and stability.

My receiver consists of 2 H.F.—D.—3 L.F., and is so arranged as to enable me to use any number of valves from 1 to 6. The L.F. valves can be used either with transformers or with resistances at will.

I receive all the Continental broadcasting stations at full loud-speaker strength, using the large type of Claritone. Far better results are obtained with your tapped resistance coil in series with different honeycomb coils than with the latter type alone. For wave-lengths over 1,000 metres a resistance gives better results than coils.

[We do not share this opinion generally speaking.—*Editor.*]

I am now going to try your T.A.T. circuits utilising the new "Trap" method of tuning (described by Mr. John Scott-Taggart, in the February issue of MODERN WIRELESS). As soon as I have done so I shall be pleased to let you know the results.

Bergvik is situated 230 kilometres north of Stockholm and about 1,650 kilometres from London. (10 kilometres equals 6 Eng. miles.)

I also enclose a summary of the Swedish Broadcasting Stations that you may rely upon being up to date. Yours truly,

PONTUS HEDEN.

Bergvik, Sweden.

From South Africa

SIR,—Being a reader of MODERN WIRELESS and *Wireless Constructor* since the inception of both books, I wish to congratulate you on the excellent diagrams and also radio notes.

I have made a 4-valve set, using the circuit given in the November MODERN WIRELESS, on page 690, and it works excellently, although I have put in a few extras such as switches and fixed condensers.

I am 30 miles from Cape Town and get our station excellently on the loud-speaker. I get the same results from Jo'burg and Durban. I have had Bournemouth quite loud on the 'phones on this set, and I can recommend it to your readers. I use 4 Marconi "R" valves.

In your Christmas number you have a diagram of a Reinartz set by Percy W. Harris, which I have made and get excellent results on 2 valves, detector and low frequency from KDKA, Pittsburgh.

Our village is very screened by trees, and the distance from KDKA is about 8,000 miles.

Every morning this week I have picked up KDKA quite loud on the 'phones.

The coils I find the best are made from 14 S.W.G. wire (enamelled), having three turns for aerial and ten turns for the grid coil; the reaction coil has seven turns.

Wishing you every success and also congratulating you on your good book. Yours truly,

J. F. LATEGAN.

Stellenbosch, S.A.

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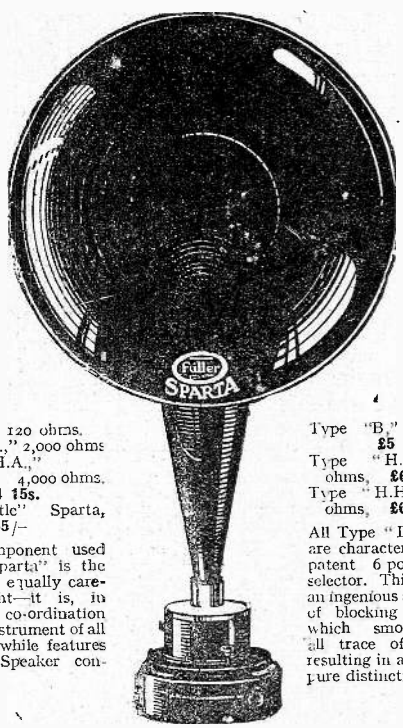
That's why we ask you to go to your dealer and hear the "Sparta" perform. It is the loud speaker that faithfully *re-creates* the performance exactly as it is given before the microphone. Nothing added—nothing lost. For the "Sparta" is the supremely good combination of good components, conceived by master designers, built by master craftsmen. If you would have every tone variation, every changing inflexion, the *personality* of the artistes themselves, reproduced with vivid realism—use a "Sparta."

Remember, hearing's believing, and a demonstration will provide convincing proof of its extraordinarily good reproduction. *All good dealers stock it.*



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

Type "B," 120 ohms, **£5 15s.**
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All Type "B" Speakers are characterised by the patent 6 position tone selector. This consists of an ingenious arrangement of blocking condensers, which smooths away all trace of harshness, resulting in a remarkably pure distinctness of tone.

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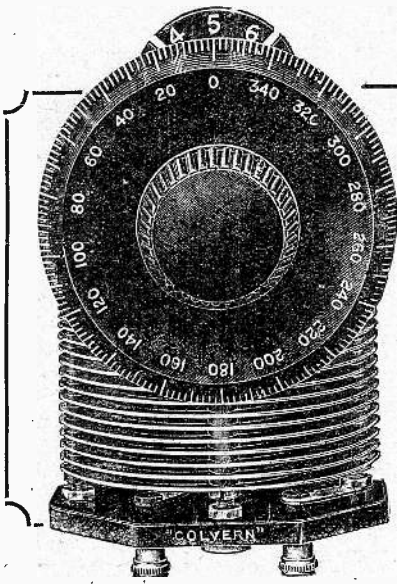

Imagine an analytical chemist without his scientific balances or an engineer without his micrometer!

Similarly, you will never tune a receiver with a direct drive condenser once having experienced the accurate tuning of the Colvern Selector Mechanically Controlled Precision Condenser.

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THE Colvern Selector Low Loss Precision Condenser is an instrument which gives the precise adjustment so essential to obtain perfect reception, whether on loud signals, such as the local broadcast, or transmission from low-powered distant stations. The mechanical method employed ensures accuracy to 1 20th of a degree; and, a further consideration, the eye is not called upon to supplement imagination. **The scale interval is readily readable to that small difference in capacity—1/3600th part of the total capacity available.**

It is when working upon weak distant transmissions that the necessity for such critical and accurate adjustment is vital. Many excellent circuits have been discarded because they required a more critical tuning adjustment than available apparatus afforded. Equally efficient circuits were condemned as uncontrollable, since existing apparatus could not give the essential final adjustment.

The Colvern Independent Vernier provides a very useful means of securing fine tuning adjustment. For balancing up H.F. Stages, taking up variations in capacity when H.F. Stages are controlled by dual or triple condensers, and for balancing up the Long Wave Intermediate Amplifier in Super Hets, when Matched Transformers are used. **Price 2/6.**

Capacity reaction circuits such as the Reinartz, ultra short wave receivers, and the short-wave stages of Super Heterodyne Receivers, require hairbreadth tuning, obtainable only by such mechanical means as the Colvern Selector provides.

The dial of the Colvern Selector is divided over the full circle, and provides 360 degrees value for each rotation of the index. This enables 1/20th of a degree to be actually located; AND ANY PREDETERMINED CALIBRATION CAN BE RE LOCATED TO THIS ACCURACY AT WILL.

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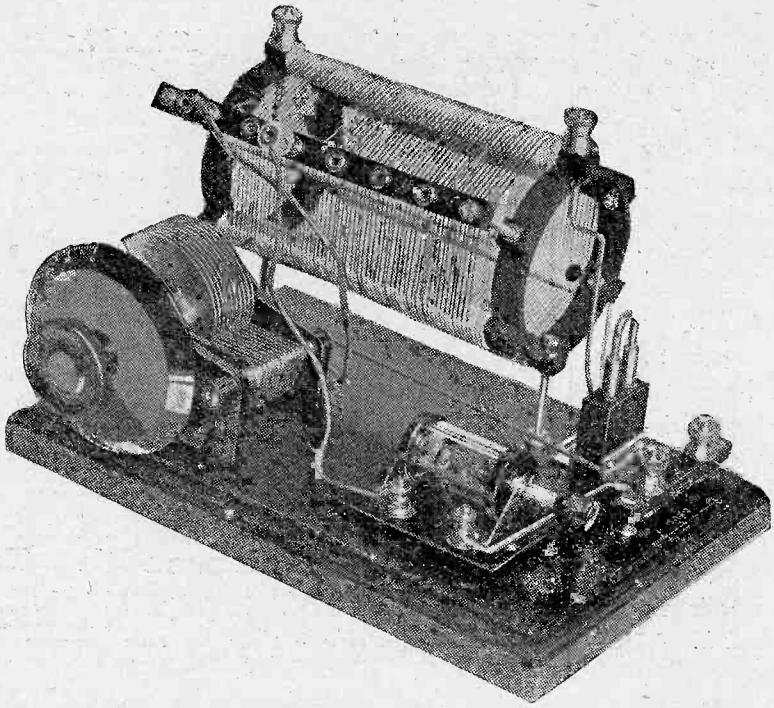


A view of the complete instrument showing the disposition of the various components; note the type of inductance used.

A Skeleton-Coil Crystal Set

By

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

FOR those who wish to receive broadcast programmes simply on the telephones and who are situated at not much greater distances than, say, ten miles from a main broadcasting station, a well-designed crystal receiver, used in conjunction with a good aerial and an efficient earth connection, has much to commend it. The mere fact of the excellent reproduction—a faithful counterpart of the original—which it is possible to obtain is in the opinion of many a sufficient justification for the use of a crystal receiver in preference to a valve set.

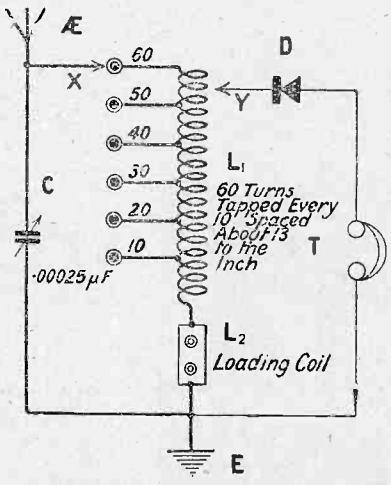
Obtaining Loud Signals

No one will deny that it is a simple matter to obtain quite good results in crystal reception even with the most rudimentary or even crude apparatus; but, seeing that in nearly all cases a crystal set is required for reception from one station only, which is generally a nearby broadcasting station (excluding, of course, the high-powered station at Chelmsford), it is as well to concentrate on the design of the receiver with a view to obtaining the maximum signal strength under these conditions.

The set illustrated in the accompanying photographs represents an attempt to produce a crystal receiver on these lines. On the author's aerial and earth system at about nine miles from 2LO this set gives, as far as can be judged aurally, results louder than those given by most of the various types of crystal sets tried. This is confirmed by independent observers.

Comparisons

In one case actual comparison by means of a four-pole throw-over switch with a crystal receiver embodying an air-spaced single-layer coil wound with No. 18 gauge wire, adjusted to give the maximum signal strength, showed that there was no difference, judged aurally, in the loudness of signals.



In this circuit diagram the arrows X and Y represent Clix plugs, while the Clix sockets are shown as circles connected to the tapping points on the coil.

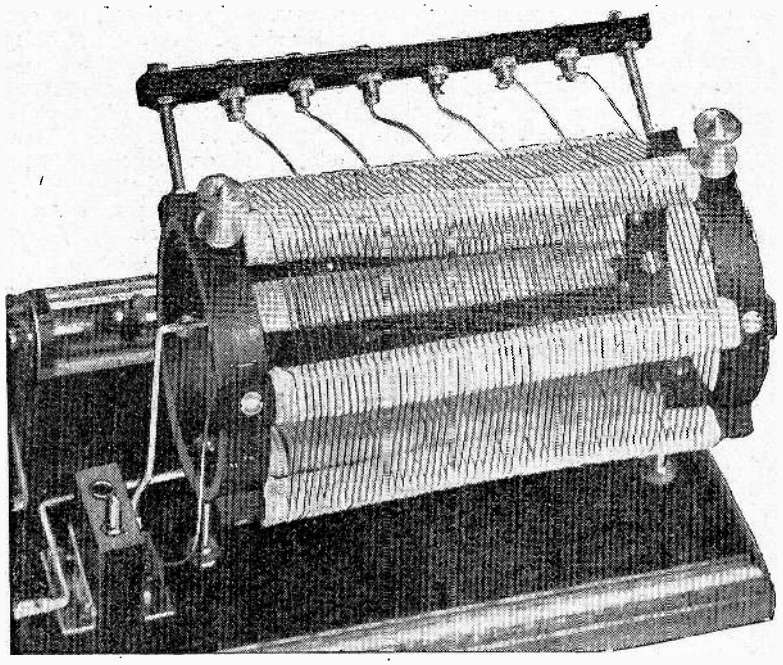
Some recent work done by Mr. A. D. Cowper on this subject (refer *Wireless Weekly*, Vol. 6, Nos. 4 and 10) is of interest, and indicates that, provided an efficient type of coil is wound on a low-loss former, there is little advantage to be gained by the use of very thick gauges of wire for a crystal tuning inductance when we have the full damping effect of the crystal-phone circuit across the whole of the inductance. As a result of much experimental work, Mr. Cowper selected No. 18 gauge wire wound as a single layer air-spaced inductance on a low-loss type of former, as the limit of thickness to which it was an advantage to go with a circuit embodying a variable crystal tap.

