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1/6

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Special XMAS number

THE ARMSTRONG SUPER-HETERODYNE. *By Edwin H. Armstrong.*
MAKING A 4-VALVE T.A.T. RECEIVER. *By John Scott-Taggart, F.Inst.P., A.M.I.E.E.*
A REINARTZ RECEIVER FOR PLUG-IN COILS. *By Percy W. Harris.*
A 2-VALVE POWER AMPLIFIER. *By John Underdown.*
A LOOSE-COUPLED SINGLE-VALVE SET. *By J. W. Barber.*
A HOME 3-VALVE RECEIVER. *By E. Redpath.*
A NEW DESIGN OF CRYSTAL SET. *By Stanley G. Rattee, M.I.R.E.*
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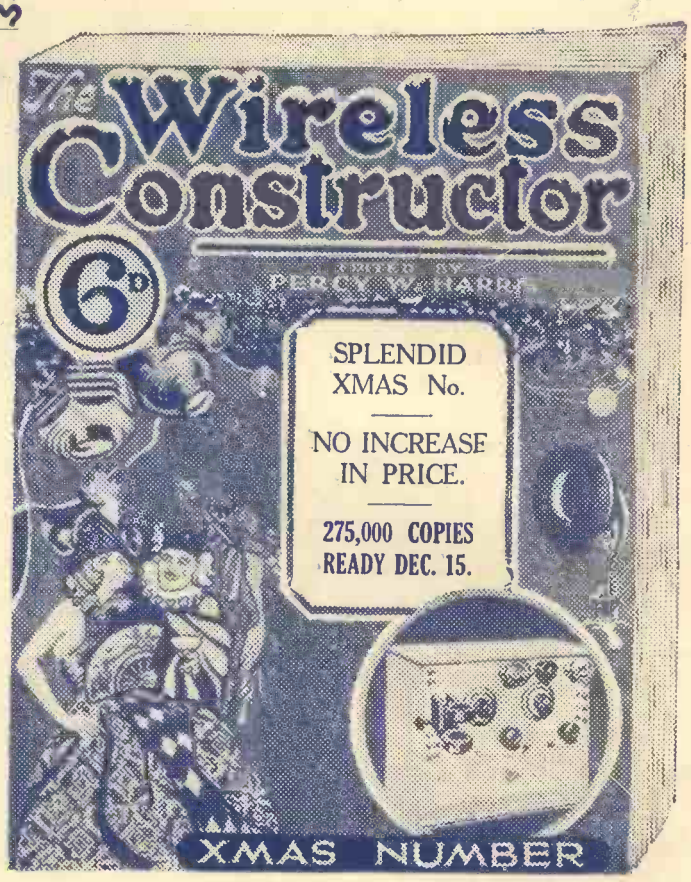

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A SIX-VALVE NEUTRODYNE RECEIVER WITH THREE STAGES OF HIGH FREQUENCY.
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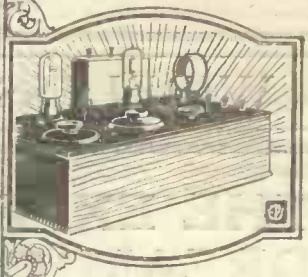

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Major E. H. Armstrong.

THE SUPER-HETERODYNE.

Its origin, development and some recent improvements.

By Edwin H. ARMSTRONG.

We have much pleasure in giving from the pen of the well-known inventor himself an account of his work.

Mr. Harry Houck.

THE purpose of this paper is to describe the development of the super-heterodyne receiver from a wartime invention, primarily intended for the exceedingly important radio telegraphic direction-finding service in the Signal Corps of the American Expeditionary Force, into a type of household broadcasting receiver which, with our present vision, appears likely to become standard.

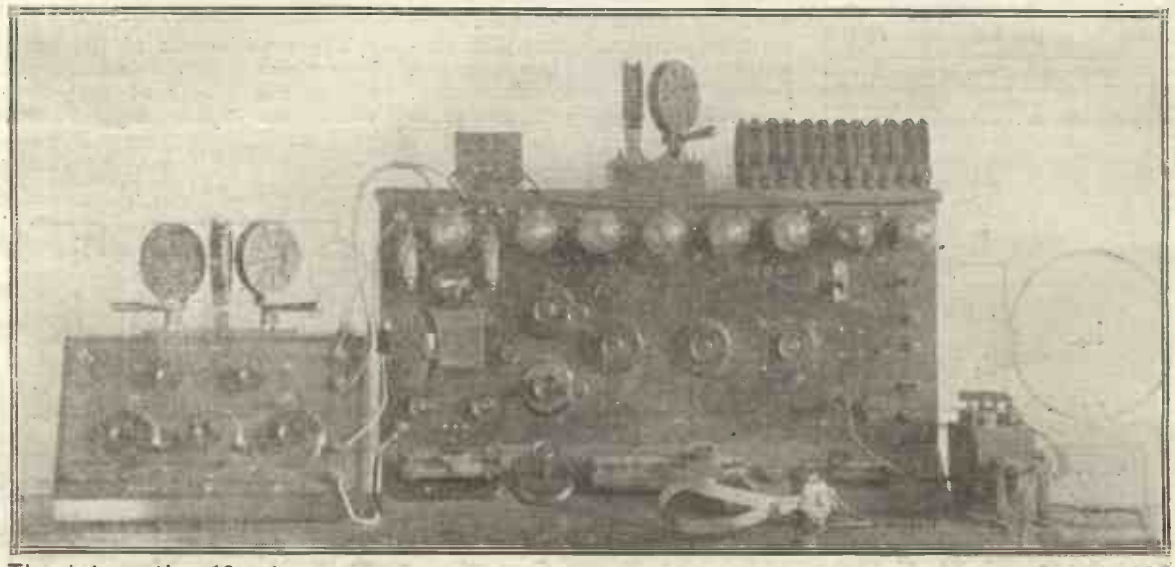
The invention of the super-heterodyne dates back to the early part of 1918. The full technical details of this system were made public in the autumn of 1919. Since that time it has been widely used in experimental work and is responsible for many of the recent accomplishments in long-distance reception from broadcasting stations. While the superiority of its performance over all other forms of receivers was unquestioned, very many difficulties rendered it unsuitable for use by the general public and confined it to the hands of engineers and skilled amateurs. Years of concentrated effort from many different sources have produced improvements in vacuum tubes, in transformer construction, and in the circuits of the super-heterodyne itself, with the result that at the beginning of the present month there has been made available for the general public a super-heterodyne receiver which meets the requirements of household use.

A Problem.

It is a peculiar circumstance that this invention was a direct outgrowth to meet a very important problem confronting the American Expeditionary Force. This problem was the reception of extremely weak spark signals of frequencies varying from about 500,000 cycles to 3,000,000 cycles, with an absolute minimum of adjustments to enable rapid change of wavelength. The technical difficulties of this problem are now so well known that it is not necessary to consider them. Round in England and Latour in France, by some of the most brilliant technical radio work of the war, succeeded in producing radio frequency amplifiers covering the band from 500,000 to 1,000,000 cycles and though covering a much more limited band, amplifiers operating on 2,000,000 cycles had been constructed. These results had been accomplished by the use of vacuum tubes and transformers of a minimum capacity. As this apparatus was used in the highly important intelligence services, all information was carefully guarded. When the United States entered the war, the facts that it was necessary to produce sensitive receivers for short wavelengths and that valve capacity would prove the bar to a straightforward solution of the problem were not known in that country. As a result, no attention was paid to the capacity in the type of valve which was adopted, and while the valve met the requirements of the lower frequencies admirably, it was impossible to use it effectively for the frequencies of importance in the direction-finding service.

The Solution.

During the early part of 1918, through the courtesy and energy of General Ferrié and his staff, the American Expeditionary Force was supplied with apparatus of French



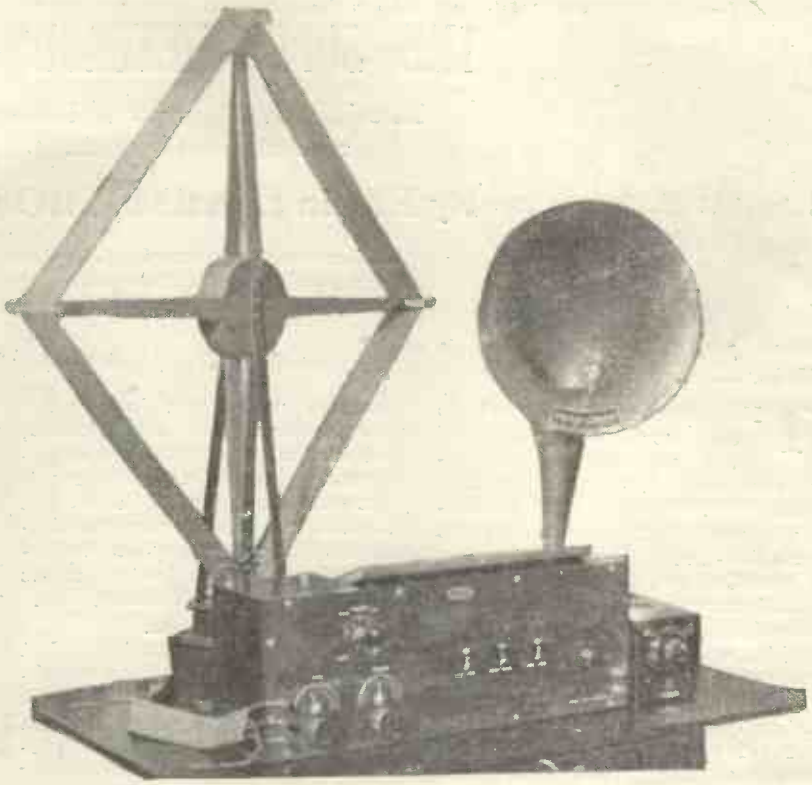
This interesting 10-valve supersonic heterodyne receiver was designed by Mr. Kennet· Alford.

manufacture. It was quite apparent, however, that this source of supply could not be a permanent one, and a solution of the problem became essential. During the early part of 1917, I had made a careful study of the heterodyne phenomena and their effect on the efficiency of amplification. With this work freshly in mind, the idea occurred to me to solve the problem by selecting some frequency which could be handled by the valves available, building an effective amplifier for that frequency, and then transforming the incoming high-frequency to this readily amplifiable value by some converting means which had no low limit; preferably the heterodyne and rectification. The principles and advantages of this method were explained in a paper presented before this Institute (1) and are now so well known that no further explanation is required here.

Experimental Work.

After much experimental work, an eight-valve set was constructed consisting of a rectifier valve, a separate heterodyne oscillator, three intermediate frequency amplifiers a second rectifier or detector and two audio-frequency stages. The intermediate frequency stages were coupled by tuned air-core transformers set for a frequency of about 100,000 cycles, with an adjustment for controlling the regeneration. The amplification of voltage measured at the input of the second detector with the amplifier just below the oscillating point, was about equivalent to a radio frequency amplification of 500. It gave satisfactory results except that the inclusion of a reaction control on the intermediate frequency amplifier made skilled handling necessary, as the adjustment of the frequency of the oscillator changed the plate current of the detector valve and this, in turn, varied the resistance which that valve introduced into the amplifier system and upset the reaction adjustment.

(1) This amplification is based on the ratio of the voltage applied to the second detector to the voltage at the frame terminals. The intermediate frequency amplification is unknown.



The Western Electric Co.'s 7-valve super-heterodyne set uses Weco valves.

Performance.

The Armistice ended development at this point, but in the autumn of 1919, for the purpose of determining the results obtainable by pushing the super-heterodyne method of reception to the limit, a resistance-coupled intermediate frequency amplifier consisting of five high μ (amplification factor) valves was constructed. The voltage amplification of these five stages was probably between 5,000- and 10,000-fold. While greater amplification could have been obtained, the sensitiveness of a set composed of a two-valve frequency converter, a five-valve intermediate frequency amplifier, a detector, and one stage of audio, was such that on a three-foot (one-metre) frame, the sole criterion of reception was simply whether the signal was stronger than the atmospheric disturbances.

Sensitivity.

The sensitiveness of the super-heterodyne was demonstrated during the winter of 1919–1920, when the spark signals from

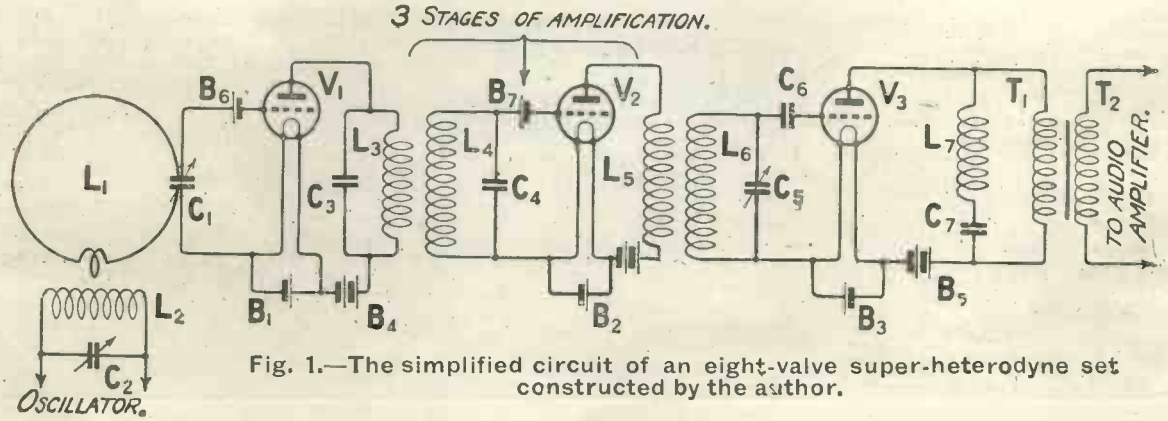


Fig. 1.—The simplified circuit of an eight-valve super-heterodyne set constructed by the author.

amateur stations on the West coast and telephone signals from destroyers in Southern waters were received in the vicinity of New York on a three-foot (one-metre) frame. Probably the most striking demonstration of the capabilities of the method occurred in December, 1920, when Paul F. Godley, at Ardrossan, Scotland, received the signals of a large number of amateur stations located in the United States, many of them being spark stations. The super-heterodyne used by Godley consisted of a regenerative valve for the rectifier, a separate oscillator, four stages of resistance-coupled intermediate frequency amplification, a second rectifier, and two stages of L. F. While it is difficult to state definitely the actual voltage amplification obtained, it appears to have been between 3,000- and 5,000-fold.

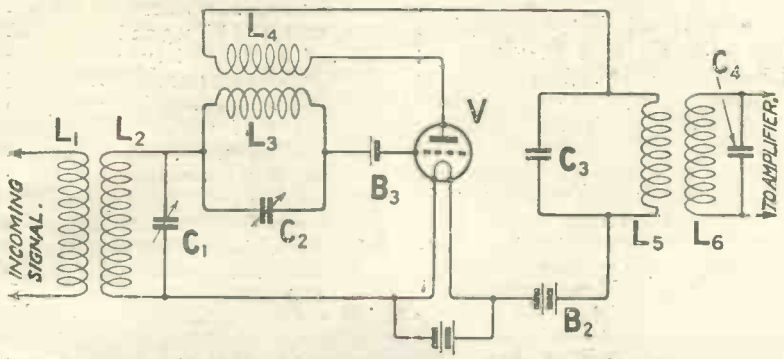


Fig .2.—Houck's arrangement whereby one valve functions as the first rectifier and the self-heterodyne oscillator.

Simple Tuning.

With the coming of the broadcasting art, and with the great increase in the number of stations and the consequent interference, the super-heterodyne began to take on a new importance—an importance which was based not on its superior sensitiveness nor on its selectivity, but on the great promise which the method offered in simplicity of operation. It was, and still is, the standard practice to furnish the public with receivers equipped with a variety of tuning adjustments for the purpose of amplifying the desired band of radio frequencies and excluding all others. As a matter of fact, many more adjustments than are on receivers should be used—more than could be placed in the hands of the average user. It would obviously be of the greatest importance if in some way these tuning adjustments could be made in the laboratory by skilled engineers and sealed, leaving some relatively simple adjustment for the hands of the operator. The super-heterodyne offered the ideal solution. This solution lay in the construction of an intermediate frequency amplifier which would amplify a given frequency and a band 5,000 cycles above and below it and which would cut off sharply on either side of this desired band. The adjustments necessary to accomplish this could all be made by skilled men, and the only operations left for the user would be the two adjustments necessary to change the incoming frequency down to the band of the amplifier—adjustments which are not dependent on each other, which are of extreme simplicity, and which can be made equally well by the novice or the engineer. To determine just what could be accomplished along these lines, the writer, work ing in conjunction with Mr. Harry Houck, constructed during the spring of 1922 a set designed for the maximum usable sensitiveness and selectivity.

Arrangement Used.

The arrangement used consisted of one radio frequency stage (non-tuned transformer) a rectifier valve, and oscillator valve (used as a separate heterodyne), a three-stage iron-core transformer-coupled intermediate frequency amplifier designed to cover a band of 20,000 to 30,000 cycles, a second detector valve, and two-stages of audio frequency amplification. UV-201 valves were used. To prevent the intermediate frequency amplifier from oscillating, each stage was shielded separately. The use of a radio frequency stage ahead of the first detector possesses a number of advantages, but the chief one is in eliminating the reaction between the frame circuit and the oscillator circuit.

Coupling Effects.

Experience with the original type had shown that when an oscillator of ordinary power was used, it was necessary to couple it rather closely with the frame circuit in order to insure a sufficiently strong heterodyne current. This close coupling affected the tuning of both circuits, an adjustment of one changing the setting of the other. To avoid this trouble and to produce a system wherein a station could always be tuned in on exactly the same settings, a single stage of radio frequency amplification (non-tuned transformer) was used, and the oscillator was coupled to this transformer. This arrangement eliminated the reaction, reduced the radiation to a minimum and, in addition, removed the damping of the first rectifier from the loop circuit and improved its selectivity.

High Selectivity.

The results obtained with this set were about as expected. On a three-foot (one metre) frame, the factor determining the reception of a station was solely whether the signal strength was above the level of the atmospherics. The selectivity was such that stations which had never been heard before on account of blanketing by local stations, were received without a trace of interference. While the

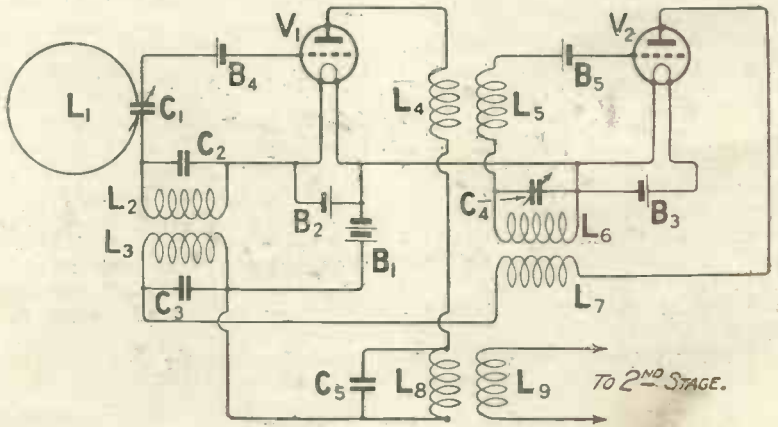


Fig. 3.—The radio-frequency amplifiers here act in a dual capacity.

performance of the set was much superior to any other receiver, it was apparent that the cost of construction and maintenance was prohibitive. The single item of a ten-ampere filament current will give some idea of the size of the storage battery and auxiliary apparatus required.

With the coming of the low filament consumption, or dry battery type of valve, the possibilities of producing a super-heterodyne for household use were tremendously improved. A set was remodelled for the WD-11 valve, and its sensitiveness was brought to about the same value as obtained with the bright-emitter valves. This was a long step forward, but still the cost was prohibitive.

Eliminating Valves.

It has been apparent ever since the question of the application of the super-heterodyne to broadcasting had been considered, that there were too many valves performing a single function which were quite capable of performing a double one. The most outstanding case is that of the separate heterodyne oscillator. In view of our knowledge of the self-heterodyne, it appears quite obvious to perform the first rectification by means of a self-heterodyne oscillator and thereby save a valve. As a matter of fact, this was one of the very first things tried in France, but, except for very short wavelengths, it was never very successful when a high intermediate frequency was necessary. The reason was this : If a single tuned oscillating circuit was used, the mis-tuning to produce the proper beat caused a loss of signal strength which offset the gain of a valve. If two tuned circuits were used on the oscillator, one tuned to the signalling frequency and the other arranged to oscillate at the heterodyne frequency, then on account of the relatively small percentage difference in frequency a change in the tuning of one circuit changed the tuning of the other. The solution of this problem was made by Houck, who proposed an arrangement so simple and so effective that it completely solved the problem. Houck proposed to connect two tuned circuits to the oscillator, a simple circuit tuned to the frequency of the incoming signal and a regenerative circuit adjusted to oscillate at such a frequency that the second harmonic of this frequency beating with the incoming frequency produced the desired intermediate frequency. The general arrangement is illustrated by Fig. 2.

Circuit Diagram.

In the diagrammatic illustration, circuit L_2C_1 is tuned to the incoming signal, circuit L_3C_2 is tuned to one-half the incoming frequency plus or minus one-half the intermediate frequency, and the circuits L_5C_3 and L_6C_4 are both tuned to the intermediate frequency. The operation of the system is in line with ordinary self-heterodyne action. By reason of the asymmetrical action of the valve, there are created in the circuits a variety of harmonics. The second harmonic combines to produce beats with the incoming signals of the desired intermediate frequency, the valve rectifies them to produce the desired intermediate frequency and, through L_5C_3 and L_6C_4, the new frequency is supplied to the amplifier. On account of the fact that circuits L_2C_1 and L_3C_2 are tuned to frequencies differing by approximately 100 per cent., a change in the tuning of one has no appreciable effect on the tuning of the other. This arrangement solved the oscillator problem and, in addition, practically eliminated radiation.

The next step in the reduction of the number of valves was to make the radio frequency amplifier perform the function of amplifying intermediate frequency as well. This can be done with none of the difficulties inherent in audio frequency amplification, as the very small amplitudes of voltage handled by the first valve preclude the possibility of the grid becoming positive with respect to the filament. The general arrangement of circuits for carrying this out is illustrated by Fig. 3. In this arrangement the signals received by the frame are amplified at radio frequency by the first valve and applied to the grid of a second harmonic oscillator by means of an untuned radio frequency transformer. The combined signalling and heterodyning currents are then rectified by the second valve, producing a current of the intermediate frequency which is applied to the grid of the first valve, amplified therein, and passed on to the second stage of the intermediate amplifier. A more practical method of carrying out this idea is illustrated in Fig. 4. In this arrangement, a secondary of the first intermediate frequency transformer is connected to the grid of the first valve and in parallel with the frame circuit. Otherwise, the arrangements of Figs. 3 and 4 are identical. The parallel type of circuit arrangement eliminates a variety of reactions which would give rise to oscillations of various frequencies and in addition, prevents the reception of long wave signals by the intermediate frequency amplifier. When this development had been completed, improvements in the design of the intermediate frequency transformers made it possible to obtain with two stages all the amplification which could be used.

An interesting supersonic heterodyne receiver.

Overloading.

On account of the high amplification, signals from local stations overload the second rectifier and introduce distortion. Control of the amount of intermediate frequency amplification is essential. While there are numerous methods equally effective, the simplest one appears to be the control by means of the filament temperature of the second intermediate frequency amplifier.

The features just described were all incorporated in the receiver. The set measured 18 in. by 10 in. by 10 in. (45·6 by 25·4 by 25·4 cm.) and was completely self-contained—the batteries, frame aerial, and speaker mechanism being enclosed in the box. The results were highly satisfactory, and loud-speaker signals (at night) in the vicinity of New York were obtained from

stations in Chicago and Atlanta. It demonstrated that not only could a household receiver of the super-heterodyne type be built, but that the first practical solution of the portable set was at hand.

A Commercial Form

In this form, the capabilities of the set were brought to the attention of the Westinghouse Electric and Manufacturing Company and the Radio Corporation of America a little over a year ago. Its possibilities were instantly visualised by Mr. David Sarnoff, who immediately took steps to concentrate the resources of the research laboratories of the Radio Corporation of America, the Westinghouse Electric and Manufacturing Company, and the General Electric Company on this new development.

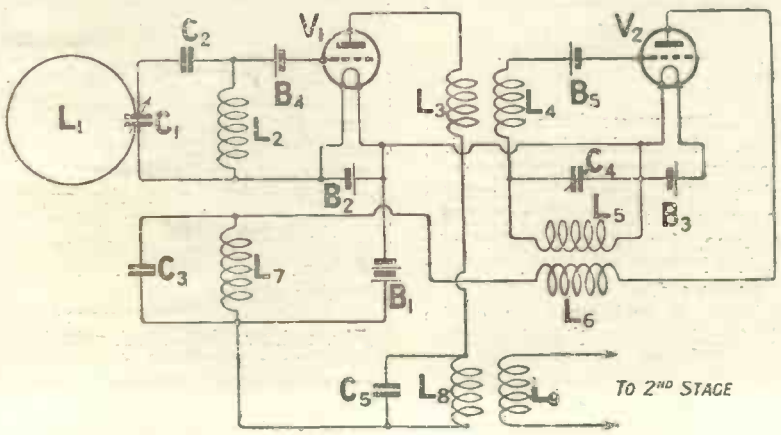


Fig. 4.—A more practical arrangement of Fig. 5.

From that point on it passed into a new phase—that of placing an invention in a commercial form.

The Final Set

In the limited time available, this was a most extraordinarily difficult proposition, and credit for its accomplishment is due to the untiring efforts on the part of the engineers of the above organisations. Many improvements and some radically new ideas of designs have been introduced, but it is the privilege of those responsible for them to present these. In the final development, an additional stage of audio frequency amplification was added in order to insure operation within steel buildings, particularly those within the city limits where signals are relatively very weak compared to suburban locations. This makes a six-valve set, but six valves can be readily operated on dry batteries and the increase in sensitiveness is well worth the extra valve.

Some idea of the sensitiveness and ease of operation of the set may be gathered from an incident during the Transatlantic broadcasting tests of November and December, 1923.

2 LO Received

On December 1, two ladies, neither having any technical radio knowledge, received loud-speaker signals from station 2LO, London, England. This was accomplished at Merrimac, Massachusetts, and probably constitutes a record for the first reception from Europe with a portable receiver. With the same set and a three-foot (one metre) frame, loud-speaker signals from broadcast stations on the Pacific Coast were received in the vicinity of New York on an average of three or four times a week. The factor determining reception was simply whether the signal strength was above the level of the atmospheric disturbances.

The type of super-heterodyne described is now available to the public in the two forms. Each of these sets incorporates the arrangements herein described. Their sensitiveness is such that, with a two-foot (61-cm.) frame and an unshielded location, the atmospheric disturbances are the criterion of reception. Here we reach a milestone in the development of broadcast receivers, for no increase in the distance of reception can now be obtained by increase in the sensitiveness of the receiver. Unless the power of transmitting stations is increased we are about at the limit of the distance which can be covered. Future improvement of this receiver will lie along the line of selectivity and simplifying the construction.

The above article is reproduced from the Proceedings of the Institute of Radio Engineers, Vol. 12., No. 4. October 1924. In considering the theoretical diagram given, it should be understood that these are shown in the conventional American fashion.

Interference Abroad.

To the Editor of MODERN WIRELESS.

SIR,—You may be interested in the following notes *re* atmospheric interference abroad. As is only to be expected, atmospherics abroad are vastly different from those at home. Doubtless the great ionisation of the atmosphere in the tropics is in no small measure responsible. The disturbances are at times of a degree undreamt of by the majority of listeners-in. As a case in point, I had once to communicate with a certain coast station in the Dutch East Indies. The coast operator was using a multi-valve receiver. I was at the time only seven miles distant from him, and was endeavouring to get a code message through. Although I was using a Marconi 1½ K.W. transmitter, on full power, he was utterly unable to read me! Those of your readers who live near the coast will know that a Marconi transmitter can make itself heard under most conditions. Considering that my aerial was 250 feet long, and 60 feet above the wireless room, it says something for the power of those "X's." I had eventually to close down altogether, as lightning was continually striking the aerial. Such conditions are quite common in the tropics.

On the other hand, excellent ranges are sometimes obtained. It is no uncommon thing for a ship's crystal receiver to pick up FL time signals at over 3,000 miles. As regards interference on long waves, tropical conditions vary considerably. Sometimes interference is more marked on long waves, sometimes it is less. No hard and fast rule can be laid down. It is probably on account of atmospherics that there is so little broadcasting outside of Europe and U.S.A.

Hoping these few remarks may, is some degree, illustrate conditions abroad,—Yours truly,

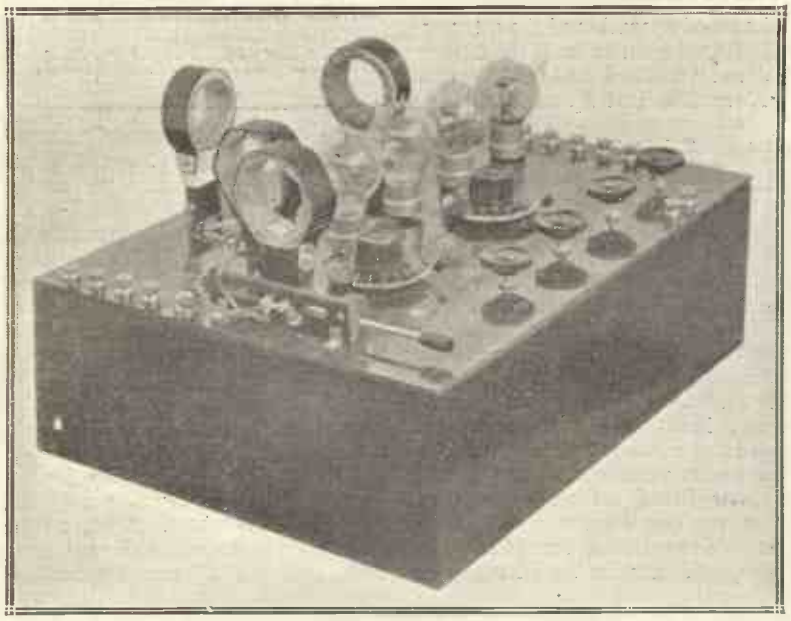
J. ROBINSON.

P.S.—I am a regular reader of your excellent journal, from which I receive much information useful to me. I wish you every success.

S.S. Arabestan,
Colombo.

"EARLY WIRELESS HISTORY."

In this article, which appeared in October MODERN WIRELESS, Mr. Hinks has asked us to point out that he is not an M.I.E.E., but a member of the Junior Institute of Engineers.



With coils in position the set presents a handsome appearance.

The T.A.T Four-Valve Receiver

Designed by

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E.

Introductory

IN the last issue of MODERN WIRELESS I went into the whole theory of the T.A.T. principle as a solution of the multi-stage high-frequency system.

For the benefit of new readers it may be as well to summarise the various points in the article. It was explained that the great trouble in multi-stage high-frequency amplifiers was the fact that one or more of the valves contained both a tuned grid and a tuned anode circuit, and that under these conditions self-oscillation of that valve was extremely likely, owing chiefly to capacity coupling, not only inside the valve itself but due to the capacity effect between condensers, leads, coils, etc. Intervalve transformers do not overcome this trouble even when the secondaries of the transformers are tuned, because a transformer, especially if the coupling is tight, acts in very much the same way as a tuned anode circuit when the secondary winding is tuned, and the tendency to oscillate increases as the coupling is tightened. This coupling between the primary and secondary of the high-frequency transformer helps considerably towards stability, but on the other hand, if this coupling is too loose, there will be an excessive loss in signal strength, owing to a falling off of the energy transfer from primary to secondary.

Perfect Stability

I obtained perfectly stable high-frequency amplification covering a multitude of stages by a method which, simple as it may seem, has nevertheless never been proposed before. It consists in separating tuned circuits by an aperiodic circuit so that grid and anode circuits of the same valve are not both tuned. I can tune, for example, the grid circuit of the first valve, making the anode circuit of the first valve aperiodic, a resistance or choke coil forming the high-frequency part of the anode circuit of the valve. The high-frequency potentials across this choke coil or resistance are then communicated to a second valve in the anode circuit of which is a tuned anode circuit; the next valve acts as a detector, or if it acts as a high-frequency amplifier, then the anode circuit of this third valve will have a choke coil or a resistance. The next valve, if a further stage of H.F. amplification is desired, would have a tuned circuit.

By doing this we have the T.A.T. system, the letters indicating tuned, aperiodic, tuned, this implying, of course, that the tuned and aperiodic circuits alternate so that in the case of no single valve are both the grid circuit and the anode circuit tuned; one or other is tuned, but both of them are never tuned at the same time to the incoming signal.

A 3-Valve Arrangement

Fig. 1 shows the T.A.T. principle applied to a three-valve set using two stages of high-frequency amplification and reaction, but no low-frequency amplification. It will be seen that the first valve V_1 acts as a high-frequency amplifier, the coupling being provided by the choke coil Z, which, for wavelengths over 1,000 metres, e.g., when receiving 5XX the high power station, may be replaced by a resistance R_6 of, say, 100,000 ohms resistance. The high-frequency potentials established across the choke

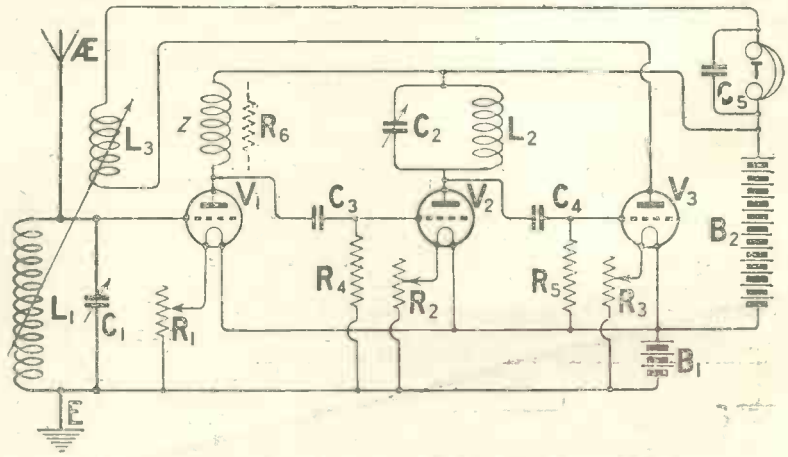
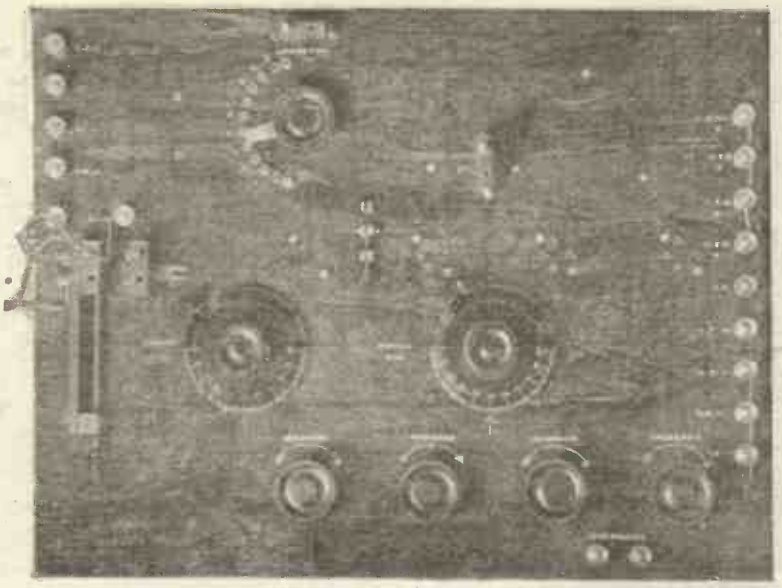


Fig. 1.—A three-valve T.A.T. circuit with two H.F. stages.

Full constructional details of a very distinctive 2 H.F. Receiver.



From the photograph the disposition of the components is clearly seen.

Z or the resistance R_6, as the case may be, are communicated to the grid of the second valve V_2 which is the second high-frequency amplifier. In the anode circuit of this amplifier we have the circuit $L_2 C_2$ tuned to the incoming signal, and the potentials across this circuit are now communicated to the grid of the valve V_3, which acts as a detector. In the anode circuit of this valve we have, not only the telephones T, but also the reaction coil L_3 which is coupled to the aerial inductance L_1, thereby introducing a reaction effect, not only into the aerial circuit but also into the tuned circuit $L_2 C_2$.

The 4-Valve Circuit

The four-valve T.A.T. receiver which I have designed and described in what follows, works on a similar circuit, the general scheme being similar to that of Fig. 2 which shows the use of a variable choke coil L_3. It will be seen that Fig. 2 is, in general, similar to Fig. 1, but that a stage of low-frequency amplification is added so that a loud-speaker may be used.

Choke Coil Sizes

It will be noted in Fig. 2 that the choke coil L_3 is shown variable; obviously a different size choke coil will be required for a different range of wavelengths. For example, whereas for short waves a small choke coil will be found quite satisfactory, for receiving long wave stations a much larger choke coil will be necessary.

Another factor which enters into the question is that there is always a rough adjustment where the best transfer of energy will be obtained. To speak about an aperiodic choke coil is, of course, not altogether accurate, because there is always a certain amount of "tuning" in a choke coil, but nevertheless, in the apparatus about to be described, and in the system generally, a very fair approximation to aperiodicity is obtainable with the result that great stability is obtained combined with ease of adjustment.

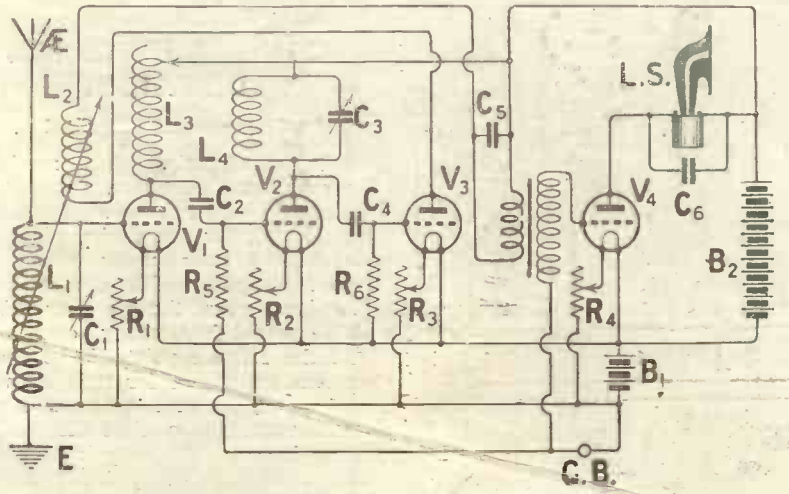


Fig. 2.—The general theoretical circuit of the receiver.

The Aperiodic Stage

I explained in the original article that the aperiodic stage of high-frequency amplification does not give as good signal strength as the tuned stage, although I would like to qualify this statement in regard to the longer wavelengths. On 5XX I find that a resistance substituted in place of L_3, thus producing the circuit shown in Fig. 3, will give nearly as good results as if a choke coil of 300 turns is employed. In this case there is no question that the two valves are giving a full measure of high-frequency amplification, and this combined with perfect stability.

It was made perfectly clear in the original article that the T.A.T. system is not merely adding one method of high-frequency amplification after a different method. Others, of course, have combined different methods, but the method of sandwiching described in the article for stabilising multi-stage H.F. receivers is as novel as it is effective.

It will be clear to those who read the original article that the peculiar advantages of the T.A.T. system become more and more pronounced as additional stages of high-frequency amplification are used. I am only proposing in this article to describe a four-valve receiver using two stages of H.F., a detector

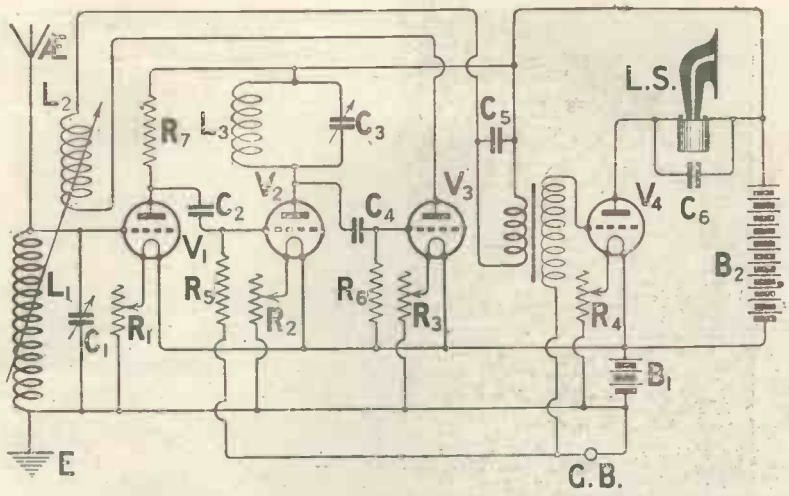


Fig. 3.—On the higher waves the choke coil may be replaced by a resistance.

valve and one L.F. valve. This forms an excellent combination for working a loud-speaker, and if the receiver is suitably placed, several, or all, the main B.B.C. stations, as well as many foreign stations, should be heard on a loud-speaker. For a Continental or an experimenter in a foreign country desiring to receive 5XX, the set should prove ideal. Our very many readers on the Continent and in Denmark, Norway and Sweden will probably take even more interest in the set than British experimenters, whether they propose to receive 5XX or the 300 to 500 metre stations, because in their case range is a vital matter and two stages of H.F. amplification are really necessary for good working.