It must, of course, be appreciated that a crystal receiver which gives particularly good results on a certain aerial and earth system will not necessarily give the same performance upon another system, though with average broadcast receiving aerials of fair efficiency and if provision is made for varying the aerial inductance, the results should not be sensibly different assuming a good earth connection to be used in all cases, since dead-end losses with an air-spaced inductance of the type indicated above do not appear to be serious.

Gauge of Wire

Some readers may be surprised to learn that the wire used for the inductance in the crystal set to be described is of No. 24 gauge, enamel insulated. Since the effectiveness of a crystal set is, in the end, judged aurally, the author considers that the slight increase in signal strength, if any, which may be observed with a thicker gauge of wire in a coil of the type illustrated does not warrant its use under ordinary circumstances in view of

In this contribution the author describes a crystal receiver designed to meet the requirements of those who are willing to take a little more trouble in the construction of a set to obtain that extra volume which makes all the difference between average and good crystal reception.



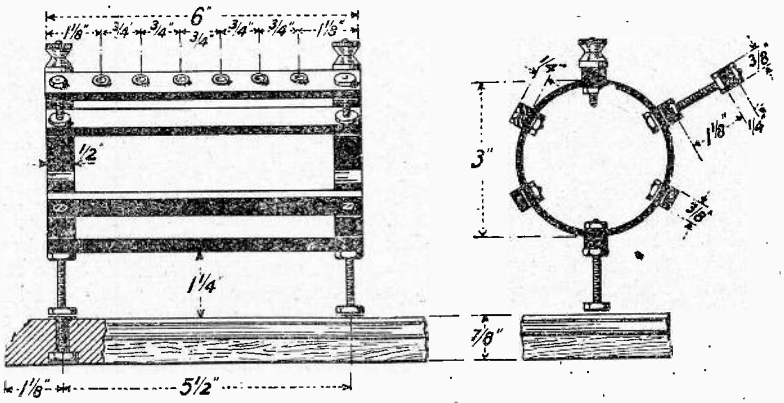
The method of winding the coil is more clearly shown in this photograph.

the practical difficulties in winding attendant on the use of thicker wire. The former would have to be more substantial if the wire was wound at all tightly, and appreciably larger, and the thinner gauge wire is considerably easier to wind.

The theoretical circuit of the set is shown in one of the accompanying diagrams. It will be seen that a coil of 60 turns tapped at every ten turns is used, and that both aerial and crystal taps are provided. The parallel tuning condenser C has a maximum capacity of ·00025 μF. Allowance is made for a loading coil L_2 for the reception of the Chelmsford station; a short-circuiting plug is inserted into the socket provided for this when using the set on the lower broadcast wavelengths. A by-pass condenser across the telephones is not used, since no difference could be detected aurally with or without this component.

Baseboard Mounting

The photographs should give a good idea of the arrangement of the set, which is mounted entirely on a baseboard. The tuning condenser and the crystal detector are both placed at the front of the board in accessible positions. The special coil is mounted at the back, while a strip of ebonite, supported away from the coil in the front, carries six Clix sockets from which short leads are taken to the tapping points of the coil. A single coil mount to take the loading coil for Chelmsford is affixed to the baseboard on the right-hand side of the coil. The 'phone terminals are mounted on the right-hand side at the back of the baseboard, while the aerial terminal is on the left of the low-loss coil former at the top, the earth terminal being in a corresponding position on the right.



The construction of the coil former and the method of mounting it on the baseboard may be seen from the above diagrams. Note also how the strip carrying the Clix sockets is supported.

For those who wish to make an exact duplicate of the set, the following list of the components actually used is given, but the discriminating constructor has ample choice of suitable material.

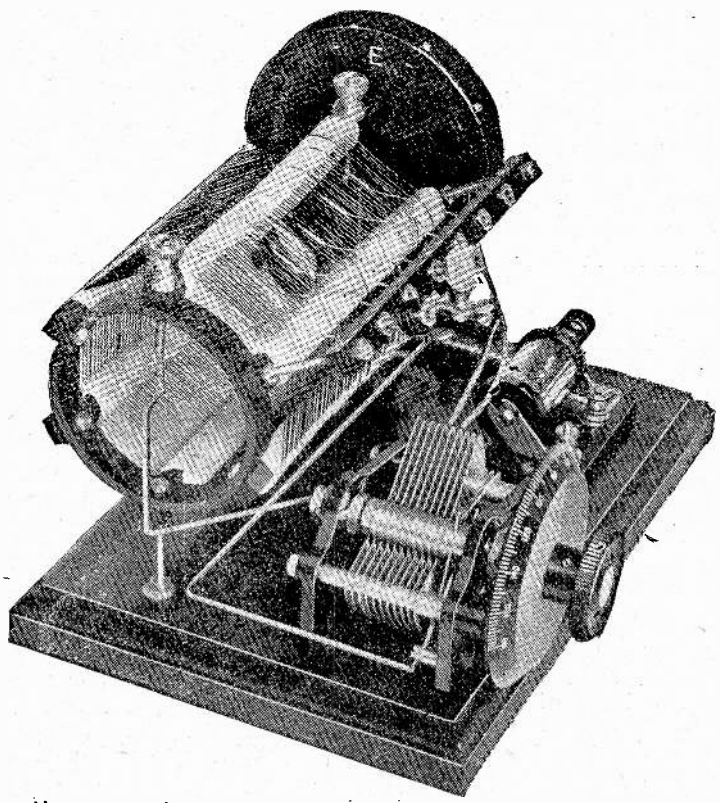
1 baseboard, 9 in. by 6 in. by $\frac{7}{8}$ in. thick (Camco).
1 ·00025 μF variable square-law condenser (Sterling Telephone and Electric Co., Ltd.).
1 crystal detector (Type B.C. 38, General Electric Co., Ltd.).
1 single coil mount (for baseboard mounting) and shorting plug (Burne-Jones and Co., Ltd.).
4 terminals.
6 Clix sockets and 2 Clix plugs (Autoveyors, Ltd.).
7 ebonite strips, 6 in. by $\frac{3}{8}$ in. by $\frac{1}{4}$ in. thick and two $\frac{1}{2}$-in. lengths of 3-in. diameter ebonite tubing (or the complete former may be obtained drilled and ready for assembly and winding of the coil from Burne-Jones and Co., Ltd.).
1 ebonite strip, 3 in. by $\frac{3}{8}$ in. by $\frac{1}{4}$ in.
Some stiff copper wire for wiring and two short lengths of flex.
Two $2\frac{1}{2}$-in. lengths and two 2-in. lengths of screwed 4 B.A. rod, six $\frac{3}{4}$-in. 4 B.A. countersunk screws.
2 dozen 4 B.A. nuts and some suitable brass wood screws.
No. 24. S.W.G. enamel-insulated copper wire. (Approximately two ounces will be required.)

The construction of the special air-spaced coil will first be dealt

with. As will be seen from the photograph showing a view of the complete coil, the former consists of two ebonite rings to which are secured the six strips of ebonite, equally spaced round the circumference of the rings, thus providing a hexagonal-shaped former.

Spacing the Turns

The method adopted of spacing the wire is of interest, and was first described by the author in *Wireless Weekly*, Vol. 6, No. 4 (April 29th, 1925) in the article "A New Receiver for Modern Conditions." It consists essentially of winding the wire in the "grooved" surface formed by winding twine of suitable thickness round the ebonite strips of the former, and solves in a simple practical manner the difficulty of spacing the windings satisfactorily without the necessity of cutting a large number of slots in all of the strips.



For the reception of 5XX the usual loading coil is inserted in the coil socket provided.

If the ebonite for the former has not been purchased already cut to the correct size and drilled, it will be necessary to cut the various strips and rings to the sizes specified in the list of components. Then at ¼ in. from each end of each strip a 4 B.A. clearance hole is drilled, and the holes in three of these strips are countersunk on one side to take 4 B.A. countersunk headed screws. In each of the ebonite rings six 4 B.A. clearance holes are drilled symmetrically and spaced equally round the circumference.

Then take one of the ebonite strips and, starting ½ in. from one end, wind on some good quality twine fairly loosely so as to cover the strip, except for ½ in. at each end. Secure the ends of the twine suitably with the aid of a little sealing-wax. This twine should be of such thickness that 66 turns can be wound on fairly loosely and evenly on the 5 in. of winding space. Thus the twine required will be approximately 1-12 in. in diameter when unstretched. This, with the No. 24 gauge enamel-insulated wire, will give a spacing of about 13 turns to the inch, which is roughly equivalent to a spacing of two diameters between each wire and its neighbour. The twine is wound and secured as indicated on each of the six strips, and the holes to take the Clix sockets are then drilled in the seventh strip, after which these sockets are inserted and secured tightly.

Assembling the Former

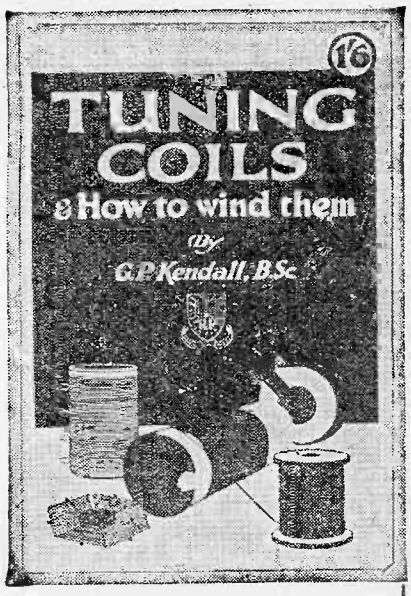
The former is then ready for assembly, and the method of doing this should be quite clear from the photographs and the accompanying drawing of the complete former. The two inch lengths of 4 B.A. screwed rod serve to hold the strip carrying the Clix sockets at a distance from the coil and also secure one of the strips of the actual former. Two terminals and back nuts fix the strip at the top of the former, while that at the bottom of the former is held in position by means of the two 2½ in. lengths of screwed 4 B.A. rod and 4 B.A. nuts. The method of mounting the former on the baseboard consists in inserting the projecting lengths of 4 B.A. screwed rod into two holes drilled through the board at a distance of 5½ in. apart. A nut and washer screwed down on each rod above the baseboard and a second nut countersunk into the wood at the back of the baseboard then adequately secure the former, which should not be mounted, however, until the coil has been wound and completed.

Winding the Coil

In winding the coil, first of all drill two small holes in each end ring, where indicated on the diagram showing the complete coil. Secure the beginning of the winding through a pair of these holes, allowing about six inches of wire for connection purposes, and then wind on 60 complete turns of the No. 24 gauge wire. The wire should be wound on tightly and pulled down between the appropriate turns of twine as it is passed over each strip of the former. If the twine has been wound on evenly and fairly loosely as previously indicated, there should be no difficulty in winding in this manner a robust and uniformly spaced coil. When the last turn has been completed, the end of the wire is firmly fixed by passing it twice through the small holes in the end ring and pulling tightly.