In order to test the set effectively at a suitable distance from 2LO, I took the set to Bedford, which is approximately 50 miles from London, in order principally to test the signal strength from 2LO on small and average aerials. Even though only one stage of low-frequency amplification is used (two L.F. stages are used on most loud-speaker sets) it was mere child's play to receive 2LO on almost any kind of an aerial at this distance, an anode voltage of 78 volts being employed.

Two Controls

It will be seen that there are only two controls, the condensers C_2 and C_4 and, of course, the reaction. The variable choke L_3 was not in the least critical. As a matter of fact, I made this choke of resistance wire, namely 40 gauge silk-covered Eureka, wound on a tube mounted under the panel. This particular choke, to save time, was the same one used by Mr. G. P. Kendall in his Radio Press Envelope No. 3, which describes a very effective set in which, as many of our readers know, the coupling between the first and second valve is entirely by means of a choke coil, no tuned anode circuit being employed in the set. The tapped choke coil method of coupling used in Mr. Kendall's set, and also used commercially by, I believe, Burndepts Limited, in some of their receivers, has many points in its favour in connection with simplicity of operation, and when used in combination with tuned circuits, as in the T.A.T. receiver, not only is excellent amplification given by the high-frequency valves, but perfect stability is obtained, although, as I have indicated above and in my preceding article, the simplicity of choke coupling is accompanied by some small loss as compared to an efficient tuned anode circuit.

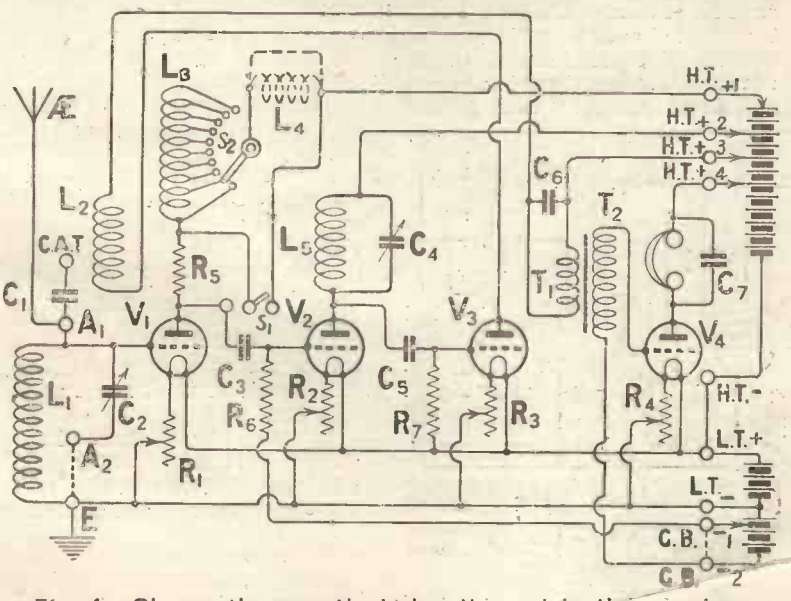


Fig. 4.—Shows the practical circuit used in the receiver described.

The Secret of Success

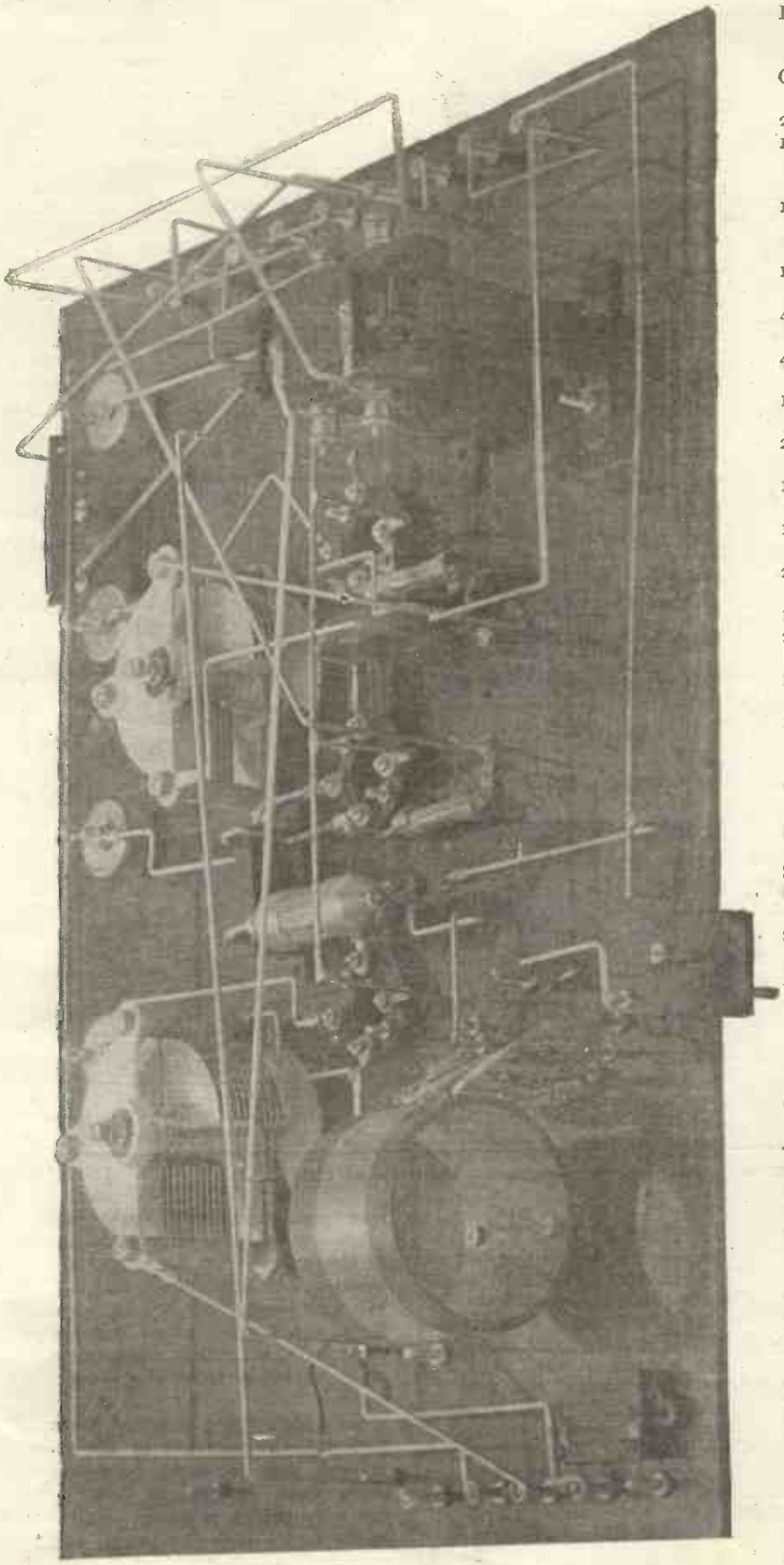
In an ordinary single H.F. valve receiver the use of a choke coupling is usually a compromise, but in the T.A.T. circuits it is the secret of the success of the whole receiver. In all cases I prefer to follow a choke coupling by a tuned anode coupling, so that when using a T.A.T. receiver it is desirable to use either two, four, six or eight stages of high-frequency amplification, rather than three, five or seven.

The choke, or resistance, is used to connect together tuned circuits, so that obviously it is desirable to end up with a tuned circuit or, put another way, it is desirable to get the maximum number of tuned circuits with the minimum number of aperiodic circuits, and this occurs with an even number of high-frequency amplifying valves.

CONSTRUCTIONAL DETAILS.

Components Required

In constructing this receiver care should be taken as to the quality of the components employed, for one faulty piece of apparatus may easily result in poor reception with the finished receiver, even though everything else were functioning correctly. In the following list of the components required for building the set, manufacturers' names have been included so that the reader may have no difficulty in copying the receiver in every detail should he so desire.



The wiring is clearly seen here.

Ebonite panel, 18 in. by 14 in. by 3-16 in. (Radion A., American Hard Rubber Co.).
Cabinet of suitable size for above panel.
2-coil holder. (Beard and Fitch.)
1 0.0005 μF variable condenser with vernier. ("Utility," Wilkins and Wright.)
1 0.0003 μF variable condenser with vernier. ("Utility," Wilkins and Wright.)
1 L.F. inter-valve transformer. (Radio Instruments, Ltd.)
4 valve holders. (H.T.C. Electrical Co., type C.)
4 filament rheostats. (Wates Bros., "Microstats.")
1 0.0001 μF fixed condenser. (Dubilier.)
2 0.0003 μF fixed condensers. (Dubilier.)
1 0.001 μF fixed condenser. (Dubilier.)
1 0.002 μF fixed condenser. (Dubilier.)
2 2-megohm gridleaks with clips. (Dubilier.)
1 100,000 ohm resistance. (Dubilier.)
2 fixed coil sockets. (Burne-Jones and Co., Ltd.)
1 single pole, double throw, knife switch for panel mounting.
1 nickel-plated switcharm, 10 nickel-plated contact studs and 2 switch stops. (K. Raymond.)
1 tapped reactance coil. (Burne-Jones and Co., Ltd.)
17 W.O. type terminals. (K. Raymond.)
Short length of rubber tubing.
Quantity of square section tinned copper for wiring.
Short length of rubber-covered flexible wire.
About 2 dozen 6 B.A. screws and nuts.
1 packet of Radio Press panel transfers.

Panel Drilling

A number of firms now sell ebonite of guaranteed quality, and though it may be possible to purchase cheaper ebonite which is *not* guaranteed, this proceeding is not advised, for the troubles arising from the use of cheap semi-conducting ebonite are numerous and not always easily traced.

Having purchased, then, a piece of guaranteed ebonite of the correct size, drilling may be commenced. The drilling diagram is given in Fig. 5, and with its aid all the necessary holes may be drilled save for a few whose positions should be found when all the components are to hand.

Mounting the Components

This is easily accomplished with the aid of the photographs and the drilling and wiring diagrams, to which reference should be made.

The following components are not mounted until wiring is in

progress, for reasons which will shortly become obvious :—

The five fixed condensers.

The gridleak shown in the centre of the panel.

The 100,000 ohm resistance.

Six B.A. screws are used for fixing the valve holders in position, and also for securing the two grid-leak clips marked X in the wiring diagram, Fig. 6. Another clip, it will be seen, is secured to a filament terminal of V_3.

The same size screws hold in leads, adequate support being obtained in this manner. The grid-leak clip Y is soldered to the wire which goes to the grid socket of V_2 and thence to the condenser C_3.

A novel method of mounting the 100,000 ohm anode resistance has been adopted. Two pieces of stiff wire have been adapted for the purpose, the ends being bent into small circles into which the ends of the resistance fit. These wires are shown in dotted lines, being underneath the resistance.

enable the reader to construct the coil himself should he so wish. A piece of ebonite tube is required, 2¾ in. in diameter and 2 ins. long, and also 1 oz. of No. 40 resistance wire, single silk-covered. The wiring is commenced ½ in. from one end of the tube, and 50 turns wound on. At this point a tapping is taken, after which 10 turns are wound and another tapping made. After this 60 turns more are wound, a tapping being taken at every 10 turns. We have

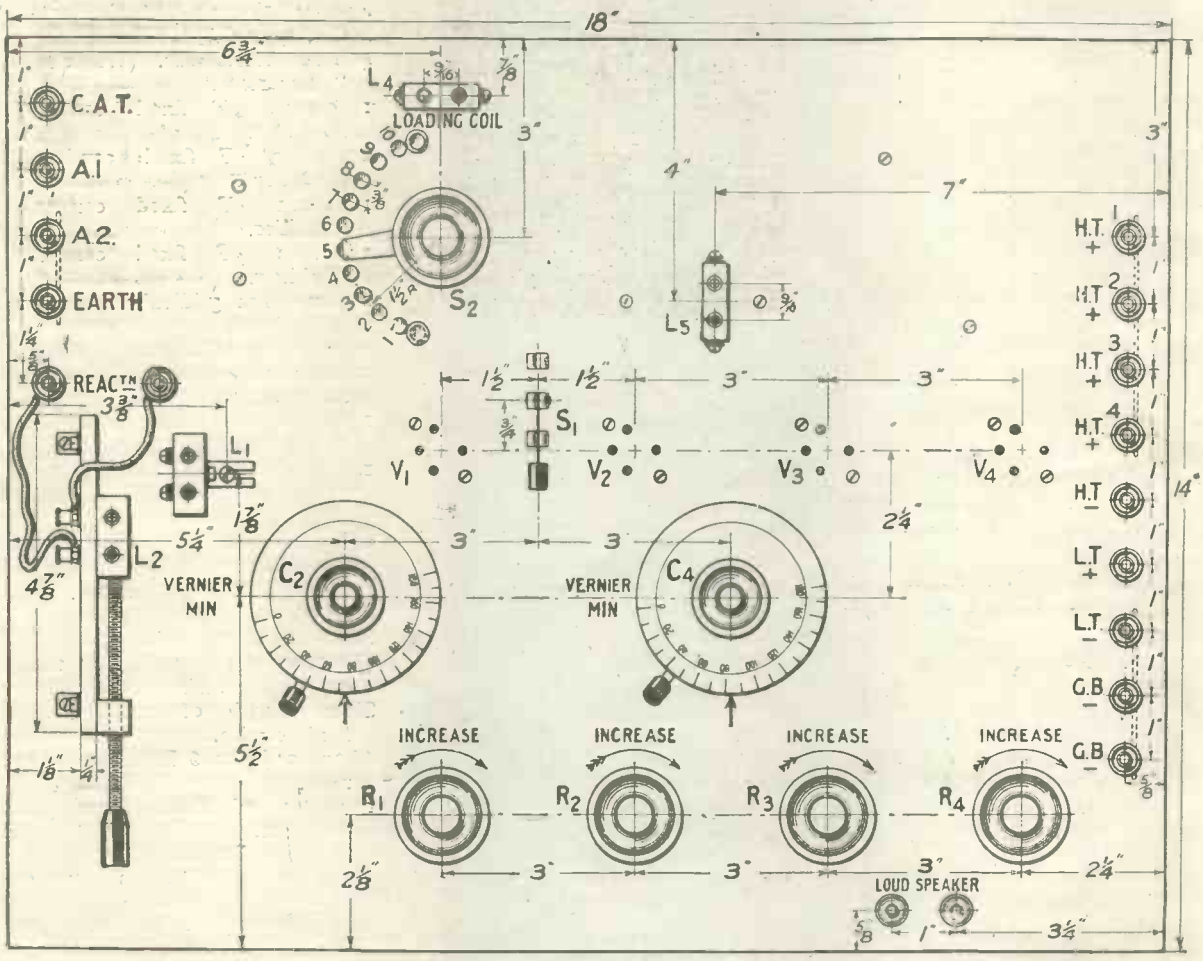


Fig. 5.—Front of panel drilling diagram. Blue Print No. 79A.

position the reactance coil — the method being seen in the photographs.

Wiring Up

The complete wiring diagram is given in Fig. 6, which should enable the whole of the wiring to be carried out without any difficulty whatever. Reference to back-of-panel photographs will be found helpful, and is a guide to spacing the various connections.

Comments upon the method of securing the fixed condensers, grid-leaks and anode resistance may be welcome. The condensers are merely soldered to their respective

The Reactance Coil

The construction of this coil will prove difficult for most readers, and it is consequently advised that the coil be purchased ready made from the manufacturer mentioned in the component list. The firm primarily intended the coil for constructors of Mr. G. P. Kendall's "Simplicity" 3-valve receiver, in which a similar tapped reactance coil is employed, and this fact should be mentioned when ordering.

Coil Construction

The following directions will

now wound on 120 turns and taken 8 tappings (excluding the end of the wire). 30 turns are now wound, this completing the coil. We now have eight tappings and the two ends of the coil, constituting 10 points to which connections must be made from the contact studs.

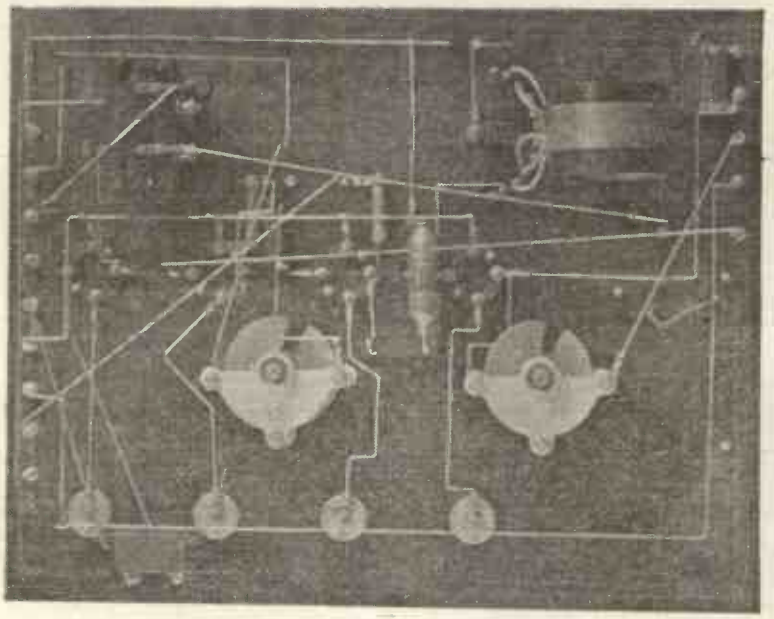
Care should be exercised when soldering the tappings of the reactance coil to their respective studs, both to prevent breaking the wire (which is easily possible owing to its very fine gauge) and to ensure that the connections are

made correctly. Upon consulting Fig. 6 it will be seen that 50 turns are included between stud 1 and stud 2, and 30 turns between stud 9 and stud 10. Ten turns are included between each pair of consecutive studs from stud 2 to stud 9.

It is not essential to cover the tappings with rubber tubing as in the present case, but by so doing, the risk of short-circuiting is eliminated.

Two flexible rubber - covered leads will be seen in Fig. 6, soldered to the leads from A_1 and E; these pass through holes in the panel, and are connected on the other side to the fixed aerial coil socket as in Fig. 5. Other leads (stiff wire) may be seen passing through the panel at L_4 and L_5, and these are also connected on the other side of the panel to fixed coil sockets.

The wiring of the receiver is completed upon connecting the two terminals marked reaction in Fig. 5 to the terminals on the moving coil socket by means of flexible leads.



A helpful plan view of the wiring.

The Cabinet

As will be gathered from the photographs, an ordinary square box has been used in the present instance. Since the cabinet does not affect the working of the receiver, the constructor may please himself as to the type of cabinet chosen.

Results obtained with the Set

The four-valve T.A.T. receiver, as stated above, was tested at Bedford, the various results being

(continued on page 834)

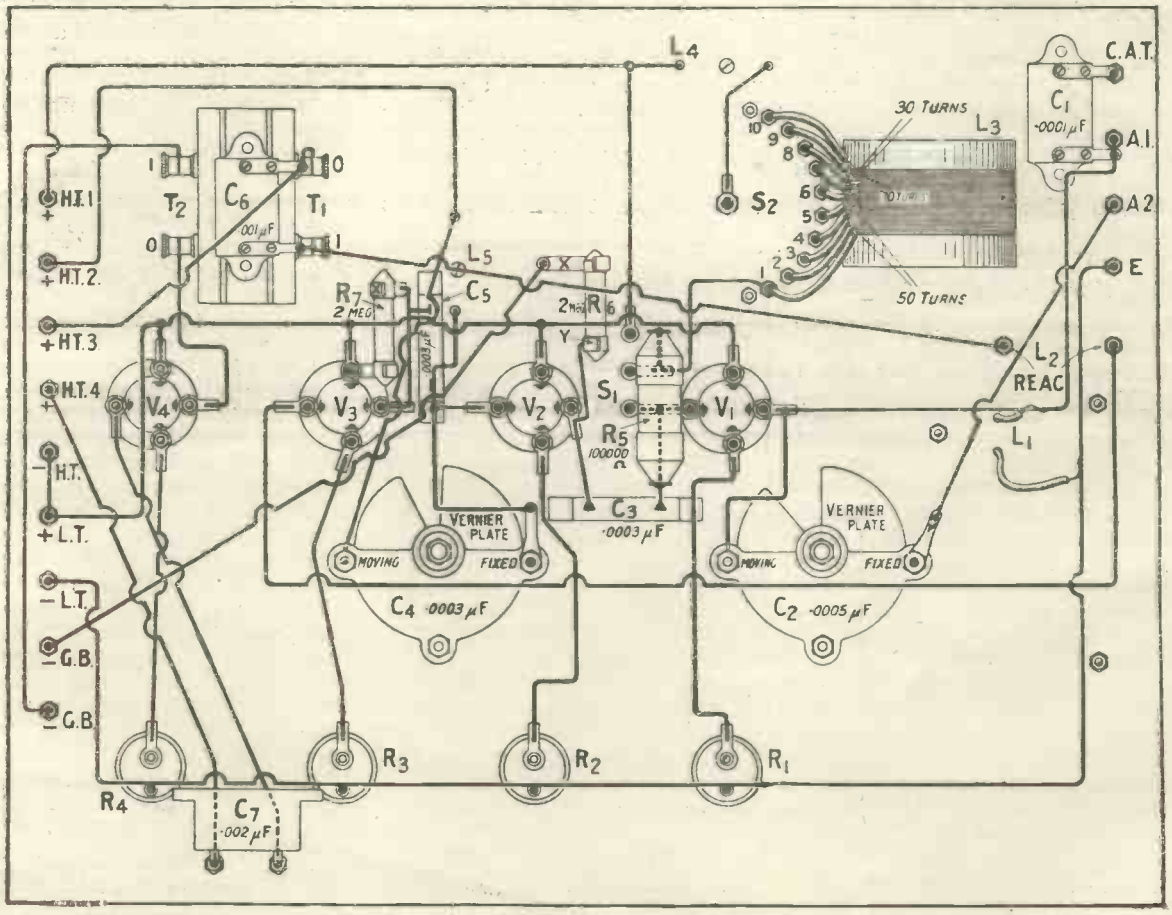


Fig. 6.—Wiring is a simple matter using this diagram. Blue print No. 79B.

I HAVE seen it stated by authorities for whom I have the utmost respect, especially as I am myself one of them, that there is no component in a wireless set over which the purchaser is more likely to be done to a turn than the simple, harmless-looking variable condenser. Even the fixed variety can administer a shrewd bite to the unwary buyer, for the gentle Hun has put upon the market a brand of grid condenser upon which he himself marks in large figures .0003 μF, whereas its actual capacity may be anything you like or even nothing at all. However it is not of the fixed condenser that I would speak to you just now. I want to give you careful and detailed instructions for purchasing variable condensers, so that when next you visit a wireless shop you may foil any base deceiver behind the counter who tries to palm off a priceless dud upon you as the finest thing of its kind ever turned out. Let me say at once that you must fling aside all base notions of economy. Few variable condensers at ninepence apiece are really good articles. And even for double that sum I once bought one whose fixed plates could be moved in all directions, whilst the moving plates remained firmly fixed. This strikes me as a most ingenious and novel arrangement, but I must say that it worked very inefficiently. I mention this little incident just to show you what can happen if you are not thoroughly on your guard.

Why Condenser?

Before I give you full instructions for sallying forth to purchase your component I think that I had better answer the question with which I am sure you are bursting. You want to know why it is called a condenser. Attend carefully and I will tell you. Many years ago there lived at Leyden an old scientist whose name is a household word, though for the moment it escapes me. Being something of a jester in his lighter moments he one day took an empty jam pot from the store cupboard and covered both sides of it with tin foil. Inside it he placed a rod with a brass ball at its upper end. The next morning, during his lecture, he had his eye upon a student whom for want of a better name I will call Heinrich Sauerkraut. This lad, though not really a bad fellow, had the reprehensible habit of ragging his professors, and most particularly the Professor of electricity. The latter watched his antics for some time without appearing to notice that anything was happening and then said sweetly, "I will now show you another little experiment. Heinrich Sauerkraut, will you kindly hand me that jam pot." Not knowing that the aforesaid pot had spent some time in contact with the business

ends of a Wimshurst machine, or whatever they had of the kind in those days, young Sauerkraut obeyed with alacrity. He placed his right hand upon the brass ball and his left upon the outer tin foil. The Professor continued to smile whilst the student, after a leap into the air, sat down violently upon the floor and expressed himself in fluent and forcible Dutch. When he had recovered his composure he shouted to the class, "Don't you ever touch one of those things. They are full of condensed electricity." That is how the condenser got its name, though between you and me and the bedpost it does not do much in the way of condensing. For this reason I strongly advise the novice not to say to the man behind the counter, "Are you quite sure that this condenser condenses properly?" To do so is to betray a lamentable ignorance of modern electrical theory.

The Outfit

Before setting out for the wireless shop you must first of all assemble the outfit which it is necessary to take with you in order to make quite sure that your purchase is up to snuff. For this you will need a high-tension battery, a pair of telephones, a milliammeter, a megger, a micrometer, and a life preserver. The last is to be used only if the salesman shows signs of losing his patience and begins to turn nasty. The best way of conveying these things with you is to obtain a soap box from the grocer and a pair of ex-perambulator wheels from the rag and bone shop. With the aid of the box, the runnells (as John Henry would call them) and a little ingenuity, you can make a neat and handy cart which will be invaluable to you not only when purchasing condensers, but also when going in search of other components of various kinds. When the ordinary man, unprovided with testing gear, enters a wireless shop, the salesmen are frequently quite off-hand with him; but I make bold to say that when you go in with your outfit you will attract immediate attention. This is as it should be. There is nothing like making a good impression from the first, as the schoolboy remarked when he took at one bite a generous half of the apple held out to him by a trusting friend.

Creating Atmosphere

Success is largely a manner of letting people in the shop see right away that you are somebody. An excellent way of doing this is to advance to the most intelligent-looking salesman and say to him: "Good-morning. I want a condenser. By the way, I am Smith." "Oh, yes, certainly, sir," he will reply, "certainly, Mr. Smith." The man will endeavour to look as though you had said Marconi, but this will be rather a failure on his part. "I see," you proceed, "that you do not know my name. I presume that you don't read the wireless papers." The man will then assure you that your name is thoroughly familiar to him and that everyone, of course, knows the story of your achievements. It is probably just as well that they do not . . . but we will not become personal. You will now find that even though there are twenty other people in the shop clamouring for attention, the whole staff is engaged in looking after your needs. If you listen carefully you will hear the other customers whispering to one another in an awed kind of way, "I say, that's Smith." So far so good. In explaining how to create atmosphere I have really given away the secret of the famous Smelman Course which teaches you in six postal lessons how to develop your personality.

Getting On With It

But you must not stop here. It is essential that even greater diffidence shall be shown you. Throw out a few airy sentences such as: "As I was saying to my friend Hercy Parris . . . "; or "When I was showing Bendall how to wind coils . . . " This sort of thing goes splendidly. When the first variable condenser is shown to you give it one scathing look and place it as far away as possible on the counter. "My good man" you

say, "you surely don't think that *I* would ever dream of buying a thing of that kind. It is quite all right, of course, for beginners, but I am afraid that it would hardly suit me." Things will now begin to get busy. The manager will appear from his office at the back, and, brushing aside the concourse of salesmen, will assure you with a low bow that it gives him the greatest possible pleasure to serve personally such a distinguished expert as yourself.

Testing

When he has produced something which looks rather less vile than those which he has previously shown you, you say: "Ah yes, now this looks something like the kind of thing I want. I will just test it out." Be very careful over this. First of all twiddle out the moving plates and place your thumb nail under the top one. Give it a good tweak. It will probably bend upwards at right angles. Do not apologise. Just lay it on the counter with a sad little shake of the head and say: "Dear me, dear me, rather weak in the plates, I fear." If you had not impressed upon everyone that you were Smith (a name which they have never heard, though they all think that they ought to have heard it), the father and mother of a row would now ensue; but, as it is, you are warmly thanked for pointing out the shortcomings of a defective component. Another condenser is produced. You don the telephones, wire up the high-tension battery and proceed to twiddle the knob, saying meanwhile: "Tut, tut. Just what I thought." Again you return the condenser as quite useless. Perspiring freely at every pore, the manager dashes off to the stock-room, whence he returns laden with condensers of the most expensive kind. For your megger you have two sets of leads. The first contains one wire which, though it looks all right, is really shorted to the other You twiddle the handle. The pointer remains at zero. You explain that a shorted condenser can hardly be expected to produce the best results. Another is offered you. You substitute the other set of leads, obtaining an infinity reading. "That," you say, "is rather better." Further tests of all kinds follow, after which you inquire the price of the selected article. In a loud voice the manager reads the price off the ticket and then whispers that as you are Smith he will give you a fat discount. You simply say haughtily that you came to buy one con-

denser and not to purchase the shop. Then repacking your barrow you move off, leaving consternation in your wake.

A Pleasant Afternoon

You next visit in turn a number of wireless shops, playing much the same game in each. The crowd of admirers which you found in the first shop will probably follow you round, and if you are in luck some of them will precede you, spreading the news of your imminent arrival. You will thus find the way already prepared for you and the subsequent proceedings will be easy. By the end of the afternoon you will have reduced every shop in the neighbourhood to a metaphorical pulp, and you will also have spotted the one condenser that you really want to have. To obtain this at a reasonable price is a perfectly simple matter. Apply all your tests several times and finish up by saying that though the plates are buckled, the insulation is hopeless and the spacing between plates is all anyhow, you can of course put it right in a few hours in your own workshop. Though you do not care as a rule about buying an imperfect article, you are willing to purchase this condenser even in its present ghastly state provided that the price is reasonable. If you have made yourself sufficiently objectionable they will probably give it you, but anyhow it will be yours for a trifling sum. Before you go home you will almost certainly be buttonholed by the reporter of the local paper, who will demand an interview. Give it him. Express your opinions freely upon the quality of components, the future of wireless, the broadcast programmes and the Postmaster-General. Reporters are always thirsting for copy and there is no reason why this one should not get it if he wants it.

THE LISTENER-IN.

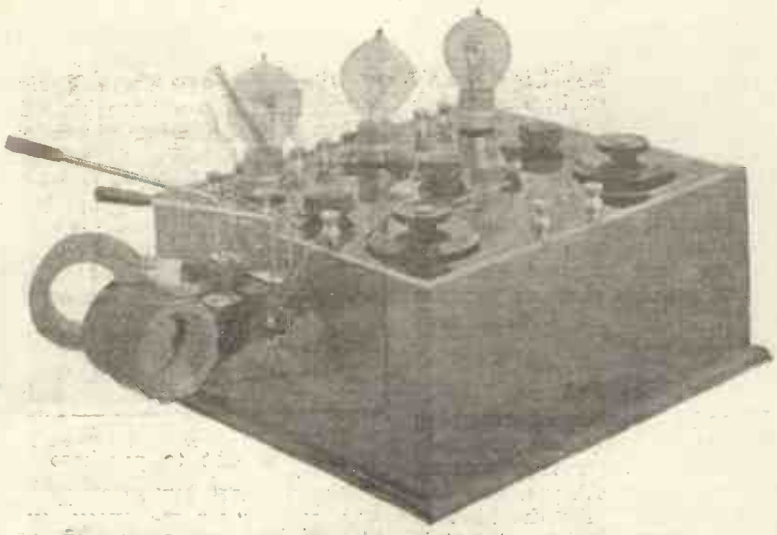


Fig. 1.—Outwardly the set resembles a conventional three-valve set.

A New Reinartz Receiver

By PERCY W. HARRIS,
Assistant Editor.

A QUESTION often put to me and extremely difficult to answer is: "Which is the best three-valve circuit to make up?" It seems a simple kind of question—one to which any experienced man ought to be able to reply—but actually no satisfactory direct reply can be given. So much depends upon the tastes, circumstances, and limitations of the would-be builder. Does he desire to stretch out into the great distances, being content with only moderate signals in the telephones? Is he prepared to sacrifice something in range to obtain volume from a near-by station? Is his problem one of interference, and will he be thankful to sacrifice some strength in order to eliminate signals from near-by shipping? Is simplicity of handling one of the vital requirements? These are but a few of the questions which must be put before any answer can be given.

Reinartz Tuners

I have lost count of the number of receivers I have designed in the last two or three years, but one which has always interested me, and which, strangely enough, has not achieved the popularity its merits deserve, is the Reinartz. John L. Reinartz, the young American originator of this circuit, is one of the most prolific producers of tuner designs in the United States. In the spring number of MODERN WIRELESS (March, 1924) I wrote a fairly comprehensive article giving many modifications of the original Reinartz circuit, and also published a complete design for a three-valve Reinartz receiver, consisting of a detector followed by two stages of note-magnification. In this receiver, as in all other Reinartz designs previously published, it was necessary to wind a special coil, and this, of course, has limited the wavelength range. I have been experimenting lately to find a suitable way in which to use standard plug-in coils in the Reinartz, and I am pleased to say that the design in the present article has proved thoroughly satisfactory for all the wavelength ranges in which telephony and broadcasting are comprised. The two great virtues of the Reinartz circuit, high selectivity and simplicity of reaction, are both present in full force in this receiver. Indeed, reaction control is particularly easy here owing to an arrangement which I shall describe later. Whilst not quite as sensitive for distance as the best circuits containing one stage of high frequency magnification, it is yet quite sensitive enough on a good outside aerial to hear all the broadcasting stations when conditions are favourable. When tested recently on two different aerials, it succeeded in giving Aberdeen on the loud-speaker at what may be termed "small room strength" quite easily.

Theoretical Circuit

The theoretical circuit which is given in Fig. 5 differs only slightly from that of the last design published, in that a radio frequency choke coil is included between the plate of the detector valve and the primary of the low frequency transformer. This choke is not always necessary, and often, particularly with the latest type of inter-valve transformers with very low self-capacity, it can be dispensed with. I have included it because I think its presence will ensure that practically every make of

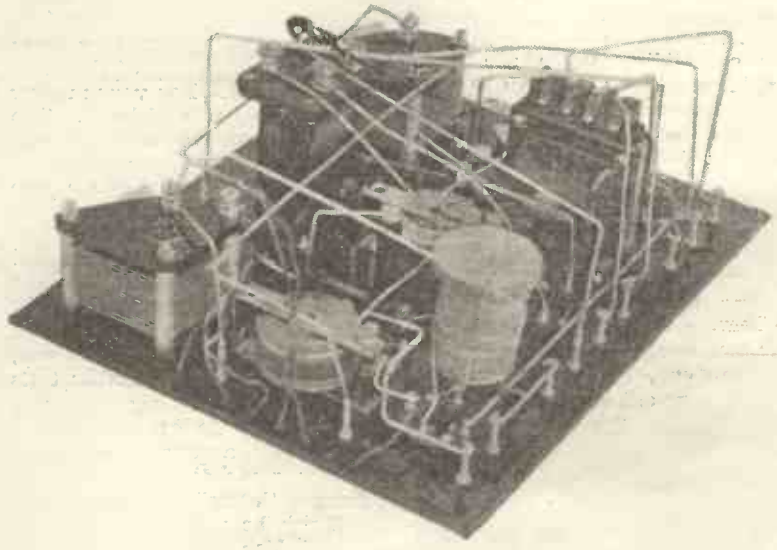


Fig. 2.—Compact construction is a salient feature.

In this instrument the disadvantages of the older types of Reinartz Receiver are removed.

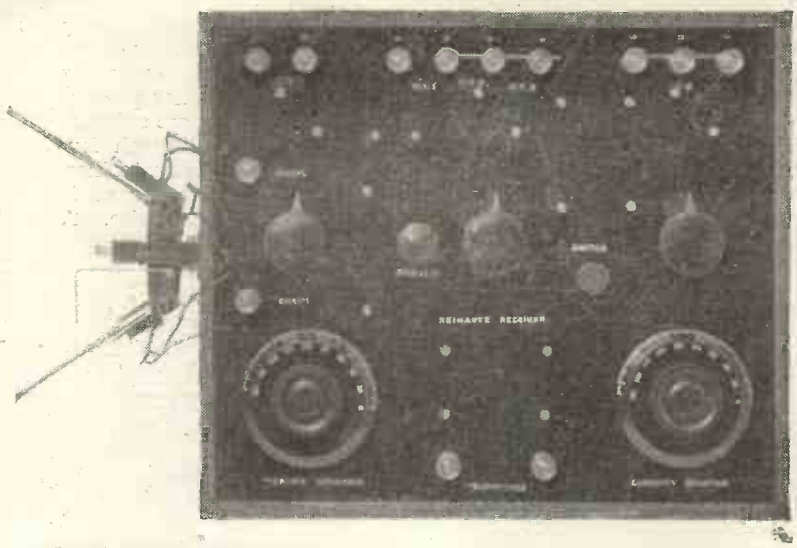


Fig. 3.—Separate high tension terminals are provided for each valve.

low frequency transformer will give good results, and I advise its inclusion in all cases.

Semi-Aperiodic Aerials

All Reinartz receivers have a semi-aperiodic aerial system, the aerial coil being both conductively and inductively connected to the grid coil as shown. In the original Reinartz receiver the aerial coil was tapped in single turns and the grid coil in two or three places. The plate coil was also tapped. Later it was found that if the grid coil was suitably wound with thick wire it was possible to dispense with the plate coil; this I have confirmed myself. The presence of a plate coil, however, makes reaction control easier, and, when used as I am about to show, gives a simplification of reaction control which is most desirable.

The aerial coil and the grid coil in the present receiver are two plug-in coils in a three-coil holder, the third socket of this holder being used for the reaction coil. It will be seen that connections are made between the aerial and grid coils, and in practice they are kept closely coupled all the time. The plate coil, which is in the furthermost moving socket, has its position determined by some preliminary experiments, and once the best position for the particular valve and the wavelength range has been found, it is left so adjusted and reaction control carried out entirely on the reaction condenser.

Reaction Control

Reaction in the Reinartz receiver is carried out by combination of the electrostatic and electro-magnetic methods, and it is essential that the high frequency current takes the path through the reaction coil and reaction condenser rather than through the self-capacity of the transformer windings, or the capacity of a shunt condenser. This is why we must omit the usual ·001 condenser across the primary of the transformer, and to make sure that the self-capacity of the transformer windings is itself not permitted to by-pass these high frequency currents, a radio frequency choke consisting of about 300 turns of No. 36 double silk covered wire on a former about 1½ in. diameter is used.

There are no special arrangements in the note-magnifying stages save that, as just mentioned, it is essential to omit the usual shunting condenser across the primary of the first transformer. A push-pull switch is incorporated in the receiver so that the second note-magnifying stage can be cut out when reception in the telephones only is desired. Filament resistances can be fitted for either bright or dull emitters. In the present instrument special dull emitter resistances have been fitted, as it was desired to use this particular instrument with dull emitter valves only.

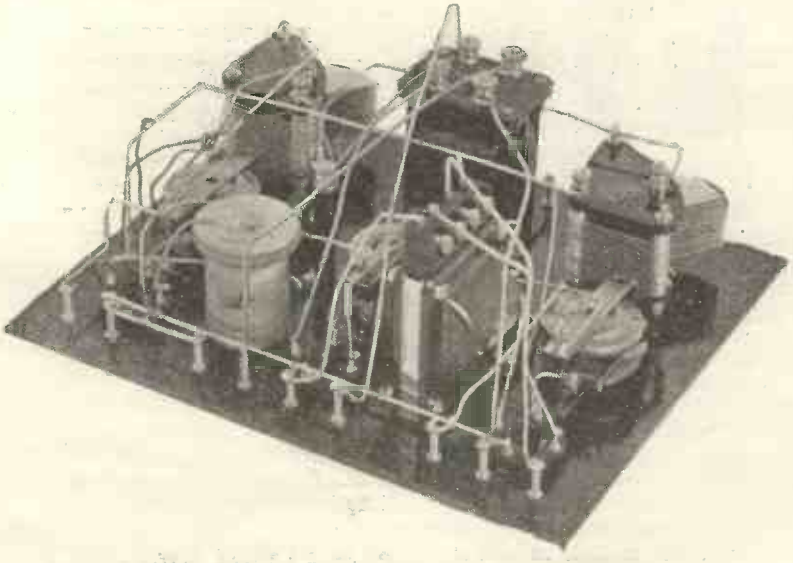


Fig. 4.—The panel viewed from another angle.

Components Required

The components in this receiver should be of good quality, but apart from this they can be of any of the numerous makes now available. As usual, I strongly recommend the use of square law condensers for tuning. In the case of the reaction condenser, however, there is no special point in having

this of the square law pattern, seeing that it is not used for tuning; but, on the other hand, it is quite as convenient to use the square law type here, and so I have fitted it. We need, then—

One ebonite panel 12 in. by 10 in. by $\frac{3}{16}$ in. or $\frac{1}{4}$ in. (Use one of the guaranteed makes here. In the instrument illustrated I have used a Bowyer-Lowe panel.)