Mounting the Components

The completed coil should now be mounted on the baseboard, together with the variable condenser, the crystal detector and the single-coil mount, in the positions indicated in the wiring diagram. The variable condenser is secured to the baseboard by means of four 4 B.A. screws passing through holes drilled in the board and countersunk at the back of it. These four bolts screw into the tapped lugs provided on the end plates of the condenser. The two telephone terminals are mounted on the short strip of ebonite, and behind the fixing nut of each is secured a large soldering tag arranged to project from the side of the strip. The shanks of



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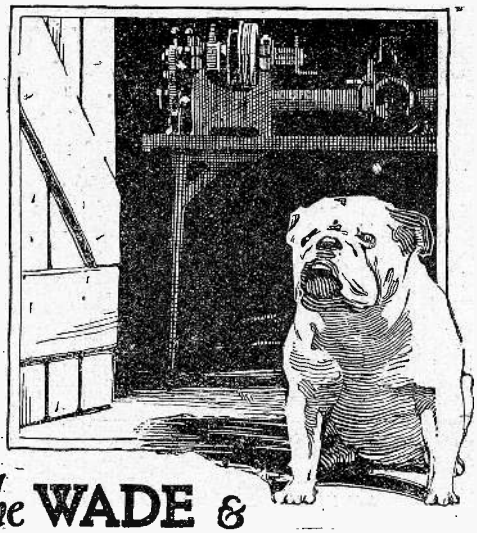

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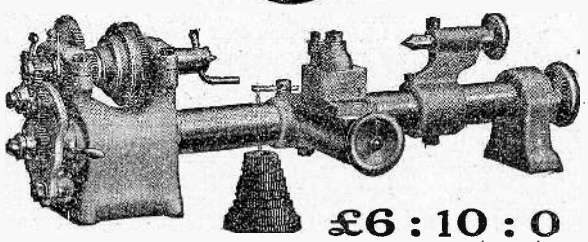

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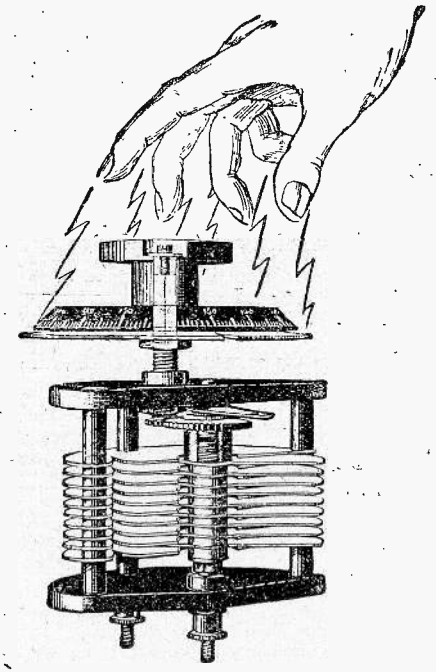

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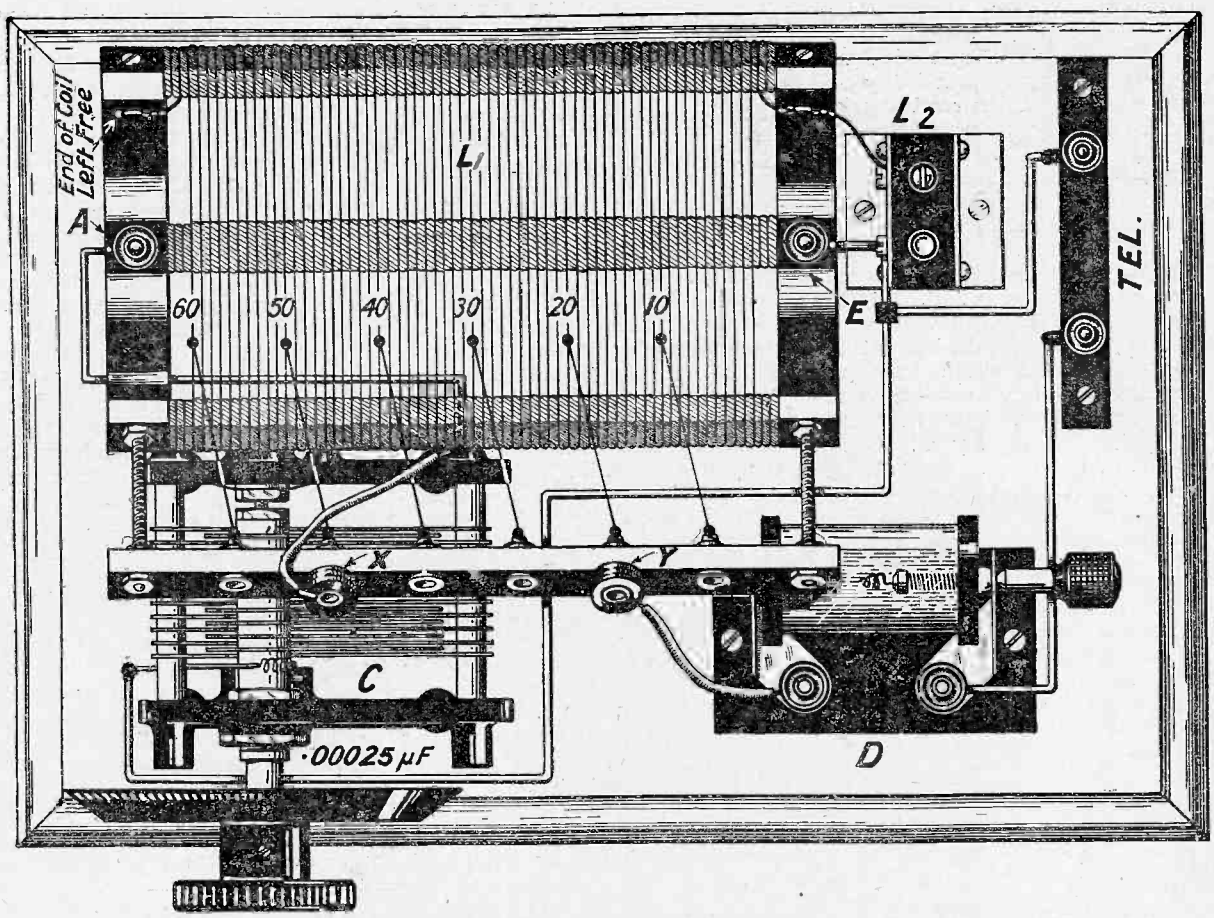


A plan view of the complete receiver. For those who are not accustomed to wiring a set from a circuit diagram this will prove a useful guide.

the terminals are then cut off just above the fixing nuts; the strip is fixed to the baseboard by means of two wood screws passing through countersunk holes in the ends of the ebonite, spacing washers being placed on the screws between the strip and the board to lift the strip a suitable distance above the latter.

Wiring

The set is now ready for wiring; this is quite a simple matter and should be followed without difficulty from the diagram showing a plan view of the set. Note that the beginning of the coil on the right hand side of the former is connected to one of the screw contacts of the loading-coil socket, while the other end is left free. The connection to the loading coil socket should be so arranged that when the loading-coil is plugged in, its windings are in the same direction as those of the lower wavelength coil. Both ways should be tried and that which gives the lower condenser reading on, say, the Chelmsford wavelength should be adopted.

There finally remain only the coil tappings to be made; at every 10th turn the enamelled wire should be carefully scraped with the blade of a penknife and short lengths of wire soldered to these points. The other ends of the wires are soldered to their respective Clix sockets. It will be found most convenient to use a thin gauge of bare wire for this purpose, for instance some of the No. 24 gauge.

Tuning for Loudest Signals

The operation of the set to get the best results is as follows:—Insert one Clix plug into the other, then plug the whole into the various tapping sockets in turn, at the same time varying the tuning condenser. Select that socket which gives the loudest results and leave the aerial tap plugged into it; then after careful adjustment of the crystal detector, try the effect of varying the crystal tapping, again retuning slightly if necessary.

With some aerials the effect of changing the crystal tapping may not give any increased signal strength, but in general on a good aerial this is a desirable refinement.

Some indication has already been given as to the results obtained in the author's case on the local station; in addition Chelmsford is received quite well, though the strength, as with all other crystal sets the author has tried on his present aerial, is not so good as that from London.

An auto-coupled circuit may also be tried by taking the aerial connection direct to a Clix plug and inserting this in the various tapping sockets.

With regard to the tuning range with the coil as described and using the total number of turns in the aerial circuit, this proved to be from 330 metres to 520 metres with direct coupling on the author's aerial. Since provision is made for varying the amount of inductance in the aerial circuit there should be no difficulty on an average aerial of tuning to any particular wavelength in the broadcast band. For reception on a certain wavelength using a given aerial and earth system, it may be an advantage to experiment with the size of the coil with a view to obtaining the best inductance value under the particular conditions.

Distant Reception and Simplicity

IT may be safely assumed that the desire to hear really distant broadcast is prevalent amongst practically all possessors of wireless receiving sets. It is still often thought, however, that a set which will receive distant signals without forcing cannot be used successfully unless the operator possesses much skill in tuning. This is not the case. *Wireless Weekly* for May 20 contained a constructional article by C. P. Allinson entitled "Distance with Two Valves," whilst in the issue of the same periodical dated June 3 a description of a three-valve receiver specially designed for distant reception by Stanley G. Rattee, M.I.R.E., appeared. Both of these sets, whilst covering really long distances, possess no more than two tuning controls.

Pure Reproduction

Most listeners are ready to forego a little volume if purity can be obtained. John W. Barber in the May 27 issue of *Wireless Weekly* gave full instructions for the building of a receiver for the local station, utilising three valves, a detector, and two L.F. amplifiers coupled by the choke-capacity method. Very pure reproduction on the loud-speaker is obtained from this set.

Selectivity, also, in many localities is one of the very necessary qualities desired in a modern receiver. Without this, pleasing loud-speaker reception from a distant station is practically impossible, owing to the number of stations working on a limited band of waves.

In the "Two-Valve Wavetrap Set," described in *Wireless Weekly* for June 10, Mr. D. J. S. Hartt has incorporated a selective arrangement in the aerial circuit which eliminates jamming to a remarkable degree, even when the troublesome station is nearby.

In the various books mentioned above several articles appeared which are of extreme value to the serious experimenter, and some of them are given below.

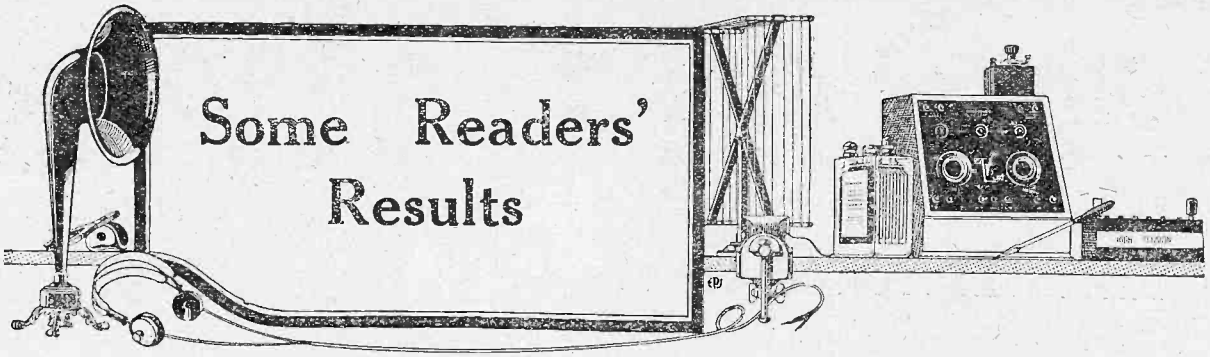
A loud-speaker shunting unit enabling the tone of your speaker to be controlled was described by A. S. Clark in May 20 issue. In the same number some useful and reliable information regarding Litzendraht coils as compared with other types is given by G. P. Kendall, B.Sc., who is well known as an authority on these subjects. Ultra-short-wave reception is nowadays receiving the attention of many amateurs as well as professional workers, and both classes will welcome the article by A. D. Cowper, M.Sc., in *Wireless Weekly* for May 27, giving constructional details of a set for 20 metres and below, besides a description of the actual difficulties encountered in this sphere.

A Double-Purpose Receiver

In the July issue of the *Wireless Constructor* D. J. S. Hartt, B.Sc., has described a set which may be called unique. Two valves are used, and with only two alterations—moving a switch over and altering the position of a plug—this set may be used either as H.F. and detector for distance, or as detector and L.F. for local work.

Any doubt as to the correct method of connecting H.T. batteries in a multi-valve set is effectively eliminated by a short instructional article by Percy W. Harris, the Editor of the *Wireless Constructor*.

The same writer also describes a receiving set in which, by the turn of a switch, either valve or crystal may be used as a detector.



Some Readers' Results

Trap Circuits

SIR,—As reports are asked for re the above described by Mr. Scott-Taggart in MODERN WIRELESS, February, 1925, I submit my personal experience of the Fig. 11 circuit.

Being situated within ¾ mile of the Cardiff station, my need for selectivity is very great, and with the above circuit I can eliminate 5WA entirely and receive Bournemouth and Birmingham at good 'phone strength without the faintest undercurrent from Cardiff.

My aerial is inside the house and consists of six 15 ft. wires, about 15 ft. from ground. I have not taken any special precautions to prevent losses on the H.F. side of set, and am using Igranic coils. It took me some time to ascertain the best combination of coils and the reaction coil L5.

In conclusion, may I thank you for producing an "all-station-at-any-time" circuit, and also hope that this report may be of interest?

Awaiting further developments from you on what I consider to be the finest piece of research work produced for some time.

Yours truly,

Cardiff. G. J. BEST.

The "Long Range" Neutrodyne Receiver

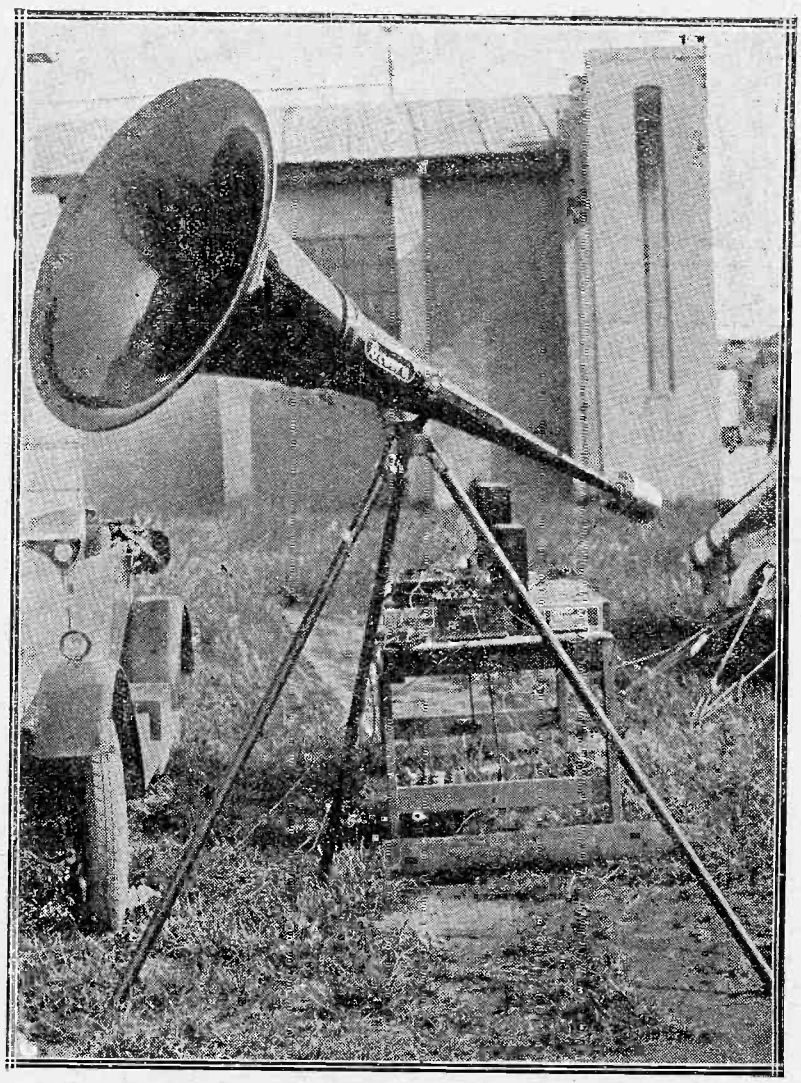
SIR,—I am writing to let you know the results I have had with the four-valve Neutrodyne described by John Underdown in January MODERN WIRELESS. I had a little trouble at first, but it was my own fault for using ordinary valve-holders instead of the anti-capacity type. The first-mentioned completely spoiled H.F. amplification. I wonder if anyone else is having the same trouble. Another curious thing is that although I am not using Neutrodyne Units (I am using McMichael 300 to 600 transformers), I can still tune the set down to Edinburgh, 328 m., which I get at good 'phone strength on first three valves. On four valves I get nearly all the longer wave B.B.C. stations on the L.S. Glasgow is as loud as Birmingham. The station I do not seem to find is Aberdeen, 495 m. With an extra L.F. valve I think the set is ideal for long-distance loud-speaker work. Will close down now for I expect you have hundreds of other letters to read.

Wishing MODERN WIRELESS every success,

Yours truly,

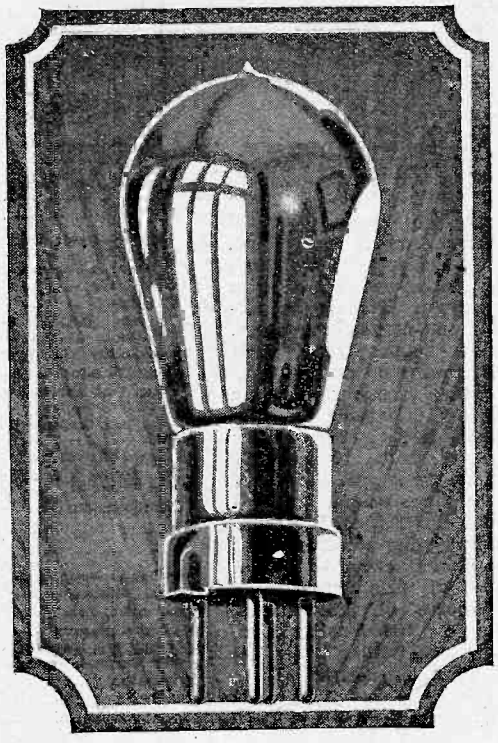
T. R. CHENEY.

Earlsdon, Coventry.



Part of the apparatus used in connection with the Royal Air Force Pageant at Hendon.

Louden Valves



The 6-volt Dull Emitter.

THE economy of the Dull-Filament Valve is undoubted. Its low current consumption, especially if you possess a multi-valve set, will save you several pounds a year in the recharging of your accumulators alone.

The economy, of course, is all the greater if you can fit the Dull-Emitter Valve straight on to your set without having to alter the Filament Resistances. For this reason we have recently placed on the market a Louden Dull Emitter which works at 6 volts. This means that if you are now using ordinary bright-emitting valves, getting their current from a 6-volt accumulator, you can substitute Dull-Emitting Loudens for them and reduce your accumulator bill to one-seventh. This, if you consider it, means quite a large saving in a year's broadcasting expenditure.

To effect this saving, incidentally, does not involve any large initial outlay. The Louden 6-volt Dull-Emitter only costs 13s. 6d., and this is not much more than you have to pay for the ordinary Bright Emitter. In addition you get a valve which has become famous for its qualities of Silver Clear Reproduction, and which will improve your reception beyond recognition.

If you desire a personal test of these valves visit your local retailer and ask to hear them. They are a revelation in clear reception.

NOTE.—The Louden Bright-Emitter is now available at the wonderfully low price of **7/-**

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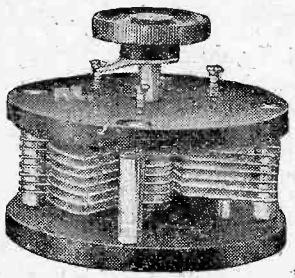

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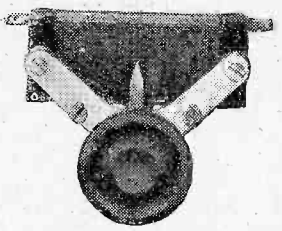

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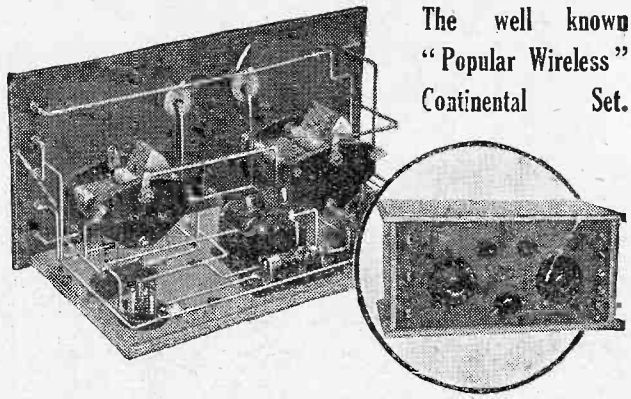

The well known "Popular Wireless" Continental Set.

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NO need to spend a lot of money on a ready-built Receiver when you can build the splendid 2-valve Set shown above for just over £3. This is a wonderful Set for long-distance reception. Now that valves have been reduced in price no one can say that a Valve Receiver is costly to build or expensive to run. Send for the parts you need to-day —wiring diagram giving full instructions is supplied free of charge to all customers. Our 32-page Pilot Chart (post free, 3d.) shows many other Receivers just as cheap and easy to build. Catalogue of Components, 48 pages; scores of illustrations, post free, 3d. Peto-Scott's Wireless Book, containing over 80 circuit diagrams, post free, 1/5.

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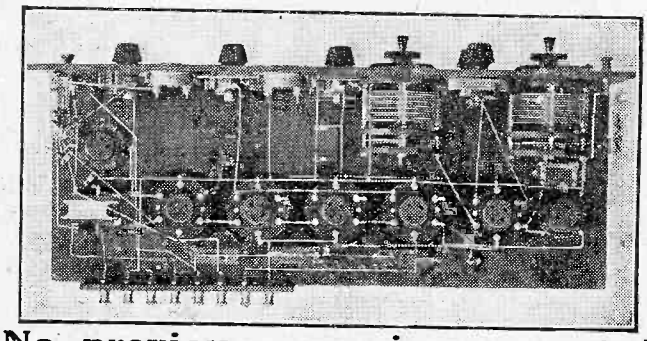

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EVERYWHERE wireless enthusiasts are talking about the selectivity obtainable with Super-Heterodynes. Within the sight of 2LO's aerial, 2LO can be tuned out and either Cardiff or Manchester received on an absolutely silent background. Stations separated by only three or four metres can be eliminated with ease. The Super-Heterodyne shown here is made up from Keystone parts and is wonderfully efficient. It uses 7 valves yet requires only a frame aerial. Its range is limited only by atmospheric conditions. Owing to its simplified internal design it can be built by anyone without any special wireless knowledge and the cost will be no more than you would pay for a ready-built 3-valve set.

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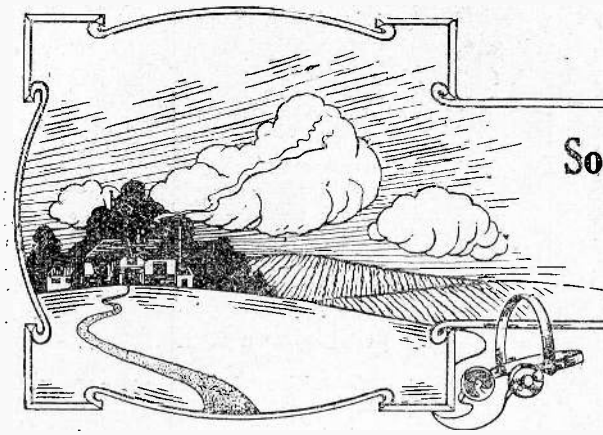


Some Suggestions for Obtaining Better Reception

By JOHN UNDERDOWN.

THE subject of getting the best out of the set is one which is of pressing interest to the experimenter and broadcast listener alike, and a few suggestions with this end in view will be appreciated. Distant reception is becoming more and more difficult as the evenings get lighter, and those at some distance from a station are finding it increasingly necessary to take measures to combat a falling off in signal strength which is to be expected until the Autumn with its shorter and darker evenings is with us again.

Examine the Aerial

Attention should be directed first to the aerial and earth system. Insulators which have been up during the winter and have become coated with dirt should be taken down and cleaned, halyards should be examined and arrangements made for tightening up the aerial so that swinging in wind is avoided, since critical reaction control is difficult with a swaying aerial. If it is intended to go down to the shorter waves, which are rapidly becoming increasingly popular, it should be remembered that a number of thinner and longer insulators are to be preferred to the more usual large shell type, since these have an appreciable capacity which serves to pass a certain amount of signal energy to earth *via* the rope or flexible steel wire used to raise and to lower the aerial. An excellent arrangement to keep the aerial taut and at the same time avoid trouble due to stretched rope shrinking and breaking when subjected to wet weather, is the use of a weight on the end of a rope as shown in Fig. 1. A petrol or similar tin filled to an appropriate height with water or soil forms a ready means of obtaining a suitable balance weight to give the required degree of tautness. It is advisable that a further length of rope be taken from above the tin, as shown, to a cleat, so that should the weight become detached, the aerial does not drag the rope through the pulley.