A suitable cabinet. (This can be of the flat or the vertical type, according to taste.)

Two variable condensers, one at least square law. (Jackson Bros. were used here.)

Thirteen terminals.

One three-coil holder. (Magnum.)

Two inter-valve transformers of good make. (I have used one Ferranti and one Igranic.)

One fixed condenser, ·0003 mfd.

One variable grid leak, $\frac{1}{2}$-5 megohms. (Bretwood.)

Three filament resistances to suit the valves it is desired to use. (I have used Igranic dull emitter resistances.)

One three-point push-pull switch. (Lissen, Ltd.)

One wooden bobbin on which the choke coil is wound. (I have used an ordinary spool on which wire had been wound. Any piece of wood roughly an inch and a half in diameter and about two inches long will do.)

Suitable valves.

Coils for wavelength range desired. (See note at end of article.)

Batteries and telephones.

The panel should be laid out carefully from the designs given, and departure from the general arrangement is not recommended, as it is essential on this receiver to avoid certain interaction effects which might not be quite so harmful in others. Different makes of transformer, condensers, etc., vary slightly in the space they occupy, and the parts should be laid out first of all before drilling the panel to see that all components fit into the places given

The Choke Coil

The choke coil should be made from No. 36 double silk (or double cotton) covered wire (even enamelled wire will do, but the double silk is best). This coil is not critical in its dimensions, and can be made up of 300 turns (approximating to a single layer, but it does not matter if the turns are slightly "scrambled") on a bobbin of about 1½ in. diameter. After the ends have been secured the coil can be wound round with empire tape or some such substance to protect it from mechanical injury. Ample length should be left at each end for subsequent connections. I should mention in passing that where the wires go from the coil to other portions of the apparatus they are safeguarded by being passed through lengths of insulating tubing, otherwise wiring is done with the ordinary square section tinned wire. After the coil is wound it is a simple matter to secure it to the panel by two wood screws.

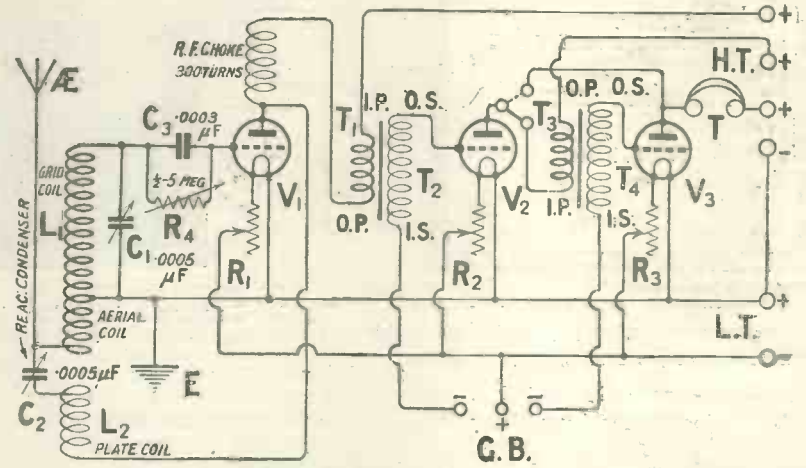


Fig. 5.—The theoretical circuit.

The Push-Pull Switch

The push-pull switch has three soldering lugs attached to it. An examination of the switch will show that one of these lugs is connected to a screw which makes contact with the central rod. The other two lugs are connected to metal fingers. When the switch is pushed inwards the centre spindle makes contact through a grooved ring with one of the blades, and when the switch is pulled out the other blade is substituted. Thus the switch acts as a single pole throw-over switch. The switching arrangement adopted in this instrument is to connect the plate of the second valve either to the primary of the intervalve transformer or to the telephones. In this way, when the switch is pushed in we have three valves in circuit, and when it is pulled out we have two. When only two-valves are used the third filament resistance should be turned to the off position.

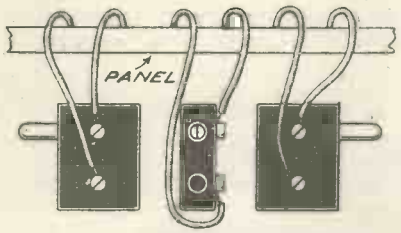


Fig. 6.—How to join up the sockets.

Owing to lack of room it is not found possible to mount the three-coil holder on the panel itself. It is therefore attached to the side of the box. Six holes in the left side of the panel (looking from the top) are made for flexible leads from the interior of the instrument. These flexible leads are pushed through the holes and left free when the panel is secured in place, and are subsequently joined to the three-coil holder by the special securing screws. Note particularly that the exact order of connections of the flexible leads to the coil holder must be followed, the leads going alternately to the top and bottom of the plugs. The first wire can go either to the top or the bottom of the first plug so long as the alternate order is followed.

New Wiring Method

This month we have introduced for the first time a new method of depicting the wires in our wiring diagrams. In previous diagrams the crossing of one wire over another has been shown by a small semi-circle, so that the reader may know which wires cross over and which are soldered. Whilst this method is free from confusion in one respect, it has the disadvantage that in sets where there are many wires the constant looping confuses the eye and gives rather a false idea of the complication of the wiring. The new method consists in showing the wires between points as a straight line just as they appear on the set, the cross-over points not being indicated by any semi-circles. So

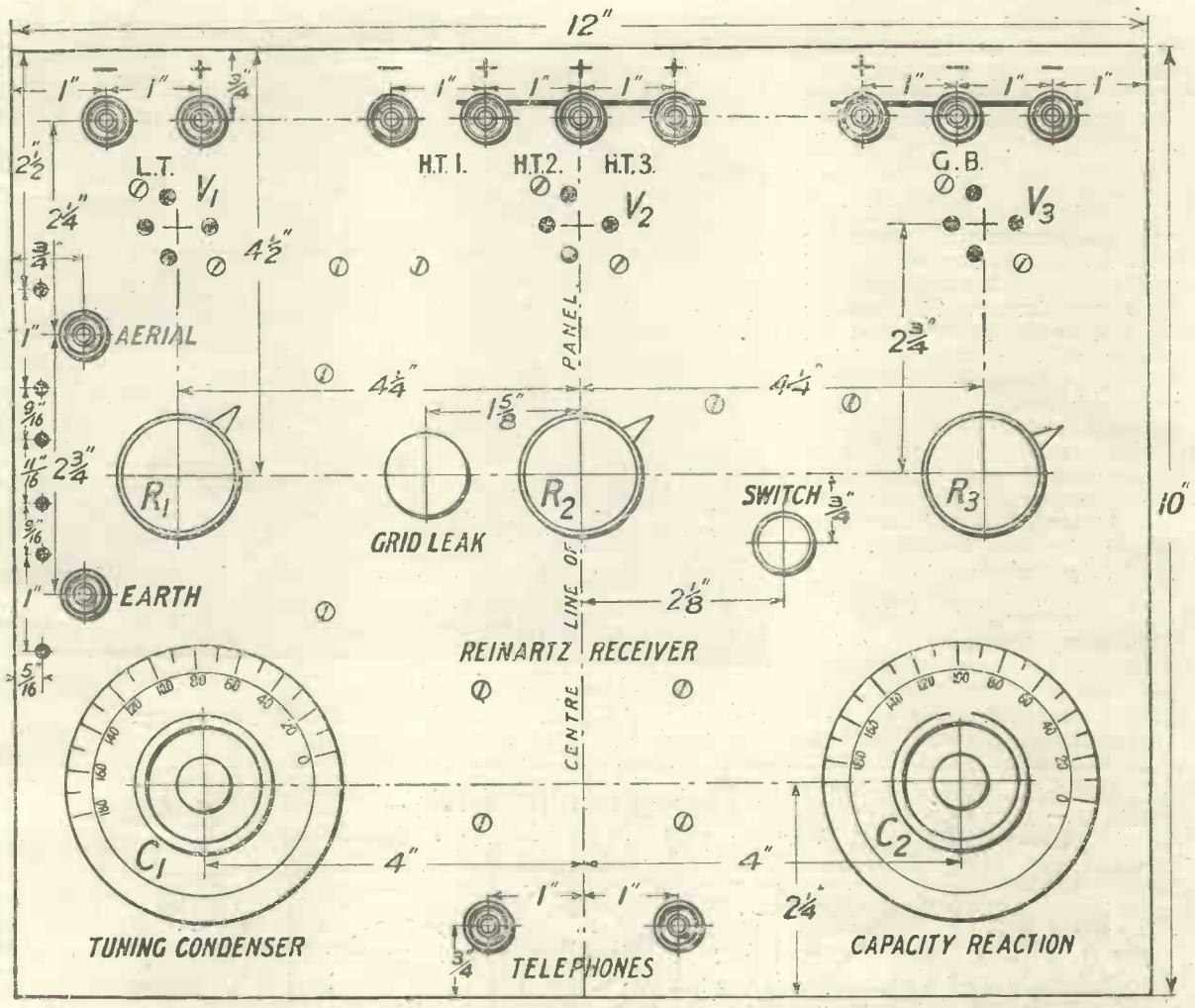


Fig. 7.—Drilling diagram of the top of the panel. Blueprint No. 75A.

that the reader may have no doubt as to which points are soldered, these connections (other than on terminals where a soldered connection is obvious) are shown by small black squares. The wiring diagram therefore is a more faithful reproduction of the actual wiring, and I think will be clearer. We should greatly appreciate readers' opinions on this matter—whether they like the new or the old method, and which of the two they consider the clearer.

It will be noticed that in the present instrument provision is made, not only for grid bias, but for separate high tension for each valve. In this way it is possible to use a power valve in the last socket, a good arrangement when signals from the local station are very strong and the ordinary valves cannot handle them. Until the reader is used to manipulating this receiver it is just as well to connect the three high tension positives together and to short circuit the grid bias terminals. When he has become accustomed to the instrument, he can find the best high tension voltage for each valve and the best grid bias.

Testing the Receiver

As soon as the wiring is completed valves may be inserted and the batteries connected for preliminary test. The best results with this receiver will be obtained with the aerial coil best suited to your own aerial, but as a preliminary trial I would suggest a 25 coil (or its equivalent in other methods of indication) in the aerial socket, a 50 in the grid circuit socket and a 50 or a 75 in the plate socket. Before turning on the current set the reaction coil at right angles to the grid coil and the reaction condenser at zero. The aerial coil should be placed as close as possible against the grid coil. Now turn on the current and, leaving the coils as stated, tune on the aerial tuning condenser. You will soon pick up your local station, although you may easily miss it in rapidly turning the tuning dial. As soon as you have found the station, turn the reaction condenser half way round and see whether the set oscillates. It will probably not do so. Now very slowly approach the plate coil to the grid coil until, with the condenser still at the half-way point, the set just oscillates. Now leave the coil in this position and turn the condenser back towards zero until the set ceases to oscillate. You will now find that reaction control can be carried out entirely by the reaction condenser, and you will obtain a very smooth control without "backlash." A further slight adjustment of the tuning condenser will be needed. Considerable variations of the tuning condenser will make it necessary to alter the reaction setting, but it will be found possible to obtain a good measure of reaction over the whole range of the tuning condenser without any further alteration.

You will soon get used to handling this receiver, and once

you have found the best position for your coils in the three-coil holder you need not touch this again. On the longer wave broadcasting stations try inserting a 75 for the grid coil.

Selectivity

If you have a set of special short wave coils, one of which is smaller than the 25, put the smallest coil in the aerial socket and again try some experiments. The smaller the coil in the aerial socket the greater will be the selectivity, although a point will be reached when you lose signal strength in gaining this selectivity. In general, I have found a 25 coil quite useful. For longer wavelength ranges it is wise to have coils in which the grid coil is twice the size of the aerial coil, and the reaction coil about the same size as (or one size larger than) the grid coil. The size of the grid coil can be found by referring to the MODERN WIRELESS Coil Table, using the same size as the table gives for an anode coil. Thus Radiola and Chelmsford will need a No. 200.

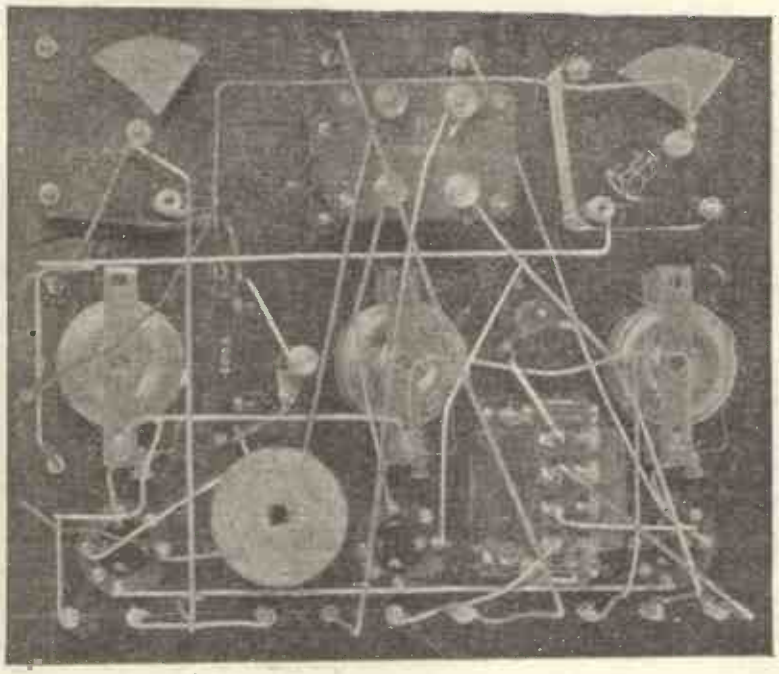


Fig. 8.—Plan photograph of the wiring.

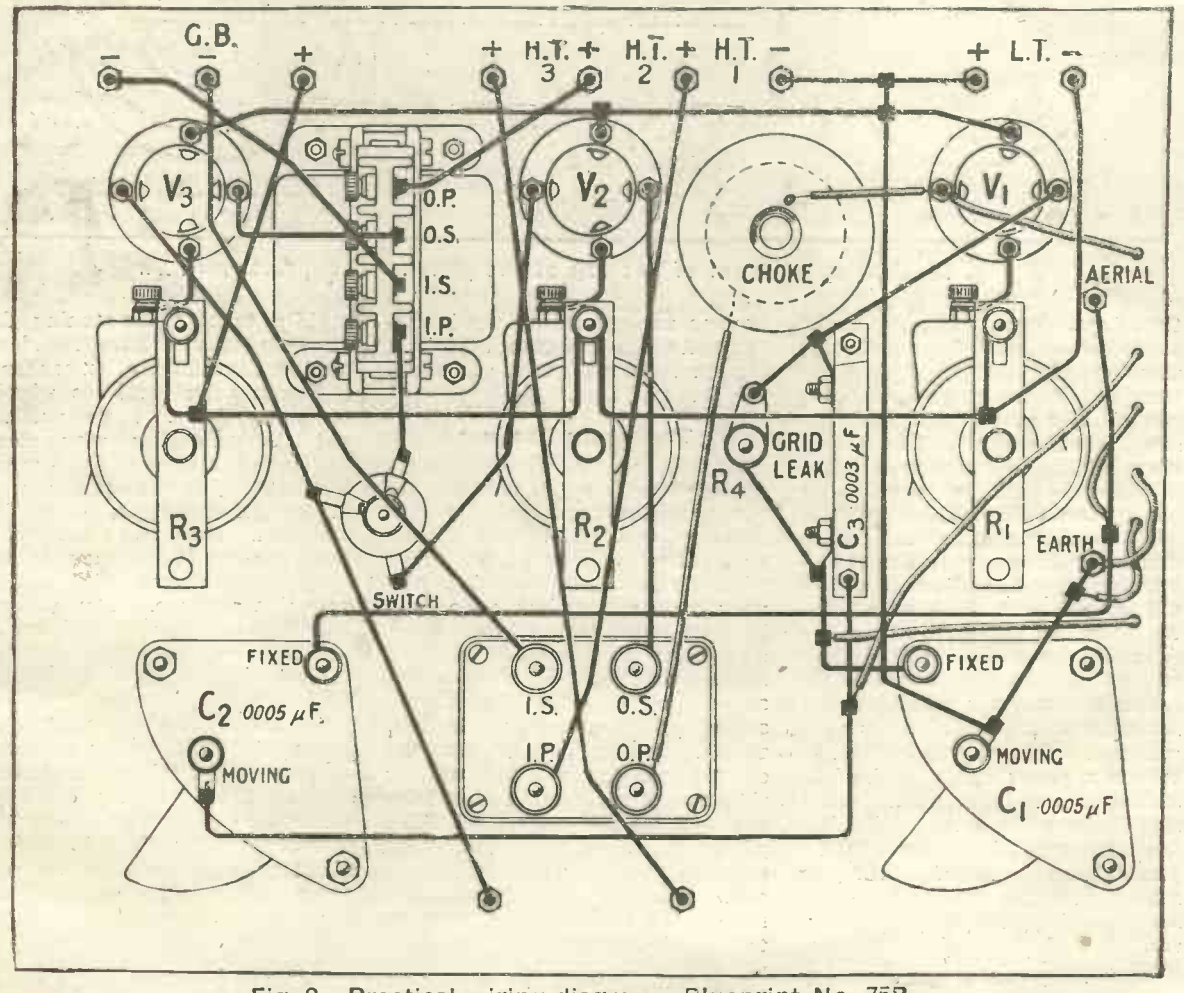


Fig. 9.—Practical wiring diagram. Blueprint No. 75B.
Note the new method of showing wiring. Joints are indicated by small squares. Where no square is shown, the wires cross without touching.

Test Report

During the very full test I gave this instrument on completion it was found to give adequate loud-speaker strength for the average room on a very small indoor aerial seven miles from 2L.O. On a good outdoor aerial Aberdeen was received at small room loud-speaker strength, and three other stations similarly. In the telephones all the British stations were heard, with the exception of a few of the relay stations, which do not come in well, although some difficulty was found in picking up one or two of the main stations. The fact that all stations can be received in favourable circumstances should not be taken to mean that I recommend the set for long distance work, but for anybody who desires a highly selective receiver to work a loud-speaker from a near-by station the present Reinartz system will be found hard to beat.

Continental Stations

Of the Continental stations Ecole Supérieure and several Germans were heard at excellent telephone strength, whilst Radiola was quite satisfactory on a loud-speaker in a small room. As an extra test the instrument was lent to other members of the Radio Press Editorial Staff, and their reports coincide with that just given.

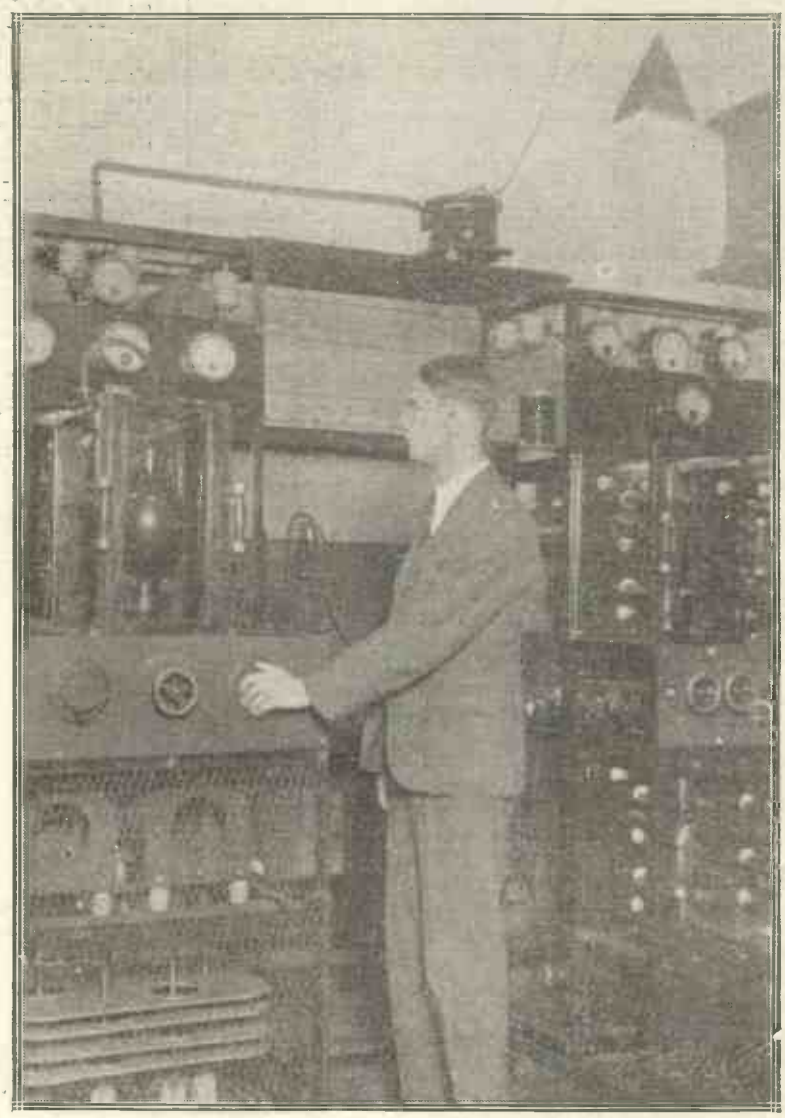
Aerial Reaction

As this set is arranged to give reaction on the aerial the usual precautions must be taken to prevent radiation. In practice this is quite a safe receiver, as control of the reaction is most gradual and the set does not "flop" into oscillation as do many sets in which the ordinary magnetic reaction is used.

American Broadcasting

Reports on this set will be, as usual, welcomed, particularly from those readers who use the set to work a loud-speaker with an indoor aerial. As we are now at the time of the year when reception of American broadcasting stations is most favourable, I may say that the present receiver is quite suitable for this work when conditions are good, and, indeed, one member of the staff picked up an American broadcasting station on the first night he tried the instrument. Critical adjustment is, of course, needed, and for those who are particularly desirous of picking up American broadcasting I would recommend a design using one or more stages of high frequency.

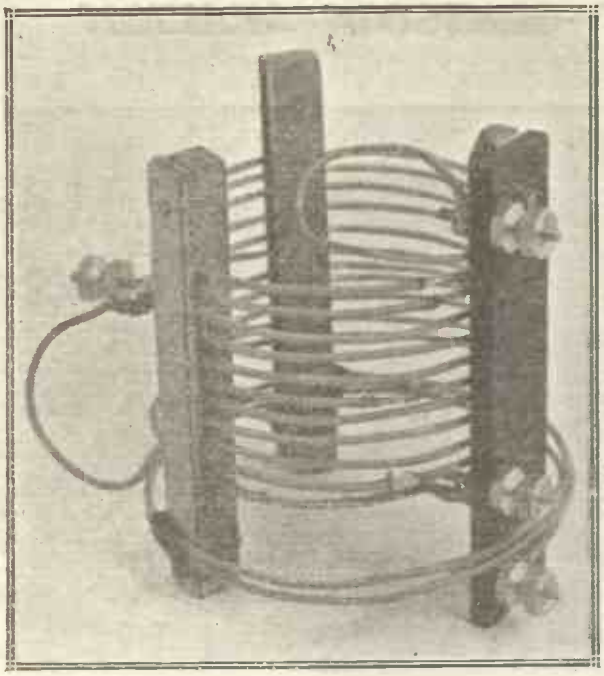
THE GLASGOW STATION



The Engineer, Mr. H. M. Hill, at the Main Oscillator.

QUERIES

Readers are reminded that the fee charged by RADIO PRESS LTD. for answering technical queries is 2s. 6d. per question. As a highly technical staff is devoting its whole time to replying to these queries it is impossible to answer any query which is unaccompanied by a remittance.



An efficient coil for short wave reception.

Reception on the Ultra-Short Waves

IT is not an exceedingly difficult matter, requiring any extraordinary or unusual types of apparatus, to receive successfully the transmissions on the very short waves which are becoming increasingly popular (particularly since the remarkable feats of trans-oceanic telephony on about 100 metres have been made public). The recent move on the part of the powerful American station KDKA down to approximately 65 metres has inspired many in this country to try to receive him on the lower of the two wavelengths on which he is at present working.

The efficiency of transmitting aerials is approximately proportional to the *square* of the frequency. With a wavelength only one-sixth of the ordinary broadcast wavelength, the efficiency of signal energy transfer is very high, so that the most rudimentary aerial (or almost none at all) suffices to pick up as much energy in proportion as a high P.M.G. aerial on 360 metres. Those who were privileged to listen-in to the Poldhu station recently, when transmitting to the "Elettra" and to the Antipodes, will realise the tremendous force with which a short wave station of a dozen kilowatts power will come in at some hundred miles—equivalent to 2LO at a dozen miles was the writer's own experience.

Conditions for Reception

The conditions for successful reception appear to be:—First: the use of a *short* single wire aerial, preferably vertical, and very carefully isolated, with a short direct lead-in. Second: the use of as few valves as is practicable, two for 'phone use, detector followed by an *efficient and silent* stage of low-frequency amplification. Third: keeping all tuning and distributed capacities as low as possible. The last point is not due to any vague mysterious "leakage" of signal energy due to stray capacities on the short waves, as is

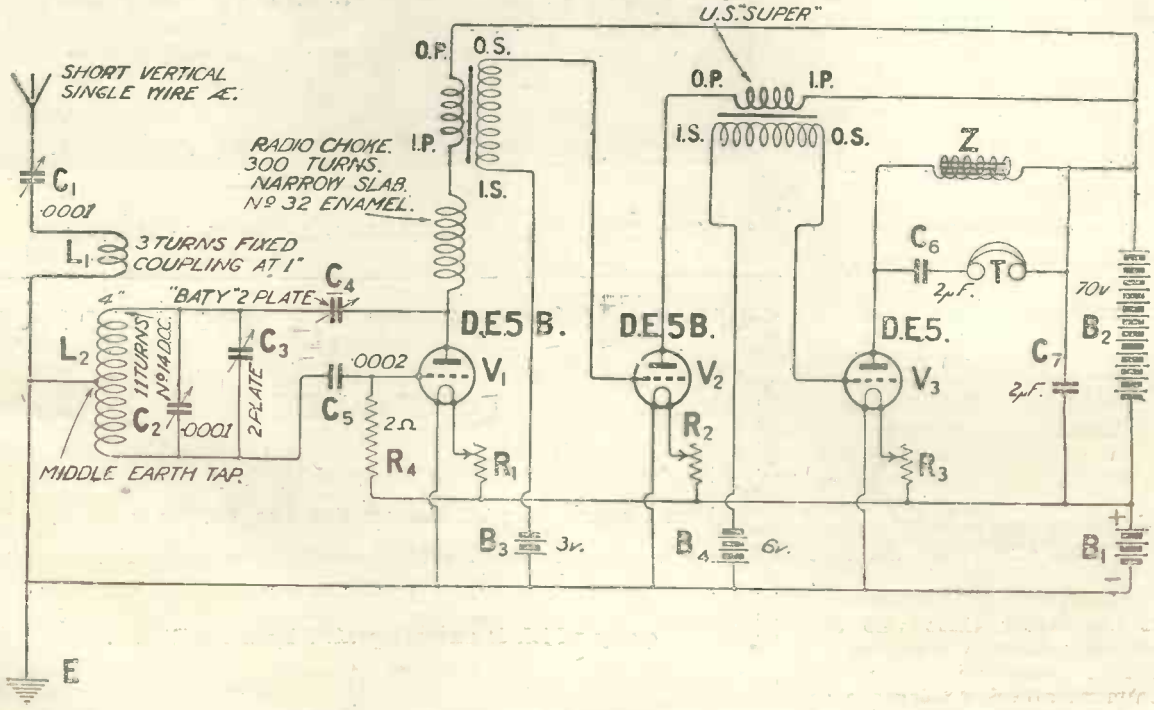


Fig. 1.—A powerful short wave circuit.

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

The present trend in wireless development is towards the use of very short waves, and this article forms a basis for much interesting experimental work in this direction.

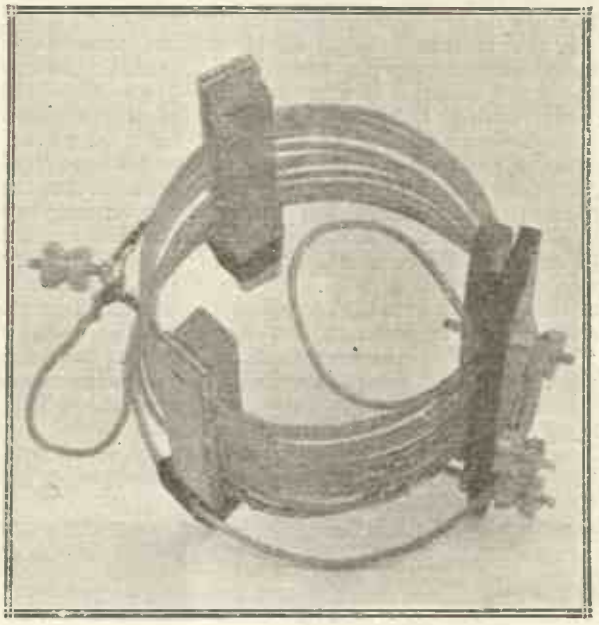
often and inaccurately stated, but because the *total* available tuning capacity is necessarily low, and these stray capacities (often poor high-loss condensers in effect) must accordingly be kept down to a reasonable proportion of this limited maximum.

Tuning to Short Waves

On one-sixth of the ordinary broadcast wavelength we need one-sixth of the inductance *and* one-sixth of the tuning capacity (for the wavelength is proportional to the square root of the product of these, according to the familiar formula), so that we may retain the ratio of inductance to capacity in the tuning circuit at about the right order for a similar degree of efficiency. So with an inductance of the order of 20 microhenries, we must combine a *total* tuning capacity of not much more than ·0001μF (100 micro-microfarads). This needs quite careful work in the design of the tuning inductance. The distributed capacity of the No. 15 coil of a well-known type of plug-in coil is near 20$\mu\mu$F, and its "natural" wavelength is given as being close to 50 metres. Apart from its very appreciable H.F. resistance, it is evident that such a type of closely wound fine wire coil is quite unsuitable for extremely short wave work, even if cut down to a small number of turns. The self-capacity can actually be brought lower by special types of winding, but at the cost of heavy dielectric losses and high H.F. resistance through the use of fine wire.

Reduce H.F. Resistance

It is essential for success on these very low waves to have the H.F. resistance as low as possible, not only to eliminate much of the interfering mush and atmospherics in reception, but in order that a minimum amount of reaction will suffice to bring the receiver into a sensitive condition. Clumsy strong reaction introduces so much trouble through stray capacities and continual interference with tuning as reaction-coupling is varied, that it makes successful reception of distant stationsalmost impracticable.



Notice the similarity to transmitter inductances.

While very little useful data on the subject is available, such as has been published shows that the high-frequency resistance of wire increases with great rapidity with increase of frequency below, say, 200 metres, and on 5,000,000 cycles (60 metres wavelength) is probably 5 to 7 (or more) times the D.C. resistance even for the larger gauges of wire. Accordingly, it is necessary to break away from the practice of using wire that is easy to wind and cheap to buy and gives results of a sort on the B.B.C. waves, and to make the tuning inductance of a type really designed for short wave work. A lesson

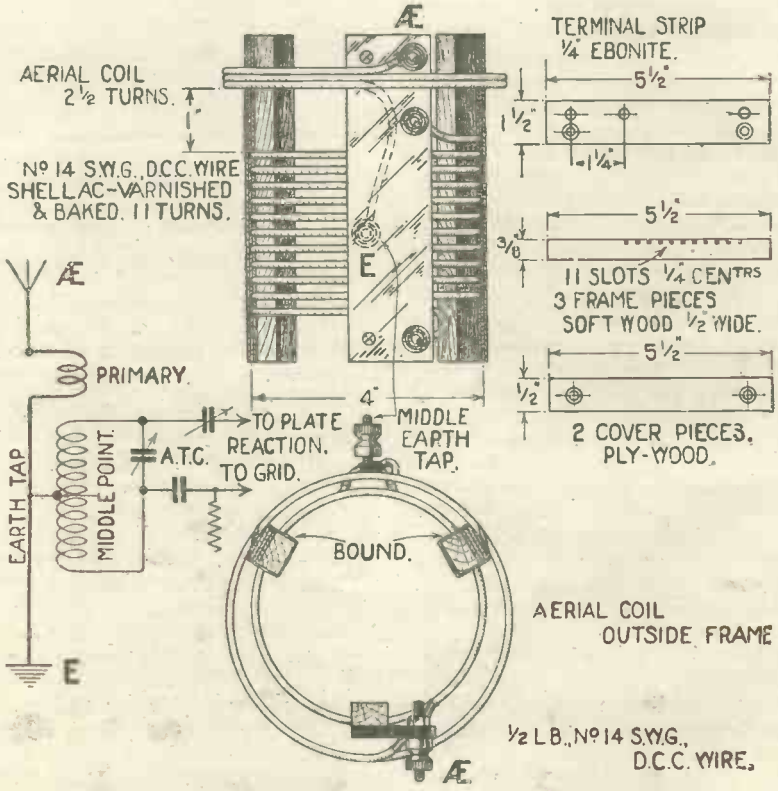


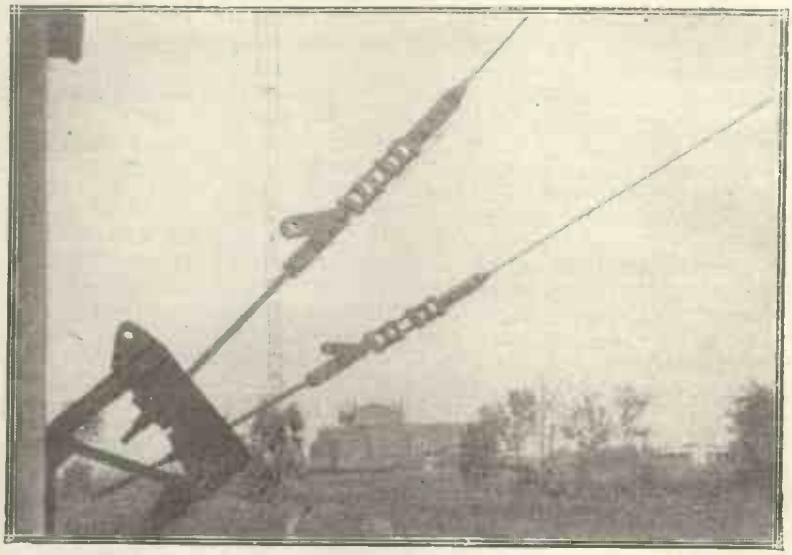
Fig. 2.—Details of a tuning inductance for 60 metres.

can be learnt here from the transmitting fraternity, who are forced by the relentless logic of their aerial ammeter to pay some heed to the quantitative efficiency of their tuning inductances. Their large air-core coils of bare copper strip or rod represent the ideal, to which one must make some approximation here. Hence the design indicated for the A.T.I. is that of an air-core coil, well spaced, of, say, No. 14 s.w.g. wire. As we are not dealing with high potentials and can stand some limited loss with the help of moderate reaction, we can use d.c.c. wire and a simple wooden frame, leaving the troublesome job of stringing ebonite strips bored with a row of holes on bare-wire coils, as is customary, for those who are interested in actual transmission.

A.T.I. Design

The design for the A.T.I. is indicated in the figures. Eleven turns of No. 14 d.c.c. wire (which is stiff enough for such a purpose and has a fairly low resistance even on 60 metres) are first wound on a handy jam-pot, preferably with the assistance of another person. The diameter should be about 4 in. when sprung off. For the frame, three pieces of soft wood are cut, about 5½ in. by ½ in. by ⅜ in., and notches (deep enough to take the wire) are cut by a saw across the wider face, 11 in number, and spaced as nearly as possible at ¼ in. Two slips of stout three-ply wood are then required, 5½ in. by ½ in., and a strip of ¼ in. ebonite 5½ in. by 1½ in. The ebonite strip is drilled to take two small screws for fixing on the frame, and has three terminals, one at each end and one 1¼ in. from one of the latter, all arranged to one side of the strip. The frame-pieces are arranged at 120 degrees around the inductance, inside, and the ply-wood and ebonite pieces fixed on outside the wire by two small brass wood-screws apiece at the ends, the turns of the No. 14 wire being arranged in the grooves in order. The ends of the latter are secured under the end and the intermediate terminal respectively. The middle of the length of the wire is then bared of insulation, pulled out a little, and a third terminal soldered on securely. This provides the earth-tap, mentioned later.

On account of the small maximum capacity permissible, direct coupling to the aerial is hardly practicable. Hence a fixed semi-aperiodic primary coil is used with a very small series condenser, if on a long aerial. For this purpose a coil of only three turns of No. 14 d.c.c. wire is wound on the projecting frame-ends of the tuning inductance, outside the cover-strips. The aerial (outer) end of this is secured to the vacant terminal at the top, and the lower end is bent round so as to clear the turns of the tuning inductance by a good margin, and is brought to the central earth-tap point and soldered there. The small coil of 3 turns (actually more nearly 2½) is secured in place with insulating tape at about 1 in. from the top turn of the other coil, no particular care being necessary here to space the turns. The whole is varnished with shellac (it will do no harm here, with good air-spacing) and thoroughly baked to exclude moisture. Damp wood is almost a conductor for high-frequency work, so moisture should be avoided even when the minimum of wood is present.



A view of the Nauen station. Time signals from this station are regularly received in the United Kingdom, and on 73 metres experimental transmissions are being carried out with both telephony and C.W.

Types of Valve

The tuning range depends on the stray capacities present. As ordinary types of valves and standard types of panel-mounting were desired, the writer investigated to what extent these give an unwelcome load of stray capacities. In order to take advantage of the high efficiency reached in a detector-valve with an amplification factor of 20, he desired to use a D.E. 5B valve here, which is scarcely what some authorities would recommend for extremely short wave work. The total grid to earth capacity of this valve alone was found by measurement to be 4·8$\mu\mu$F, as compared with a standard R, which gave 3·6 $\mu\mu$F. The greater power of the first valve surely justified an increase in tuning capacities of about 1$\mu\mu$F!

Stray Capacities

Two panels with four-leg valve-holder in place, grid condenser and leak, showed capacities from the grid connection to earth of 5 and 7·7$\mu\mu$F respectively. A lead of about a foot of flex, fairly well isolated, gave the surprising figure of 5·5$\mu\mu$F, a thing seldom realised amongst amateur constructors. As the zero capacity of the low minimum Peto-Scott ·0001μF tuning condenser (ebonite frame) to be used was 6·6$\mu\mu$F, the total casual capacities, apart from distributed capacity in the inductance, were around 24$\mu\mu$F even if short leads were practicable. With a tuning condenser range of 100$\mu\mu$F, the wavelength range could not be very great. With the experimental temporary bench hook-up, involving a total of more than two feet of leads to tuning and fine-tuning condensers, the actual range was found to be from around 40 to just below 80 metres, when loaded to some extent by an aerial.

Wavelength Range

Unloaded, it was possible to go a little lower, and with a ·0002μF tuning condenser and the aerial load the highest point was about 105 metres. These were repeatedly checked against higher

harmonics of a heterodyne wavemeter, itself standardised against a Townsend wave-meter and the B.B.C. stations, of range 300 to 600 metres. The fourth, fifth and sixth harmonics could be picked up in succession by very careful manipulation with the heterodyne meter standing close to the short wave receiver; up to the twelfth harmonic could sometimes be traced.

At first the aperiodic primary was wound on the frame right over the tuning inductance, but the distributed capacity to earth of this arrangement proved excessive. The measured capacity between the coils arranged thus was actually 30$\mu\mu$F. The range, accordingly, was limited and not as low as it was desired to get. This was subsequently changed as indicated, the primary coil being arranged 1 in. above and away from the other, with favourable results.

In order to keep the effect of casual capacities still lower and to give an effective but finely controllable reaction, the grid coil was not put between grid and earth, but arranged after the manner of a familiar type of transmitting circuit, across grid and plate, with a blocking condenser in the plate lead. As shown recently by the writer, this forms a handy, powerful circuit for use with frame aerials, if this anode condenser is made a small, low minimum variable one and reaction effects are controlled by it. A centre earth-tap is needed in the tuning inductance, and the grid condenser and leak are arranged in the conventional manner. Then no other reaction coil is needed and casual capacities are kept at a minimum.