Height is one of the main considerations with the aerial for distant reception, but against this it must be remembered that increased height generally means an increase in the ratio of atmospherics to signal strength, and is not necessarily advisable in all cases for summer reception.

The Importance of the Earth

The earth connection should also be examined carefully, as if this tends to develop a high resistance through joints becoming unsoldered, or corroded, the set will often become unstable or very insensitive, hand capacity become pronounced, a large reaction coil necessary, and the delicate reaction control, so essential for long-range working, be lost. Where the soil is sandy and tends to become very dry, thus affording only a poor earth, a good method of obtaining an efficient system is to bury one or several parallel wires under the aerial and to the full length of this. These need not necessarily be placed more than a few inches deep, and ordinary aerial wire will be found perfectly satisfactory. A symmetrical arrangement is to be preferred if a number of parallel wires are used. Thus a good arrangement is to lay one wire directly underneath the aerial and a parallel wire on either side of this, distant three to six feet from the central wire. Alternatively a counterpoise is an excellent substitute for the normal earth connection, and will often give sharper tuning with lessened reaction

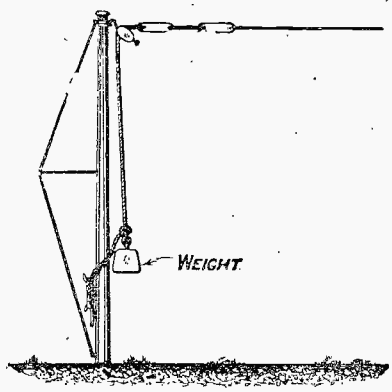
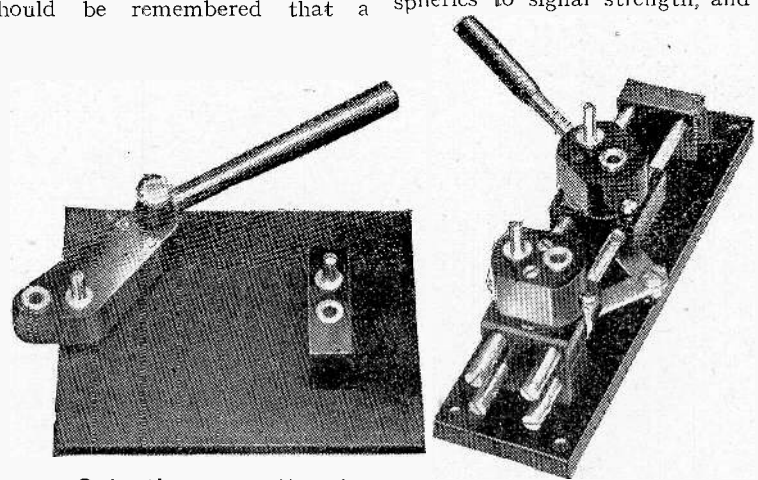


Fig. 1.—How to ensure a constant tension in the aerial wire.



Selective reception is obtained, using coupled circuits, when coil-holders permitting weak coupling are used.

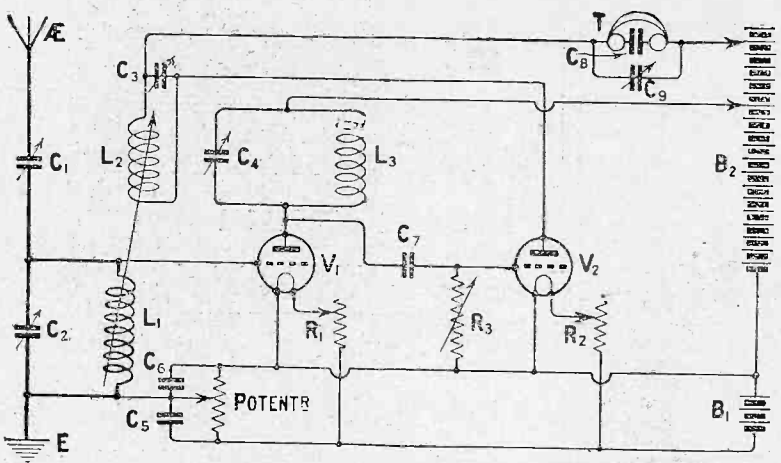


Fig. 2.—This circuit is primarily shown to indicate a number of methods of obtaining fine control.

demands. This need not be complicated in nature; a single wire stretched directly under the aerial, preferably to the full length of the former, six feet or so up and well insulated, answers admirably. It should be brought into the house through the same type of lead-in tube as the aerial, and equally well insulated. Where the foliage of trees has grown so as to almost touch either the aerial or the counterpoise, this should be cut well back, as growing foliage often makes a marked difference in signal strength.

Keep the Earth Moist

Where a buried earth is used, the surrounding soil should be kept damp, it seemingly making little difference how deep the earth plate is buried, provided this is in damp subsoil. This seems to be confirmed by Mr. Kendall's experiments on "Earth Connections" given in *Wireless Weekly* for June 10, 1925.

Do not think that too much stress has been laid on the aerial and earth system and fall into the often accepted common belief of assuming that reaction can be applied to entirely wipe out the effects of losses in this system, since no amount of reaction can completely compensate for a small and poor aerial, as this is the essential collector of energy, and therefore should be as large and efficient as is reasonably possible. It should also be remembered that when the aerial is poor, delicate control of reaction becomes increasingly difficult to obtain. For long distance reception of weak telephony with sets employing reaction it is essential to be able to adjust them easily to just below the oscillating condition, in which state they are most sensitive. Those who have spent some time in carrying out attempts at distant reception of Continental and American stations will fully appreciate that it is necessary to have some much more delicate control of reaction than is afforded by the average type of coil-holder which opens bookwise. It is equally essential if ease and certainty of control is to be obtained that values of plate voltage and filament current be adjusted with some care to obviate trouble from "over-lap," which is evidenced in a set by the fact that the reaction coil has to be withdrawn considerably past the point where oscillation started before oscillation ceases. Many excellent schemes have been put forward for obtaining the requisite delicate control, and it is proposed to deal in this article with some of them.

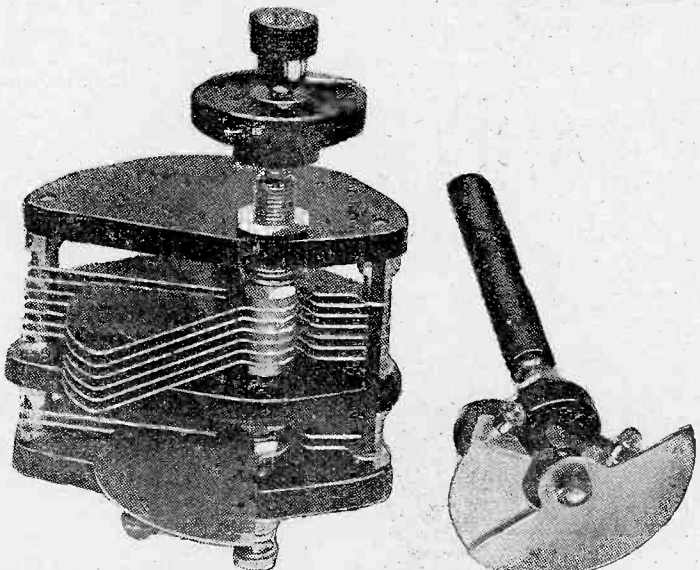
Reaction control is not delicate unless minute changes can be obtained without upsetting to an appreciable extent the other tuning adjustments of the circuit. This is an essential detail from the point of view of the user of the set, since with a number of circuits a change in reaction setting will effect a considerable change in wavelengths of the tuned circuits. That hand capacity should be at a minimum is also vitally necessary, since otherwise a station which is tuned in may easily be lost when the hand is withdrawn from the set.

The Use of Gearing in Coil-Holders

A large number of coil-holders now on the market are fitted with reduction gearing fixed on the adjusting handle which engages with the spindle carrying a coil. Both coarse and fine adjustment may be obtained with the one handle by means of ingenious mechanism. This method has, however, the disadvantage that slight movements between the coils in getting the necessary reaction adjustment also effect slight changes in the mutual inductance and capacity between the coils, which tends to upset, to a certain extent, the setting of a tuned circuit.

The Reaction Condenser

Reference to Fig. 2, in which a good long-distance 2-valve circuit is given, consisting of a high frequency stage using tuned anode coupling followed by a valve detector with reaction coupled to the aerial coil, shows other methods of obtaining fine control of reaction. One consists of using a condenser C_3, in parallel with the reaction coil. The use of this condenser,



The use of separate or integral verniers rests largely with the type of circuit used.

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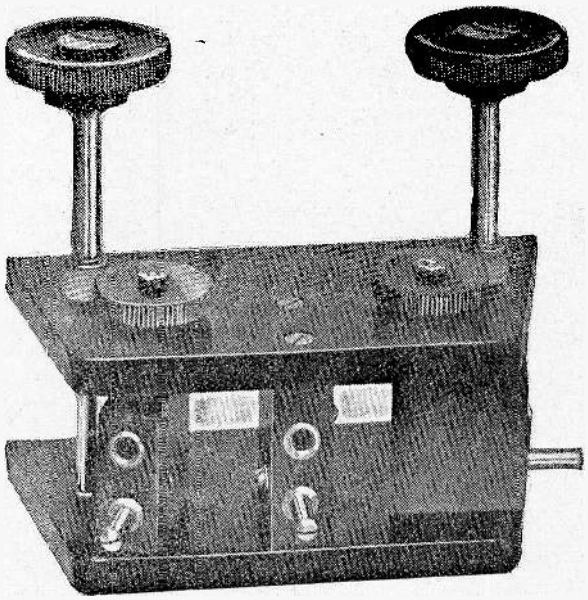


Geared coil-holders are useful adjuncts where delicate control is required.

which in practice may be of ·0002 μF, certainly gives a delicate control of reaction without giving rise to over-lap trouble, but unfortunately it does give rise to fairly large changes in wavelength adjustment of the circuit, which considerably limits its use in practice.

The Use of a Variable Telephone Condenser

A method seldom seen but one which gives more delicate control than that obtained by the use of the reaction coil, and at the same time does not result in appreciable changes in wavelengths of the tuned circuits, is the use of a variable telephone condenser. In place of the ordinary condenser C_8, which is usually of ·001 or ·002 μF, C_8 may be made a fixed condenser of ·0005, whilst C_9 in parallel with this may be made variable and of ·0005 μF in value. In cases where a stage of low frequency amplification is used these condensers will, of course, be placed across the primary of the low frequency transformer. An extremely fine control of reaction may be obtained by varying the value of C_9, it being possible to hang on the edge so that a strong atmospheric will send the set in and out of oscillation.

The Potentiometer

A very delicate and most popular method of obtaining fine reaction control is the use of a potentiometer connected as in the diagram of Fig. 2. This is connected across the low tension battery, and the lower end of the aerial coil L_1 is taken to the slider of this instrument. The method gives remarkable freedom from hand capacity effects and also changes in wavelength. A large condenser, C_5, of about ·006 μF should be connected across the lower part of the potentiometer winding as shown. It is also an advantage to connect a further large fixed condenser across the remaining portion of the potentiometer windings, although this latter condenser is not vitally essential. When using this method the set is in its most sensitive condition with the potentiometer slider at, or near, the negative end of the winding, and generally the set is best worked in this position, it being preferable to use a smaller reaction coil L_2 and to work on the negative end of the winding rather than to use a large reaction coil and work towards the positive end of the winding.