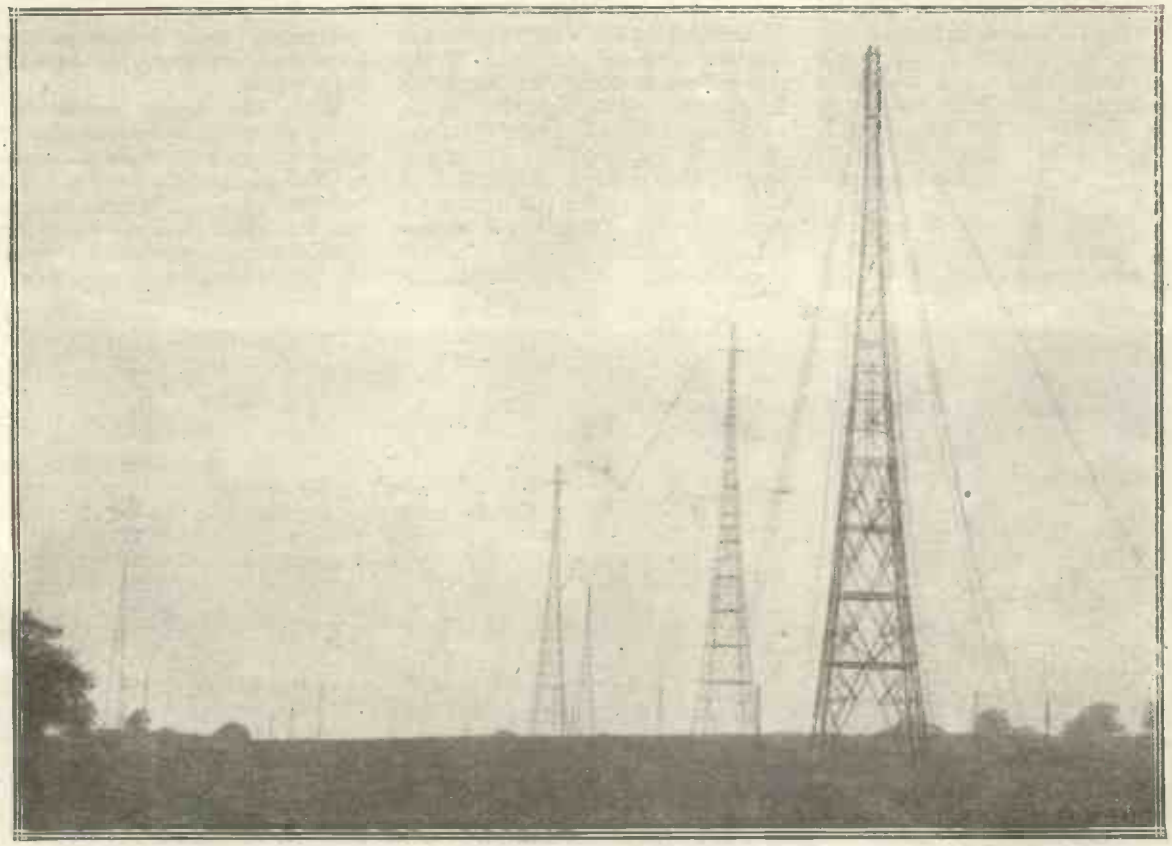
The Radio Choke

The radio choke needed in this circuit must be a particularly good one; a layer wound solenoid which operated well on 400 metres was useless here. A very narrow slab coil of, say, 300 turns of No. 32 enamel insulated wire, wound edgewise in saw slots in a small plywood frame, sufficed admirably and was easily made. The outside diameter was about 3 in. with 1 in. centre.

A two plate fine tuning condenser and at least a 6 in. handle on each condenser are quite necessary, as hand-capacity effects are very pronounced. So long as H.F. leads are as short as possible and well isolated no other special features seemed called for in the arrangement of the receiver. The reaction condenser was conveniently a two plate Baty condenser, as a very low minimum is called for at times, and a maximum approaching ·0003μF. An extension handle was fitted to this. A further control over reaction is provided, with D.E. valves, by the filament control.

High Amplification

As one had to rely largely on L.F. amplification, a high degree of amplification with but few valves (to avoid the usual "atmospherics") was sought with the aid of the D.E. 5B valve (with its M of 20) and a fairly high ratio transformer, the Pye No. 1. Small power amplification was used, on occasion, for the last valve, consisting of a high ratio U.S. "Super" L.F. transformer and a D.E. 5 valve (of fairly high M), each with its suitable grid bias and favourable H.T. The resulting L.F. amplification was terrific, and



The great aerial system of the Ongar Station contrasts with the type of that used for short wave transmission.

great care had to be taken as to grid bias and arrangement of primary leads to avoid whistling. The effect of the high ratio valves and efficient transformer coupled amplification can be judged when it is mentioned that a buzzer wavemeter a couple of feet away from the set gave an overpowering roar from the loud-speaker. At first, although real atmospherics were not very bad in the receiver, nothing could be done at all with three valves until filter circuits were introduced into both detector and amplifier H.T. leads, consisting of audio-chokes (L.F. transformer secondaries) in series and 2μF condensers across them, as otherwise battery noises sounded like a distant artillery barrage. Then, although the real atmospherics were very bad on the longer waves, on the last occasion interfering appreciably with local broadcast reception, on 50 metres they were no more than an occasional swish or loud click, with the loose coupling and low resistance tuned circuits used here.

The results obtained in a necessarily brief trial of the circuit were very encouraging. With the first arrangement of the primary right over the grid inductance, a number of successive harmonics of different broadcasting stations were picked up, using a vertical aerial of "Amplifytone Aerial" copper ribbon of about 8 ft. effective height above a corrugated iron shed-roof. Also, after the B.B.C. stations had closed down, another station, presumably of Continental origin, was heard.

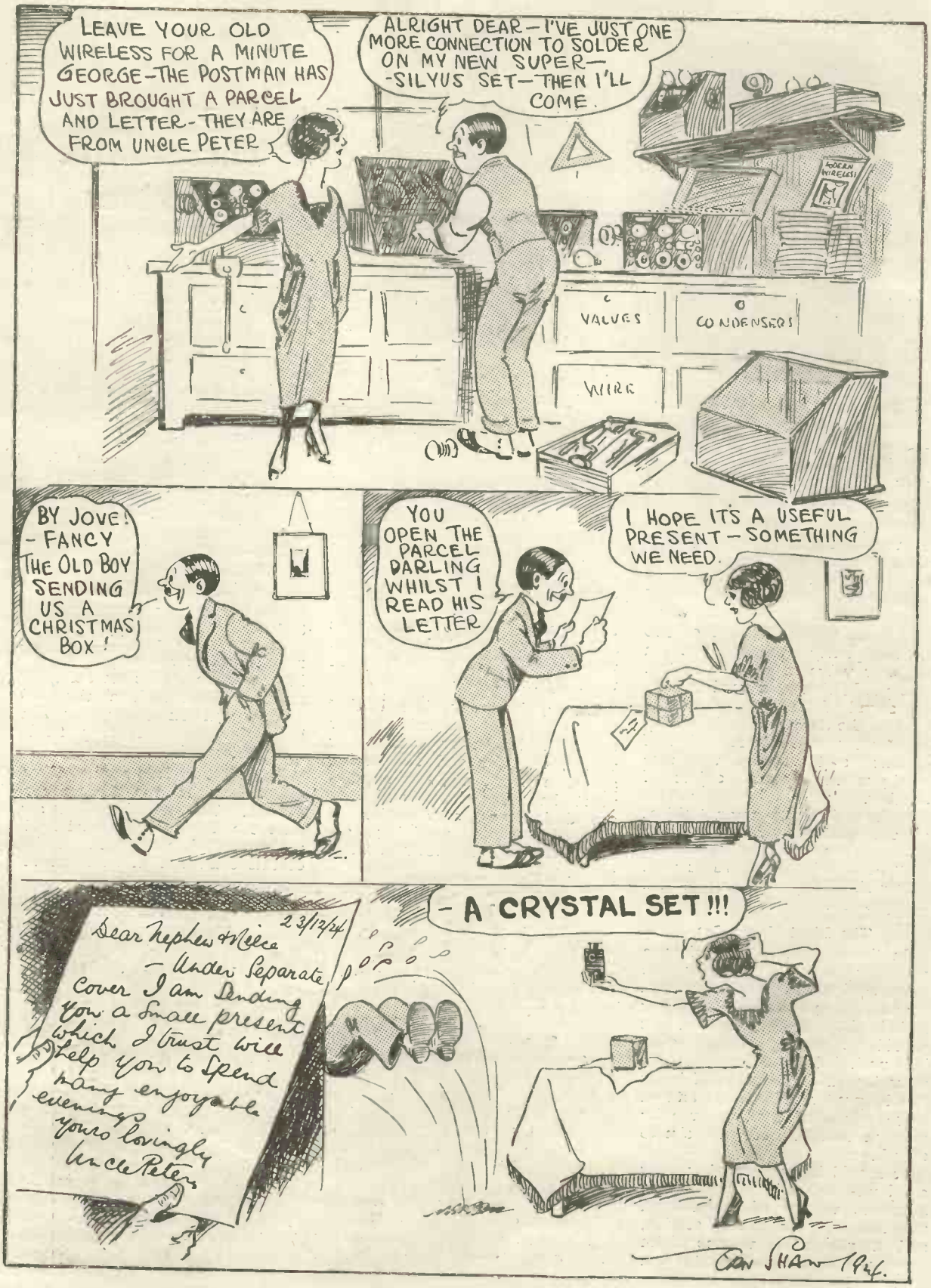
Results

A test transmission from the German Telefunken station came in clearly and at good strength around 80 metres or so, being readily tuned in on the loud-speaker on two valves. (The receiver had not yet been calibrated.) Some extra-short wave experimental transmissions have been recently announced in the Press from this station. Several amateur Morse transmissions came in, some at loud-speaker strength on two valves.

When the modified arrangement, giving a lower range of wavelength, was tried on a succeeding night under quite unfavourable circumstances (very bad atmospherics, a damp, muggy, windless evening, and on a low horizontal 70 ft. test aerial, thoroughly screened locally, in Essex) at 10 p.m. there appeared to be little going on, but presently, on between 60 and 70 metres (about 150 degrees on condenser), a powerful wave came in (on the two valves), and by extremely careful tuning and reaction adjustment was recognised as speech and music, which persisted for a considerable time. The strength was about on a par with the irregular casual noises, so that, although the modulated wave was readily found on the L.S. (new pattern "Ultra") on three valves without headphones, the effect was not intelligible or enjoyable. On a more favourable night, undoubtedly KDKA would have been more enjoyable. Using the vertical 8 ft. aerial without any series condenser, some amateurs were heard very low down on the wavelength scale.

With the larger aerial more noises came in, and care had to be taken to set the series condenser so that the natural wavelength of the whole aerial and aperiodic coil was less than that on which one was receiving, as otherwise the set mysteriously refused to oscillate.

Canadian trans-continental trains are now being equipped with wireless sets to relieve the monotony of long and tedious journeys.



UNCLE PETER'S CHRISTMAS BOX.

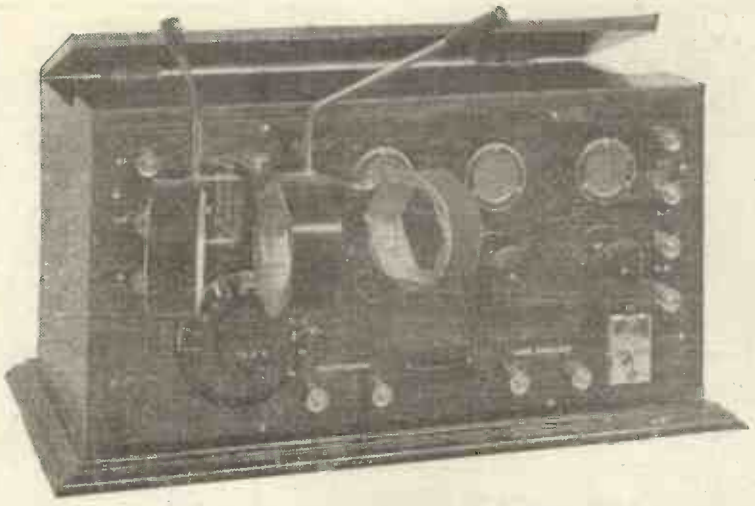


Fig. 1.—The set presents an extremely handsome appearance.

The Home Three-Valve Receiver

By E. REDPATH.

READERS with some little experience of wireless will no doubt agree that, when asked "What is the really ideal receiving set?" the reply must be to the effect that it depends upon the purpose for which the set is required.

In some circumstances a good crystal receiver may be ideal, whilst, in others, the use of two high-frequency valves and a detector valve may be indicated. The production of a good volume of sound from a loud-speaker may be the desire of one intending constructor, and the reception of distant stations in telephone receivers the special object of another.

Some enthusiasts may not object to the tuning of their receiver demanding a considerable amount of "knob twiddling," whilst with others simplicity of operation is a *sine qua non*.

The Ideal Home Set

In the opinion of the writer, a receiving set designed for the purpose of providing entertainment in the home should certainly include the following features. It should be easily operated, even by unskilled members of the owner's family; capable of being left in proper adjustment and of being put into or out of use by the movement of a simple switch.

It should be capable of making a loud-speaker reproduce an adequate volume of sound from the nearest broadcasting station, and a reasonable volume from two or more alternative stations. In order to accomplish this, a fair degree of selectivity should be provided for without complicating the tuning arrangement.

Complicated switching should be avoided, but it is certainly considered desirable that provision should be made for using one valve only with telephone receivers, which enables "searching" to be done with economy in current consumption and without the emission of sundry unpleasant noises from the loud-speaker, the change-over to "all valves and loud-speaker" being made when signals are satisfactory in the telephones.

Lastly, it is considered that the set should be suitable for use with bright or dull-emitter valves, compact and of pleasing appearance. All these requirements have been kept in view in the design and construction of the three-valve receiving set illustrated and described in these pages.

General Description

The external appearance of the completed set is shown in the photographs, Figs. 1 and 3. There are three valves—detector and two low-frequency amplifying valves—fitted inside the cabinet and visible, when their filaments are glowing, through the respective circular valve windows of wire gauze.

In order to provide for the reception of all wavelengths, "plug-in" inductance coils are employed in conjunction with a three-coil holder, seen on the upper left-hand side of the front panel in the photograph.

Immediately below the three-coil holder is the tuning condenser. The operation of the set, once the necessary external leads are connected, consists in rotation of this condenser dial and move-

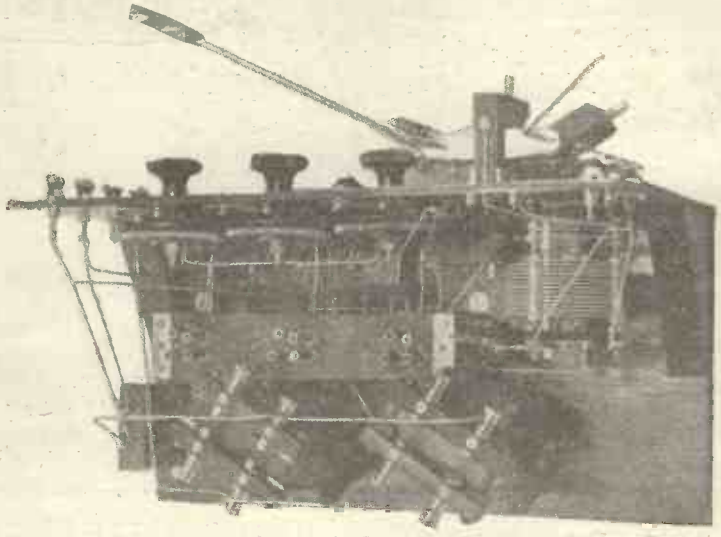


Fig. 2.—A plan view of the wiring.

In the following article Mr. Redpath gives full constructional details of a straight three-valve receiver which, by reason of its excellent appearance and ease of operation, will appeal particularly to those who desire to build the set for home use.

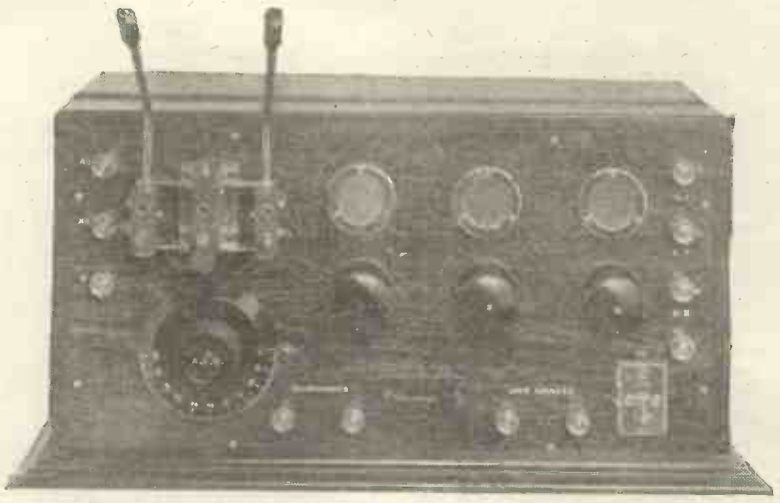


Fig. 3.—With coils removed, the terminal arrangements are clearly seen.

ment of the two outer coils by means of the extension handles on the coil holder.

The three terminals immediately on the left of the coil holder are for aerial and earth connections, and the four terminals on the extreme right of the panel are for the high tension, filament lighting and grid-bias batteries.

Telephone Terminals

Of the four terminals at the foot of the panel the two on the left are for telephone receivers, which are in use with one valve only when the lever of the centre switch (between the pairs of terminals) is over towards the left. Moving the lever of this switch to the right lights the two low-frequency valves and brings into operation the loud-speaker connected to the remaining pair of terminals at the foot of the panel, at the same time cutting out entirely the telephone receivers.

Filament Control

Each valve is provided with a separate filament rheostat to permit of individual adjustment of filament brilliancy, and the filament current to all three valves is switched on or off by the small nickel-plated switch in the lower right-hand corner of the panel.

The Circuit Arrangement

Fig. 4 is a complete theoretical circuit diagram of the receiver. Referring to the figure, the filament lighting circuits, with three rheostats R and switches S_2 and S_3, may easily be traced. S_3 is the small switch which lights or extinguishes all three valves simultaneously, whilst S_2, in reality one arm of a double-pole change-over switch, cuts off the filament current from the two amplifying valves when the telephones are in use.

Tuning Circuits

With the aerial AE connected to the terminal A_1, the aerial circuit includes the *untuned* inductance coil L (the left-hand movable coil) which is inductively coupled to the fixed coil L_1. In these circumstances, the inductance L_1 and variable condenser C_1 form a closed oscillatory or secondary circuit. By connecting the lower end of the coil L_1 to earth and providing an additional terminal A_2, the aerial lead may be connected to the upper end of L_1; the coil L may then be dispensed with and the set becomes a single circuit direct coupled receiver.

By using both coils, with a fairly loose coupling between them, the tuning will be found to be selective whilst single-control of tuning is retained. For instance, at a distance of about 15 miles from a broadcasting station (2 LO), the vernier of the variable condenser C_1 will be found very useful for fine adjustment of tuning.

Further, the coil L_1 may be much larger than when the aerial is connected to terminal A_2, with consequent increase in the wave-length range covered by a given coil on the condenser C_1.

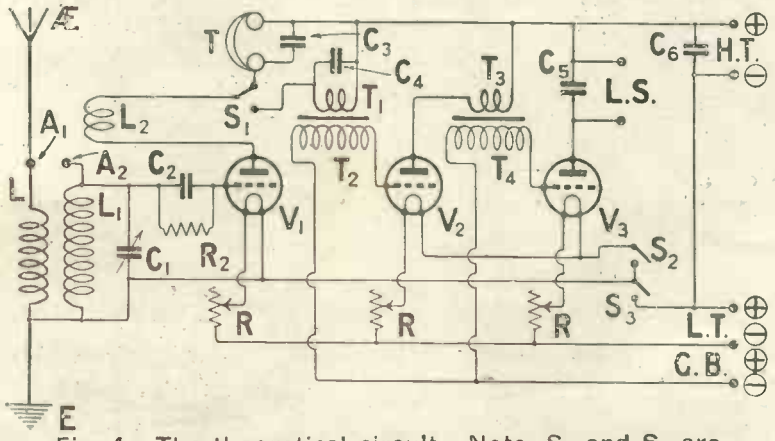


Fig. 4.—The theoretical circuit. Note, S_1 and S_2 are operated by the middle switch in Fig. 3.

The Oscillatory Circuit

The oscillatory circuit L_1C_1 is connected to the grid and filament *positive* of the first valve, the former connection being made via the usual grid condenser C_2 and gridleak R_2.

The anode or output circuit of the first valve includes the reaction coil L_2 (the right-hand movable coil) which is inductively coupled to the coil L_1 in the correct sense so as to produce a reaction or regenerative effect. L_2 is also connected to the change-over switch S_1 by means of which the connection to the positive terminal of the H.T. battery is completed, either through the telephone receiver TEL (shunted by the fixed con-

denser C_3) or through the primary T_1 (shunted by fixed condenser C_4) of the low-frequency iron-core transformer T_1, T_2.

Actually the switches S_1 and S_2 are mounted upon a common insulating spindle and moved together, so that when the telephones are put in circuit the filaments of the second and third valve are extinguished, being relighted when the switch S_1 connects to the primary of the iron-core transformer.

The L.F. Circuit

The rectified pulses of current in the anode circuit of the detector valve, traversing the primary winding of the transformer T_1, T_2, induce currents of higher voltage in the secondary winding, one side of which is connected to the grid of the first amplifying valve, and the other, via the grid biassing battery, to the negative terminal of the filament lighting battery.