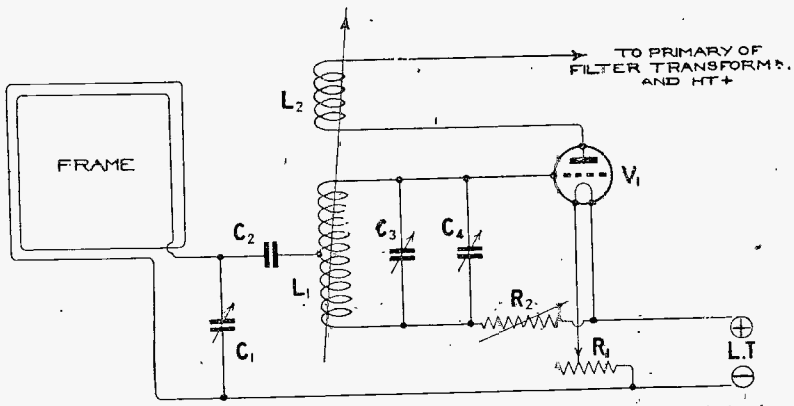


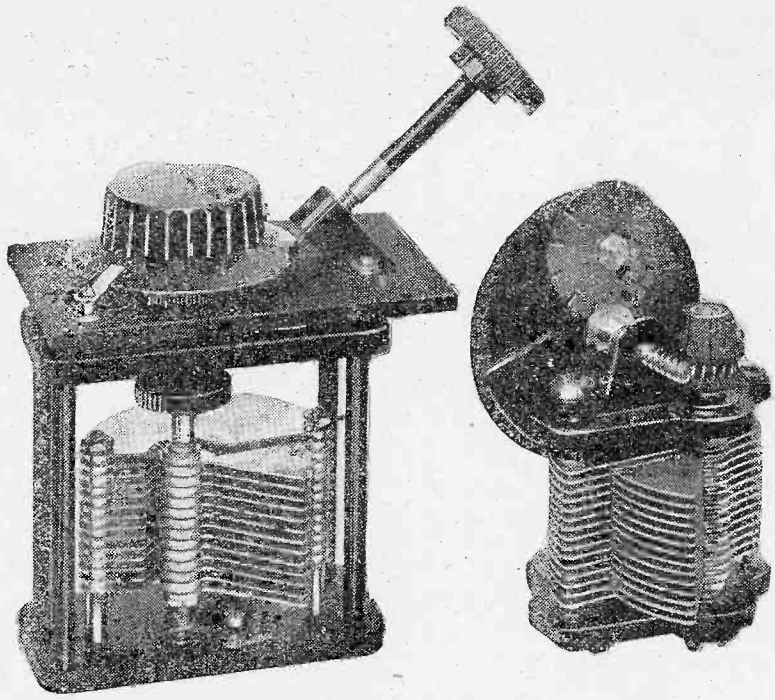
Fig. 3.—A separate vernier condenser with a long insulated handle is advantageous for the Tropadyne oscillator circuit.

Combined Series and Parallel Tuning

For the ordinary broadcast wavelength band and below, it is a generally accepted fact that series tuning sometimes tends to render the set more sensitive than parallel tuning, and this method should be adopted where the set will not readily oscillate and reaction demands tend to be excessive. The benefits of combined series and parallel tuning have so far been but little appreciated, but when its merits become better known it should come into well-deserved popularity. By using a series condenser, C_1, as well as the parallel condenser C_2 across the aerial coil, selectivity may improve, since the damping of the aerial circuit is lessened and the arrangement is most satisfactory. The range of a given coil is also considerably increased and finer tuning made possible by the manipulation of the two condensers. In practice I would recommend that C_1 be made ·0005 or ·001 μF, whilst C_2 may be of ·0005 μF capacity.

Other Methods of Fine Control

Fine control may be applied to other parts of the circuit with advantage, and for distant reception the use of a variable grid leak may be advised, provided that discrimination is used in the type chosen; one which has no tendency towards noisiness or towards packing, and in which the values are strictly reproducible should be used. Condensers with shunted or integral verniers or those fitted with some method of reduction gearing are extremely useful for tuning anode and secondary circuits, and also in the aerial, especially if the latter system is of low resistance. It is a much-discussed point as to whether the vernier should be incorporated in the condenser or used as a separate component connected in parallel with a larger condenser. Where space is limited the former method will make its appeal, but in cases where hand capacity is at all pronounced the use of a separate vernier with a long insulated extension handle is to be advised. In such circuits as the Tropadyne Supersonic Heterodyne arrangement a separate vernier with a long extension handle is to be advised for use in parallel with the oscillator condenser, since both sides



By the use of suitable gearing fine adjustment of capacity is obtained.

of this condenser are at a high frequency potential to earth. The oscillator and first detector part of the Tropadyne arrangement is shown in Fig. 3, and the vernier condenser previously referred to is shown as C_4. My experience with this type of circuit has been that for C_1, the condenser tuning the frame aerial, no vernier is needed, since the tuning of this part of the circuit is not particularly critical. A number of geared condensers are now on the market, and these are eminently suited for use in sharply tuned circuits, such as the oscillator circuits of certain Supersonic Heterodyne receivers. Alternatively ordinary types of low-loss condensers may be used with a separate vernier, connected in parallel or alternatively a number of small Neutrodyne condensers now on the market may well be used. Extension handles of various types give improved control and greaters freedom from hand capacity effect.

Coil-Holders for Selective Reception

Now that the ordinary broadcast wavelengths of 300 to 500 metres are so rapidly becoming crowded with foreign as well as British stations, the question of selectivity is becoming a vital one. The most selective type of set to use is, of course, a Supersonic Heterodyne receiver, but sets of this type require a large number of valves and are out of the reach of a very great number of listeners. In such cases the use of a loose-coupled circuit is suggested, and here the choice of a suitable coil-holder is one of great importance. With most

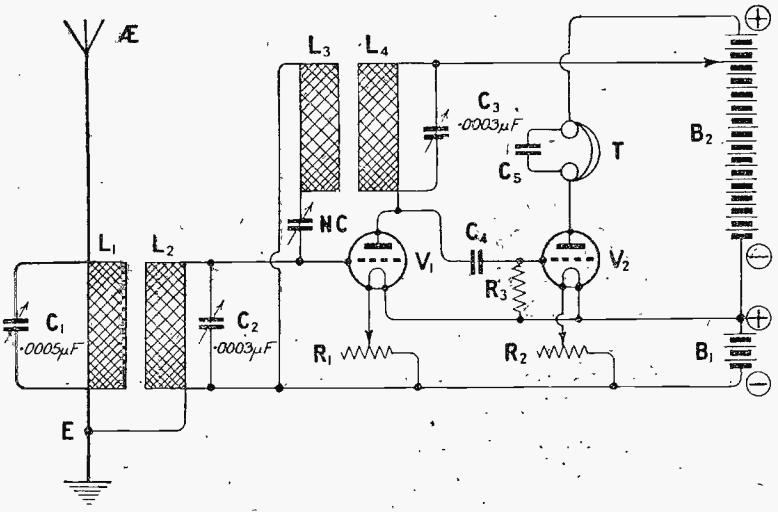


Fig. 4.—A loose-coupled Neutrodyne circuit for selective reception.

ordinary types of coil-holders which open bookwise it is impossible to get minimum coupling, around which region most selective results are obtained. Minimum coupling is only approached when it is possible to arrange that the plane of one coil lies on the centre axis of the other. Minimum coupling is not necessarily obtained when the secondary coil is exactly at right angles to the centre axis of the aerial coil, but it is somewhere in this region that minimum coupling effects are obtained. A number of coil-holders in which the movement is such that one coil may be arranged so as to allow weak coupling to be obtained, are now on the market, and these types are to be advised for use in coupled circuits.

Neutrodyne stabilisation

A loose-coupled circuit is shown in Fig. 4, in which the Neutrodyne method of stabilisation is introduced. No direct magnetic reaction is shown in this circuit, but reaction effects may be obtained by slightly upsetting the adjustment of the Neutrodyne condenser shown as N.C. in the diagram. With circuits of this type it will often be found advantageous to earth the lower end of the secondary coil as indicated. This arrangement will be found to be extraordinarily sensitive, provided suitable components are used, and selectivity is extremely high if L_1 and L_2 are used in the type of coil-holder previously indicated, and worked with the loosest possible coupling, which in practice may be practically with these two coils at right angles.

A New Trade Journal

An Announcement.

AN announcement will be found elsewhere in this issue from which it will be apparent that Radio Press, Limited, the proprietors of *Wireless Weekly*, the *Wireless Constructor* and of this magazine, are about to initiate a new undertaking which will further widen the circle served by Radio Press publications.

Those who are familiar with the history of the rise and development of Radio Press, Limited, will have realised that, owing to the unique facilities and the close touch that exists between the Company and the public on the one hand, and the trade on the other, it was only a matter of choosing an opportune moment for the Company to produce and publish a trade journal.

The sphere of influence of the Radio Press is now so extended that there is hardly a street in the country which does not fall within it. The total circulation of the three papers is approximately 400,000 copies, and in addition to this huge total the organisation carries on a very large business in the publication of books, envelopes, and other non-periodical publications. In the sale of these latter the firm is, of course, in constant touch with most of the retailers in this country, who are also indirectly influenced by Radio Press, Ltd., as most of their clients are purchasers of Radio Press magazines and books.

The management of Radio Press is, of course, well aware that to produce a new trade paper is to enter a field already to some extent filled, but the conviction is held that the unique position occupied by Radio Press ensures that the same success will be achieved by this new venture as greeted the appearance of those periodicals which cater for the general public.

The new publication is to be a monthly periodical entitled "The Wireless Dealer," and the first number is to be published on September 12th.

"The Resistance Four"

SIR,—I have recently completed the "Resistance Four" described by Mr. A. Johnson-Randall in MODERN WIRELESS for March, and after lengthy try-outs which I have given it during the holidays, I feel that I ought to write and say that in my opinion it is surely the solution to perfectly faithful reproduction of any type of broadcast, whether it be the high notes of a talented soprano, the full efforts of a church organ or even massed choirs. I am, of course, referring to full loud-speaking volume.

Looking back, during the past three years, I have constructed possibly twenty different multi-valve sets, and towards the latter part of that period, like all experimenters, decided that best transformers, etc., paid in the end, and again, like all experimenters, felt proud of the performance of the "final" effort containing two transformers totalling £4, until such time as an item came across which proved that there are certain notes in certain items which get the finest transformers guessing.

In constructing the "Resistance Four" the writer departed from the article in the matter of resistance and detector-valve H.T. "Polar" units were used and detector voltage was cut down to a point which made oscillation just possible, and by careful comparison between this adjustment and the full 120 volts on all four valves, I may say that the former adjustment was a further step to super-natural reproduction.

This may be accounted for by the fact that D.E. 5B valves were used in L.F. stages only and that an R5V was used in detector stage.

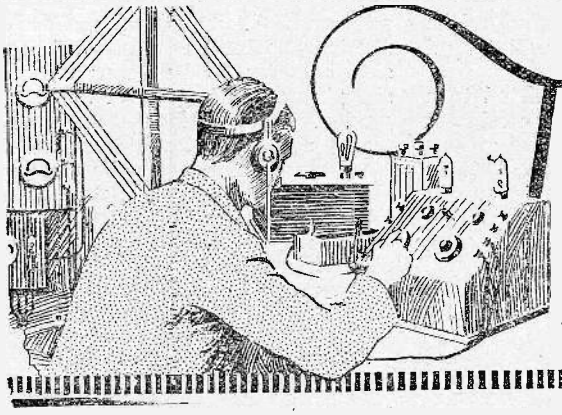
The first reception, when wiring was completed, was a church service which we get from 5WA (14 miles) periodically, and, hardened as I consider I am (after three years) to the wonders of wireless, I was honestly amazed at the delivery from my oak Amplion Dragon of the most perfect congregational singing possible. Hundreds of voices and full organ without a trace of distortion.

The writer considered that this set will never be called upon to deal with anything more searching, and so it was boxed with all batteries enclosed, coils enclosed, tuning fixed, reaction coupling fixed, plugged and fixed to the wall at a convenient height, with a four-point switch enabling the smallest member of the family to turn "on" perfect reception at will.

There is another convenient space on the wall ready to accommodate the only wireless wonder that could equal the "Resistance Four," and that, I anticipate, will only be occupied in the days when we shall be worrying you about correct grid bias for bringing up "detail" in television.

Yours truly,

Newport, Mon. E. N.



Tested by Ourselves

"Darco" Grid-Leak

A sample of the new "Darco" fixed grid-leak has been submitted by Messrs. Darco, Ltd. This is of the ordinary dimensions and general appearance, but has in place of the customary conical contact-caps, which necessitate a special clip-fitting for mounting the leak, flat-topped caps fitted with small screws and nuts for making connections, soldering tags being placed here for direct mounting, if desired, on the grid-socket of the valve. It is evident that this may lead to some simplification of wiring of a receiver. The grid leaks are, we understand, guaranteed to be within 15 per cent. of the nominal value of 2 megohms. On test, this proved to be the case, the value coming out at slightly under 2 megohms. We gather that these leaks are made in values ranging from 3 to ¼ megohm, the last value being particularly suitable for resistance-capacity coupled amplifiers.

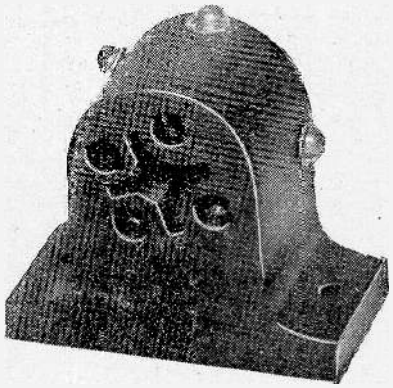
Plug and Socket Connectors

We have received from Messrs. Lissenin Wireless Co., samples of a new type of "Positive Grip" plug and socket, for making connections to radio receivers and which can be easily removed and altered. Small sockets (which are, incidentally, of the correct size to act as valve-sockets when required) are fitted into the panel with a back-nut; into these a conical plug on the end of the other fitting is inserted, giving a secure hold and good electrical contact. The flex, or other wire, is gripped between conical surfaces in the other end of the plug, the ends being turned back over the inner cone, and held in a vice-like grip by screwing up the coloured insulating sleeve outside. The insulated portion of the wire passes some distance into the fitting, giving a neat and unusually strong finish here.

The sleeves are supplied in two colours, black and red. The appearance of the device is decidedly pleasing, and the price asked is moderate, in view of the high finish. We can certainly recommend these connectors, both for permanent use on a receiver and for temporary experimental hook-ups.

"Apex" Anti-Capacity Valve Holder

A behind-the-panel valve-holder for the American type of receiver with vertical panel and totally enclosed valves which is rapidly growing popular has been submitted by Messrs. Apex Electrical Supply Co. This is a moulded composition holder with a large side flange, provided with holes for affixing to the back of the panel by two small screws, carrying the valve-leg sockets embedded as usual in the



The "Apex" valve holder

composition. In order to decrease the casual capacities between the legs, and also to decrease dielectric losses, the material is cut away in the form of a cross right through the holder, between the brass sockets. The brass sockets are further recessed into the top, to avoid accidental short-circuits when inserting the valves.

On measurement of the inter-socket capacities, after eliminating capacities of leads, etc., these came out at a reasonably low figure for a moulded socket. The insulation-resistance was unexceptionable, and free oscillation was obtained with a valve when using this socket.

A "Precision Variable" Condenser

An interesting type of geared low-loss variable condenser has been submitted by Messrs. Precision Screw Co., Ltd. In this, an extremely fine and exact adjustment is made possible by the use of a tangent worm-gear, giving a 20 to 1 ratio, the brass worm being actuated by the usual external knob provided with a 360 deg. bevel dial, and the ebonite worm-wheel being mounted on the spindle of the condenser itself. The condenser is thus arranged at right angles to the controlling spindle, and is actually mounted on an angle-bracket behind the panel. Each complete turn of the controlling spindle moves a counter-dial through one division, in a manner similar to that of a cyclometer. A scale of complete turns, reading from 0 to 10, is visible through a small hole just above the zero mark of the bevel scale and shows in what part of the capacity range one is working, thus 20 divisions on the bevel scale are equivalent to one degree on an ordinary tuning-scale, whilst the position for any one station can be read off with a corresponding degree of accuracy. All back-lash is avoided by a slotted plate and bolt adjustment for the worm engagement, and by a strong spring which takes up end-play in the worm bearings. On trial the movement was found to be very smooth and quite free from play. The bracket, with worm, bearings, counter-mechanism, etc., is fixed by the usual one-hole-mounting device, a second small hole being needed for the indicator sight-hole. The bracket fits the standard type of variable condenser manufactured by the firm, being affixed to it by two small bolts through the holes normally used for mounting the

latter on a panel. The worm-wheel is secured to the ¼ in. spindle by a set-screw.

The mechanism was fitted to a ·0003 μF "square-law" condenser of Messrs. Precision Screw Co.'s standard make. This proved to be of the low-loss type with moulded bakelite ends, substantial metal bearings and contact device, with an actual maximum capacity of ·00033 μF and a minimum of 15 μμF.

On practical trial, this fine adjustment device operated with delightful smoothness, making critical adjustments a matter of great ease. The facility with which hand-capacity effects can be obviated, when the tuning spindle is wholly insulated from and remote from the condenser itself, was a noticeable feature. An earthing tag was supplied for the gearing and bracket, which together with a metallic shielding plate, entirely prevents this troublesome phenomenon. We can strongly recommend this excellent mechanical device for fine tuning, and we understand that the makers supply the complete instrument in the usual sizes popular for home-construction.

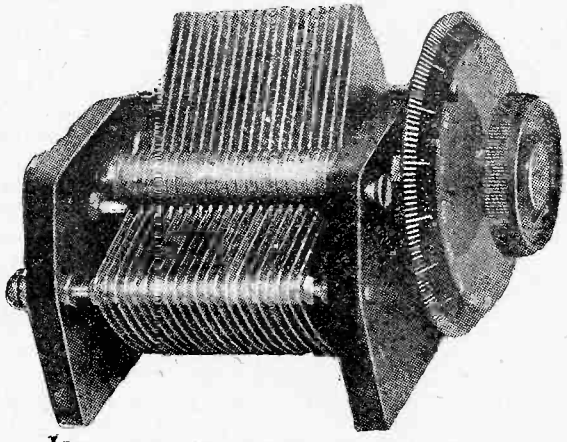
Simplex Connectors

We have from J. Martin Blair samples of a neat connector-device actually used in electrical wiring and applicable in many places to a radio installation. This consists of a porcelain thimble with a conical interior, which carries a coarse screw-thread, moulded into the porcelain. The samples were in two sizes, suitable for large heavily insulated flex, aerial wire, etc., and for small flex respectively. To apply them, the insulation is stripped off for half an inch, the wires are cleaned and placed together, then the thimble is simply twisted or screwed on to the doubled ends, the wires twisting themselves together in the process and becoming firmly jammed into the threads at the same time. The porcelain cap provides a neat waterproof insulating cover for the joint; no solder is needed for a secure connection; whilst the joint can be taken apart without much difficulty.

Practical trial showed the convenience of these connectors in putting up temporary flex connections, both on the electric supply side and for loud-speaker extensions into another room or into the garden. The joints were readily made secure, and well insulated. The larger size proved to be admirably adapted for making connections in lightly insulated steel stranded aerial wire, always a troublesome job. These connectors can be recommended for general use in practical radio work.

Ediswan Variable Condensers

We have received from Messrs. Edison Swan Electric Co., Ltd., samples of their variable condensers of the "square-law" type, with cam-shaped plates of hard brass. These are extremely substantially built, heavy instruments, evidently



The Ediswan square-law condensers

intended for satisfactory service over long periods of hard wear. A sturdy frame of insulating composition is arranged for use either horizontally on a base-board, or mounted behind the panel, in the ordinary way, tapped screw-holes being provided for both modes of mounting. A fairly large clearing hole (½ in.) is required through the panel around the spindle in the latter case, as well as two screw-holes. Ample metal bushed bearings are included in the design, and strong spring washers which ensure good contact and eliminate any play in the spindle. A large central soldering-tag, and an extra small nut on one column are provided for external connections, whilst positive stops limit the range of movement of the rotor plates. We should like to have seen a more lasting and mechanical device for locking the bevel scale and knob on the spindle than that actually incorporated.

On test, the ·001 nominal size had a minimum capacity of about 13 μμF and a maximum of ·00107 μF

and the ·0003, 8 $\mu\mu$F and ·00032 μF, respectively. Insulation resistance was excellent in every case; and the instruments can be described as of low-loss design. With the exception of the point mentioned as to the fixing of the knob and scale, the instruments impressed one as being of sound workmanship and good finish. They functioned smoothly and silently on actual trial.

"Fastnut" Wireless Spanners

Messrs. Fastnut, Ltd., have submitted for our inspection and trial examples of their small wireless spanners, to fit most of the usual sizes of small nuts used in constructional work. These are flat double-ended spanners which at first glimpse suggest the ordinary "alligator" type of wrench with V-shaped jaws; but on closer inspection it is seen that the one side of the opening is stepped so as to give several short parallel faces, which fit the various sizes of small B.A. nuts without mutilating the corners in the way that an alligator-jaw wrench often does. On trial, with various sizes of B.A. fittings—some in places difficult of access with spanner or pliers—these spanners proved easy to apply, and sufficiently strong in their grip for light radio work. There was no difficulty in obtaining a hold on a variety of unstandardised nuts of nominal B.A. dimensions, as is often the case with fixed spanners.

"Junit" Soldering Wire

A sample of bus-bar wire for internal connections in a receiver has been submitted by Messrs. Brown Bros., Ltd., in which the task of the amateur constructor has been appreciably alleviated by providing a coating of actual solder on the wire itself (not the mere "tinning," so common on bus-bar wire, which often proves exceedingly stubborn to the soldering-iron). Thus all that is necessary to make secure joints is a hot soldering-iron and a very little flux. It was found on experimenting with this wire that both end-joints and cross-joints were made with surprising ease, though in some cases a little extra solder appeared called for to reinforce a tricky joint. The larger gauge wire will be found most convenient in ordinary use.

"Therla" Fixed Condensers

The Electrical Research Laboratories have submitted samples of their "Therla" fixed mica condensers, in the (nominal) ·0002, ·0003 and ·001 μF sizes. These are of open construction, with a metal cover, and are provided with a triple connecting-tag at each end, as well as holes spaced at 2 in. for panel mounting by the customary small screws. For grid-condensers, these can readily be supported by the connecting wires alone. On measurement of the capacities, these came out sufficiently near the nominal for practical use as grid and blocking condensers respectively, viz., ·00026, ·00027, and ·00122 μF. In actual reception each sample gave satisfactory service, and the smallest size worked well as a grid-condenser on ultra-short waves. While the connecting tags are a little flimsy for experimental work where connections are frequently made and broken again, for permanent incorporation in a radio receiver these fixed condensers will evidently prove completely adequate.

The "Therla" mica condenser

"Hovimo" Crystal Valve

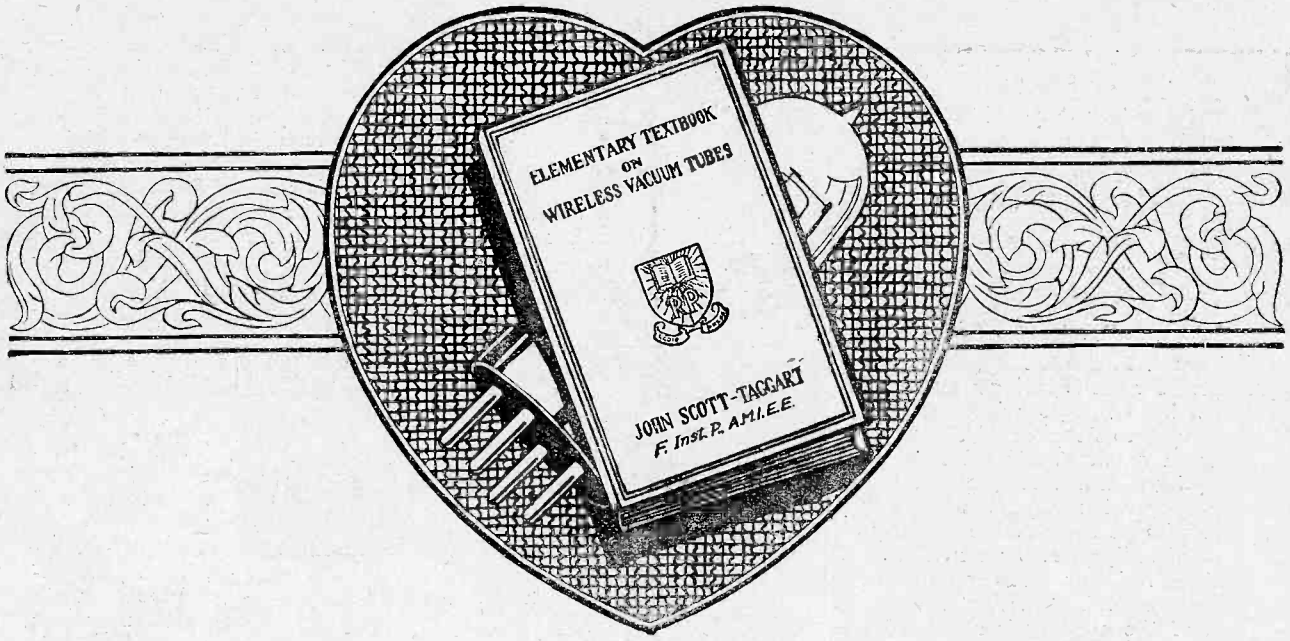
A two-crystal combination which is known to give great stability combined with a good degree of sensitivity is utilised in the "Hovimo Crystal Valve" device, a sample of which has been submitted to us for practical trial by H. Molback. Tellurium-zincite combinations have been commented favourably on by experimenters for some years. With the transparent yellow-crystalline modification used here, which shows similar properties to good zincite but actually is superior to the latter in use, it is possible to provide but simple means of adjustment for the crystal contact and still to maintain a good efficiency of rectification under ordinary reception conditions. In the Hovimo device the two crystals rest loosely in a short vertical glass tube in a small mounded stand, provided with terminals on the base. Contact plugs and slips provide the necessary connections, whilst some degree of adjustment is possible with a screw plunger at the top, giving close control of the pressure applied.

The instrument submitted was of small size and lightly constructed; possibly on account of previous rough handling, or in transit, it was broken when it reached us, so that it required much adjustment and reconstruction in order to make a fair test of its performance. On trial with an efficient low-loss crystal receiver on the local transmission, the mean of six fairly uniform settings gave 16 micro-amperes signal-strength as against 24 for a standard good galena (handset), or 67 per cent. Taking into consideration the stability and permanence of the one setting for this combination, this would represent a good high average performance when incorporated in an ordinary broadcast receiving set. With a more substantial construction this device should give every satisfaction wherever a fool-proof and trouble-free receiver is required, rather than the last fraction of signal-strength.

"A. C." Valve Sockets

A type of low-capacity valve socket which gives, on measurement, an extraordinarily low casual-capacity between the parts when mounted in the panel, is brought to our attention by Messrs. Sparks Radio Supplies. These sockets are put up in packets containing either a set of sockets alone, the former with a drilling-jig, or these together with a suitable No. 16 drill, at a very moderate price. The first hole is to be drilled; the drilling-jig is then bolted in place by a screw and nut the second hole is then drilled, and after fastening the jig by a second screw and nut the other two holes are finished giving perfect spacing. Then one socket is screwed in position, without previous tapping of the hole (though this can be done) if desired, with a taper No. 2 B.A. tap applied lightly); and the others can be guided by threading them on the legs of a spare valve placed in position when the first socket has been fixed.

On trial, these instructions were found quite easy to follow. Whilst admittedly rather more trouble to fit than standard solid types of sockets, these low-capacity sockets can be strongly recommended for critical work.



The Valve is the heart of your set.

HOW MUCH DO YOU KNOW ABOUT IT?

COMPLETE satisfaction from any radio receiver is, as a rule, based upon the operator's knowledge of its fundamentals. In just the same way as a motorist keen upon maximum efficiency needs to be conversant with his machine, so must the radio enthusiast know and understand the component parts of his receiver if best possible results are his ideal.

There is the valve, for example. The whole working efficiency of a valve receiver centres around the valve more than any other component. It is in fact almost what the heart is to the human body, a life giver.

It would be impossible to detect or to amplify weak long distance radio signals except for the valve. Yet how many radio experimenters and constructors know more than the very barest of facts about the valve? It is patent, however, that a good working knowledge of this vital component should be acquired by every radio man intent upon maximum efficiency. Indeed, it is essential to the experimenter and constructor!

Such a knowledge of the valve as meets the needs of the present day radio enthusiast is contained in "Elementary Text Book on Wireless Vacuum Tubes" by John Scott-Taggart, F.Inst.P., A.M.I.E.E. This book, which is one of the foremost treatises on the radio valve, is in its fourth edition, which testifies to the success it has already met with in the radio world. It is written in Mr. Scott-Taggart's usual lucid manner, thus making highly technical matters clear to the man who knows little of the subject.

The fundamental principles of the radio valve and its practical uses are dealt with fully and the text is profusely illustrated with graphs and circuit diagrams, which makes the subject a pleasant and a simple study. No serious experimenter or constructor can afford to do without the book.

Well bound and printed on good paper, it is eminently suitable to stand on the experimenter's shelf, and to be constantly thumbed over for reference.

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Here is a brief description of the book's contents.

Opening with instructions for making a very effective yet inexpensive little appliance which is used in conjunction with a pair of telephones for testing the set and its components, the author proceeds to deal with the testing of every radio part likely to cause faults, and gives complete series of tests for all types of receivers from crystal to multi-valve sets. Special attention is given to the testing of reflex circuits.

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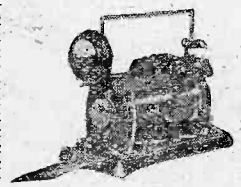

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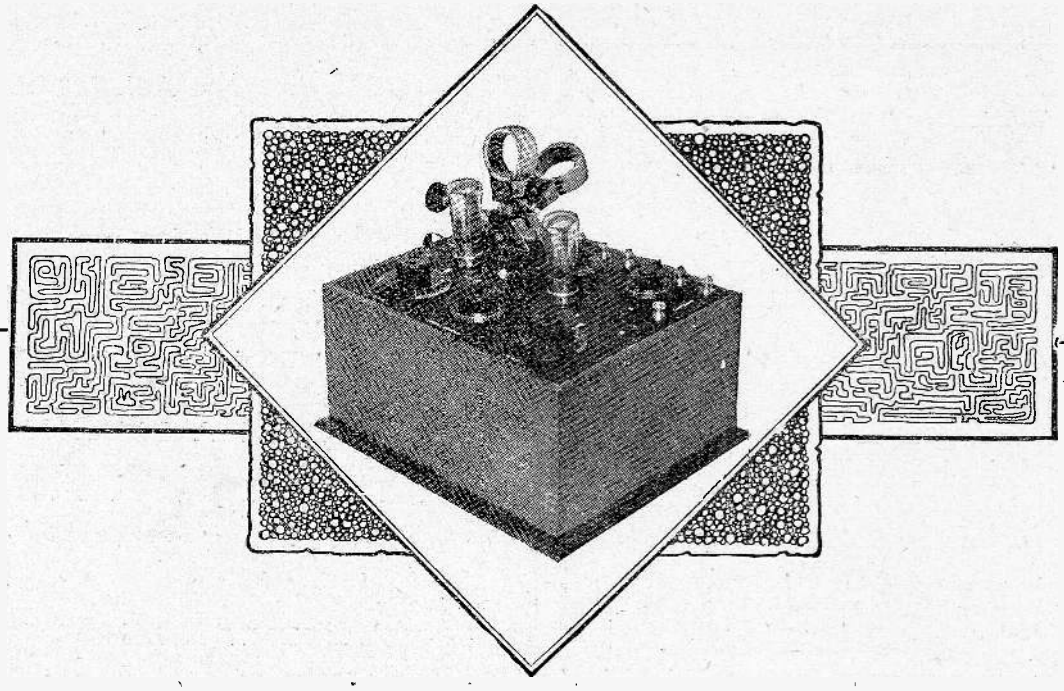

Set Construction is one of the chief joys of Radio

You can build this Double Purpose Two Valve Set yourself.

CONTENTS

of the splendid issue now on sale.

OF course, successful reception is the primary object of every radio enthusiast, but it is by no means the main interest of radio.

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The Wireless Constructor

Edited by Percy W. Harris, M.I.R.E.

6D. MONTHLY

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Our photograph shows Mr. Harris holding a map upon which Mr. Scott-Taggart is indicating some of the details of the route to be followed during Mr. Harris' American tour.

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Every Wednesday

Radio in America

IN addition to the splendid radio articles which are a regular feature of WIRELESS WEEKLY, it will shortly publish a series of articles of special interest. Mr. Percy W. Harris, well known as Asst. Editor of WIRELESS WEEKLY and Editor of THE WIRELESS CONSTRUCTOR, will describe the tour of America that he is making for the purpose of studying the conditions of radio and broadcasting. Mr. Harris has so far visited New York and suburbs, Long Island and Philadelphia. He has listened to the American broadcasting stations and has made exhaustive investigations into the question of relative selectivity of British and American sets, interference by oscillation, the merits of Super-Het circuits, and the amount of interference between the numerous broadcasting stations operating in the city areas. He has also studied the American home constructor in regard to his tastes and abilities, and the components he uses. Mr. Harris will have some very interesting things to say about all these topics and no British radio enthusiast should miss them. Buy your copy of WIRELESS WEEKLY regularly and so do not miss any of these special articles on Radio in America.

Wireless Weekly

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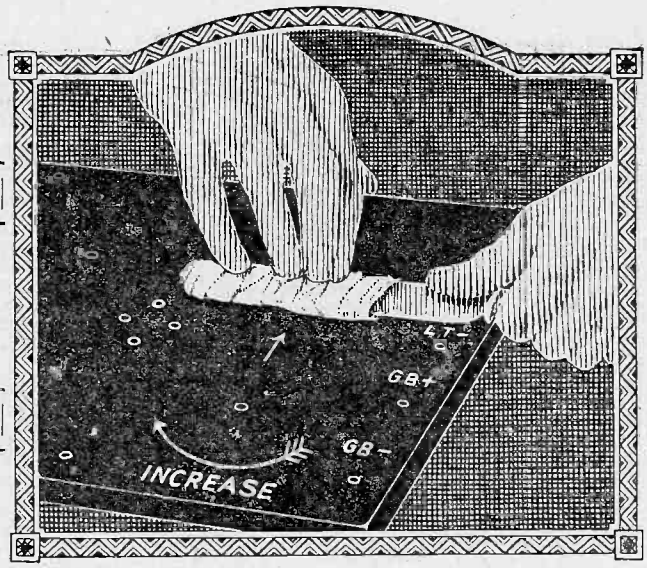

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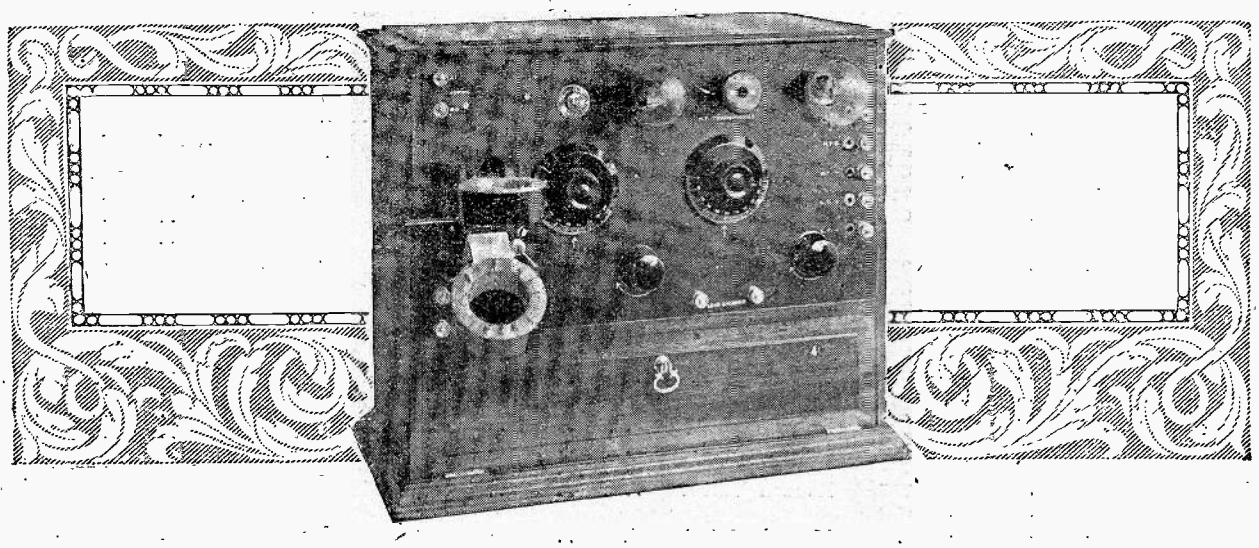

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The Twin Valve Loudspeaker Receiver

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