The amplified currents in the anode circuit of the first amplifying valve are further increased in potential and applied to the grid and filament negative of the third valve by means of the iron-core transformer and in the anode circuit of this latter valve is connected the loud-speaker shunted by the fixed condenser C_5. C_6 is a large capacity fixed condenser, known as the reservoir condenser, connected directly across the H.T. terminals and therefore across the high-tension battery.

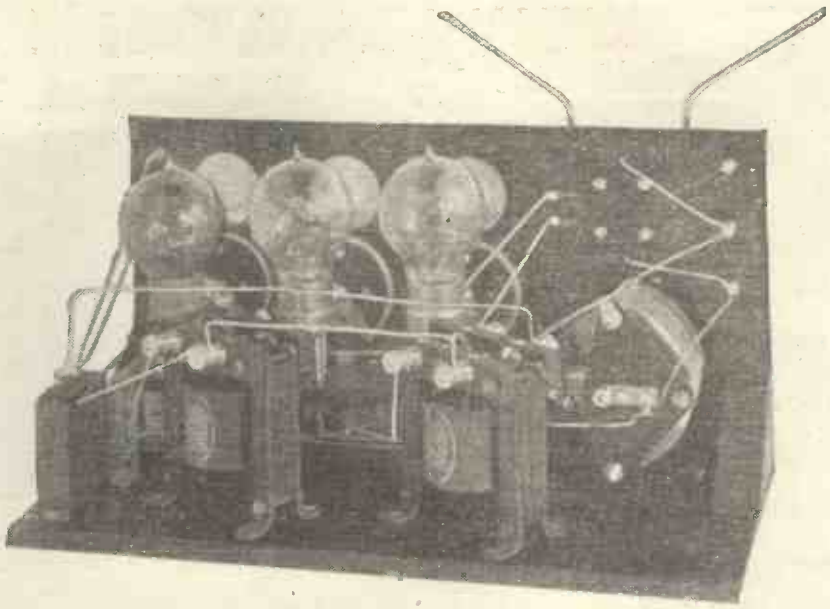


Fig. 5.—The transformers are mounted in staggered formation.

Components Required

The following is a list of components required, and includes (batteries, etc.), in addition to the items indicated in the circuit diagram, Fig. 4, the references of which are given to facilitate identification. For the convenience of readers, the make of components used in the original set is specified. Other good makes can of course be substituted.

1 Radion panel, 7 in. by 14 in. by 3/16 in. thick.
1 3-coil holder. (Burne-Jones, "Magnum.")
3 filament resistances, R, (Burndept, "Dual.")
3 valve windows (Bowyer Lowe).
1 variable condenser (0·0005μF with vernier). (Bowyer Lowe "Square Law.")
1 switch, S_3, (Connecticut).
1 double-pole change-over switch

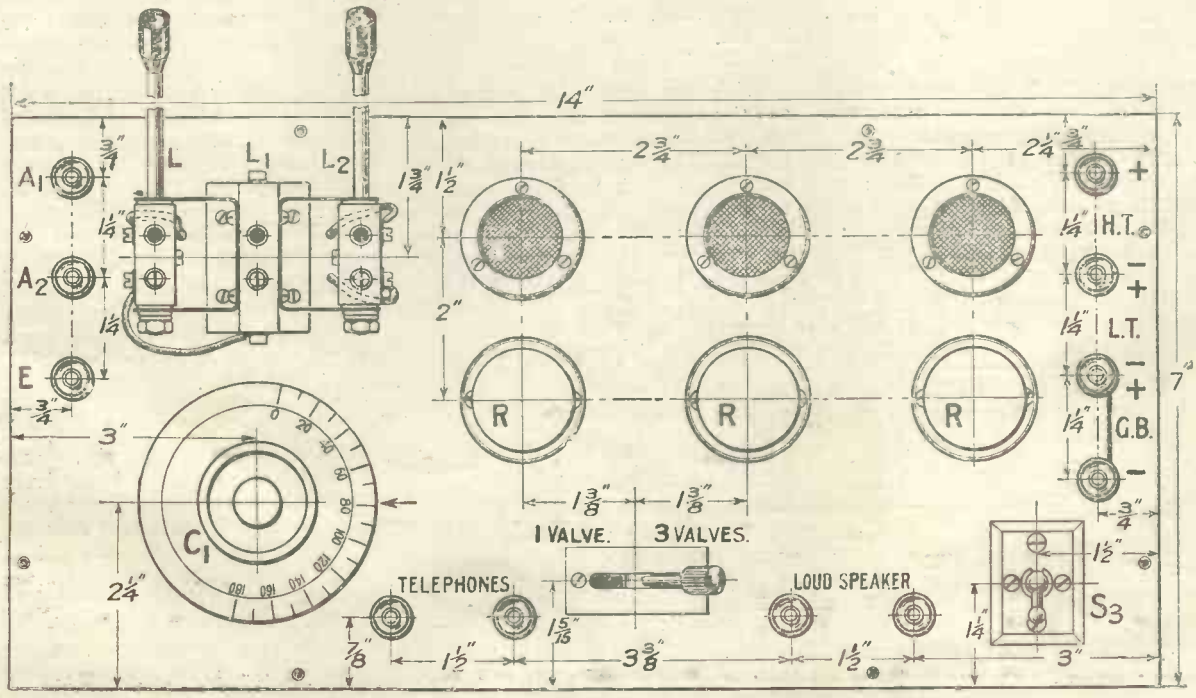
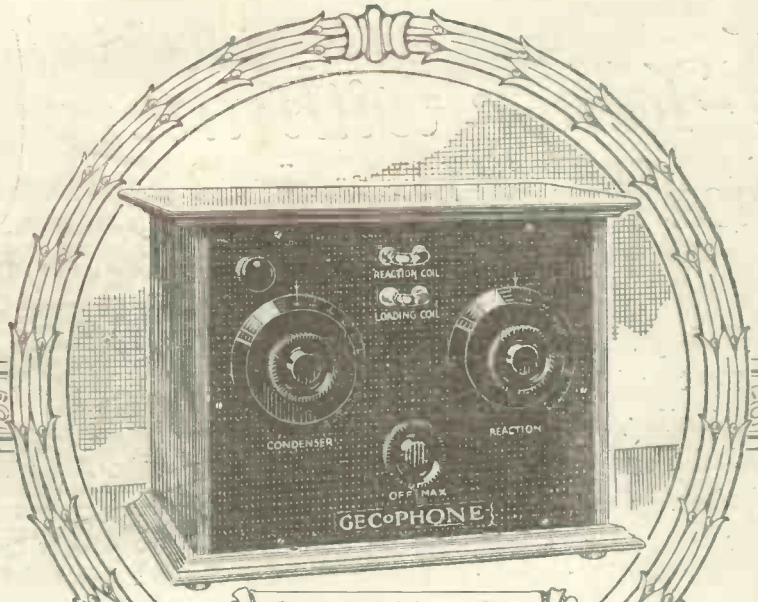


Fig. 6.—Front of panel drilling diagram. Blueprint No. 77A.



Single Valve Set

For Service & Satisfaction

GECOPHONE

(REGISTERED TRADE MARK)

NEW MODELS

The model illustrated above is the GECOPHONE Single Valve Set which meets the demand for an efficient popular-priced instrument. It is supplied either with D.E.R. Valve for use with an accumulator or with D.E.3 Valve for use with dry battery. In the latter form it is particularly **useful to those living in the country or who do not wish to be bothered with the trouble of accumulator charging.** It covers the British Broadcasting wave-length band, whilst loading coils can be added for Chelmsford or higher wave-lengths. Its range for broadcasting is rated at 80-100 miles. Operation is simplicity itself. Connections are made simply by pushing plugs into sockets.

Cat. No. B.C. 3000, Set only with D.E.R. Valve	**£5 18 0**
Cat. No. B.C. 3001, Ditto, but with all necessary batteries, headphones, etc.	**£10 0 0**
Cat. No. B.C. 3050, Set only, with D.E.3 Valve	**£7 12 0**
Cat. No. B.C. 3070, Ditto, but with all necessary batteries, headphones, etc.	**£10 5 0**

Ask your dealer to demonstrate this model to you.

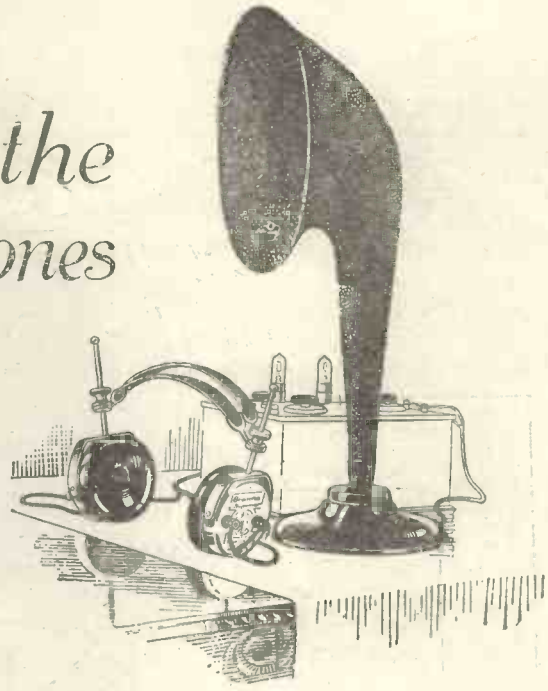
GECOPHONE Sets are sold by GECOPHONE SERVICE DEPOTS, Electrical Dealers, Stores, etc.

Ask for price list (No. B.C. 3425).

Advertisement of The General Electric Co., Ltd. (Manufacturers and Wholesale only), Magnet House, Kingsway, W.C.2.

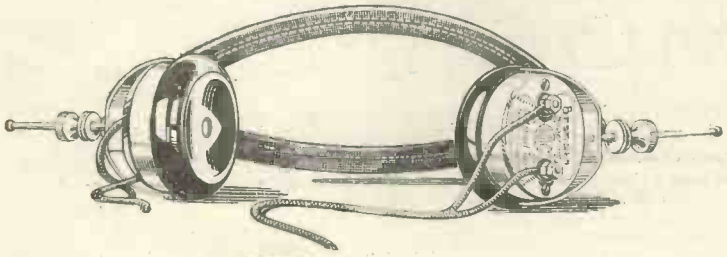
Tune the Table-Talker with the "Matched Tone" Headphones

OH, boy! What fun you'd get with the *Table-Talker*, as well as your "*Matched Tone*" Headphones. Ask Father. Can you think of a better gift for Christmas? Just real fun—fun for the Christmas Vac.—fun all the year round. You will hear every blessed word as plain as though your own form-master were speaking—and it's heaps more interesting. You'd hear real music just as loud as you hear that girl thumping on the piano next door—but no false notes. Oh, no! And it's so pleasantly natural. *Ask your Dealer for Brandes.*



All Brandes' products carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied. This practically constitutes a free trial.

The "*Matched Tone*" feature was embodied as the distinctive characteristic of Brandes Headphones in 1908, and means that both your ears hear exactly the same sound at the same instant—and you learn a new beauty of tone. They are tested and re-tested for just this one vital point, and in addition their strength, long-wearing comfort and reliable efficiency make them undoubtedly superior. **25/-**

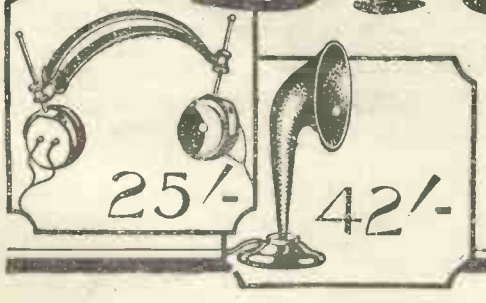


The *Table-Talker* is a Brandes' quality product at a moderate price. The non-resonant specially constructed horn is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. This means beautiful sound-balance and remarkable tone qualities. It is twenty-one inches high and has a self-adjusting diaphragm and is finished a shade of neutral brown. **42/-**

British Manufacture (B.B.C. Stamped)

Brandes

Result of 16 Years Experience



The name to know in Radio

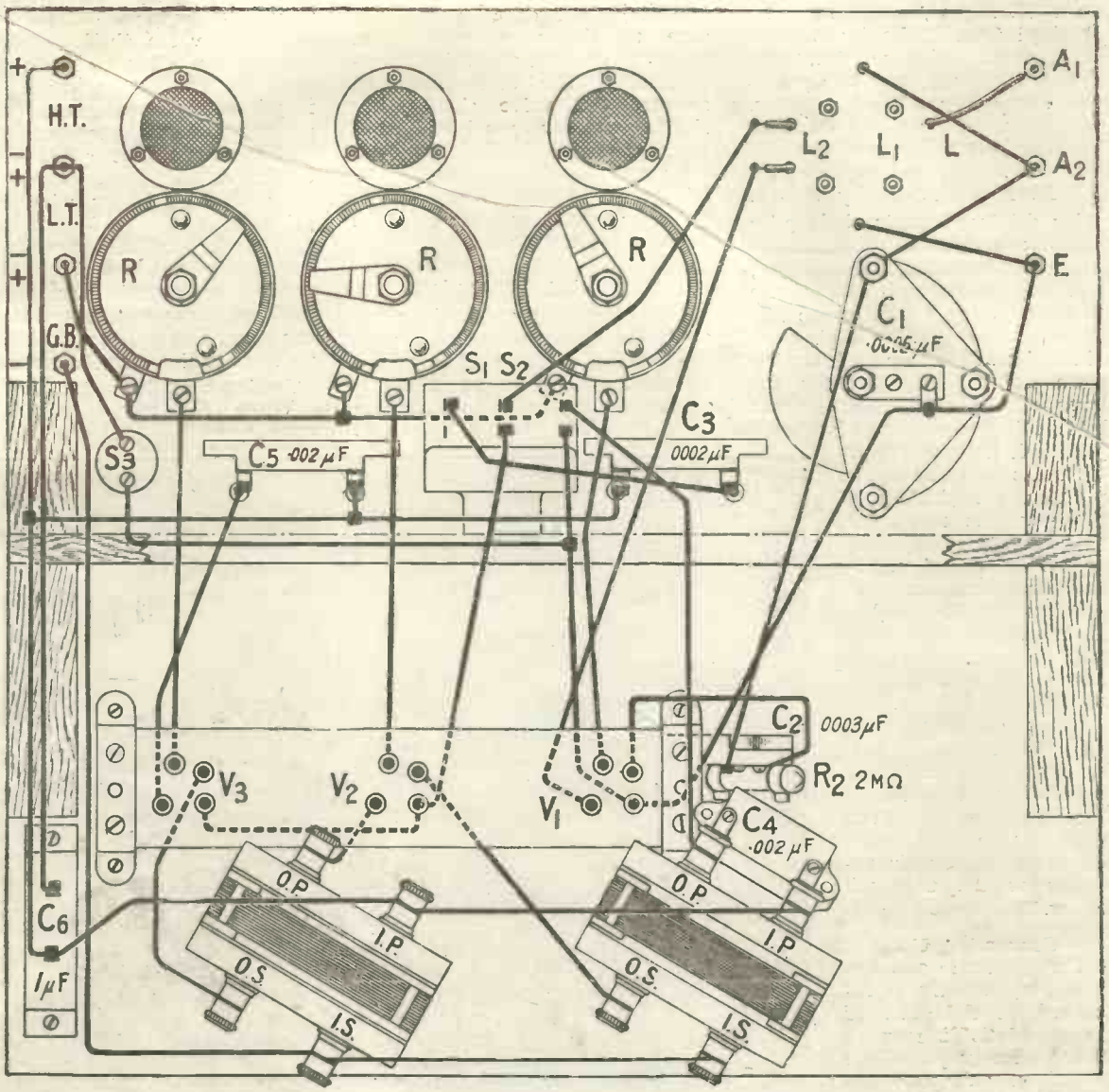


Fig. 7.—With the aid of this diagram wiring is a simple matter. Blueprint No. 77B.

S_1, S_2 (Wilkins and Wright "Utility").

2 L.F. transformers, T_1 T_2 T_3 T_4 (U.S. Radio "Super").

1 grid condenser C_2, (0·0003μF) and gridleak R_2, 2 megohms (Dubilier).

3 fixed condensers, C_3, C_4, C_5, each 0·002μF (Dubilier).

NOTE.—With some loud-speakers it may be found desirable to increase the capacity of the condenser C_5, say, to 0·004μF.

3 valve holders (*i.e.* 12 sockets).

1 strip of ebonite, 1½ in. by 7¾ in. by ¼ in. thick, and two mecano strips (13 holes) to make the valve shelf shown in Fig. 7.

1 fixed condenser, C_6, capacity 1μF. (T.C.C.)

11 terminals.

Tinned copper wire, 16 S.W.G., for internal connections.

1 mahogany cabinet. (Baker and Russell.)

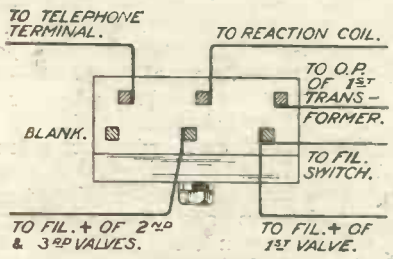


Fig. 8.—The double-pole switch connections.

Inductance Coils.

1 25 or 35 turn coil, L.
1 50 or 75 turn coil, L_1.
1 35 turn coil, L_2.

3 valves, bright or dull emitters. Any of the well-known makes of valves may be used, but it should be noted that the detector valve should be a hard valve, suitable for operating with a high-tension voltage of from 60 to 100 volts.

1 high-tension battery, 60 to 100 volts.

1 six-volt accumulator (for bright emitter valves), or dry battery to suit the particular type of dull-emitter valves used.

Grid battery suitable for anode voltages of 80 volts and over (a 4½ volt dry battery with accessible inter-cell connections).

Preparing the Panel

The ebonite panel should be carefully marked out in accordance with the drilling plan, Fig. 6.

or direct from the full-sized blue print (No. 77A), which may be obtained from Radio Press Sales Department, price 1s. 6d., post free. There are only two points which may prove difficult, namely, the cutting of the 1-inch diameter holes for the valve windows and filament switch and the slot for the lever of the Utility switch.

By drilling a centre hole 3/16 inch or ¼-inch in diameter in the centre of each 1-inch circle, and the subsequent careful use of an ordinary 1-inch centre bit *on both sides of the panel*, discs of ebonite will be removed, leaving clean holes. The slot for the lever of the switch can be cut by drilling a series of 3/16-inch holes and filing, or by the use of a fretsaw.

When the drilling of the panel is completed, all terminals, valve windows, filament rheostats, variable condenser and switches may be fitted in place and the panel itself may be secured to the false bottom of the cabinet, as shown in Fig. 10.

Now construct the valve shelf and place it in position according to the measurements given in Fig. 10, but at this stage do not fit the transformers, reservoir condenser or the three-coil holder.

Connecting Up

The general arrangement of all the components at the back of the panel is illustrated in the photographs, Figs. 2 and 5, and although it may look as if the wiring would prove very complicated, it is not so in reality, and all that is required is a little patience and care in the use of the soldering iron.

Deal with the filament lighting circuit first. Solder one end of a length of the 16 gauge tinned wire to the L.T. negative terminal, secure it beneath the screw on the third rheostat (adjacent to the battery terminals) and pass on to the corresponding screw on the second rheostat. A shorter piece of wire can then be secured beneath the screw of the first rheostat and then soldered to the first wire.

Connecting the Valve Panel

Next make loops in the ends of two pieces of wire, and secure one to the first and the other to the third rheostat, and solder the remaining end of each piece of wire to the negative filament socket of the first and third valve-holders. The stiff wire will support the valve shelf fairly rigidly, and the panel and shelf together may be entirely removed from the wooden baseboard and laid face downward upon the table or bench to facilitate the work of connecting up.

Remaining Connections

The remaining connections are to be made in accordance with the wiring diagram (Fig. 7), a full-sized blue print of which is available. In order to overcome any difficulty which may be experienced in connecting up the double-pole change-over switch, a separate drawing of the back of this switch, showing projecting "tabs" and indicating the destination of each wire, is given in Fig. 8.

So far, of course, the two transformers and reservoir condensers are not in position. A piece of the copper wire, about 8 inches in length, is to be soldered to the grid socket of the second and third valve, and to the anode socket of the first and second valve, and left projecting for subsequent connection to the L.F. transformers after the completely wired panel with variable condenser attached, valve shelf and transformers are all secured in place upon the wooden baseboard. The remaining transformer connections and the connections to the reservoir condenser do not present any difficulty.

The grid condenser, with clip-in gridleak, is soldered direct to the grid socket of the first valve, but if this method is found inconvenient, a length of wire may be soldered to the grid socket, and the condenser and leak may be brought up close to the variable condenser.

Testing and Operating the Set

When the set is wired up complete, make a preliminary test as follows:

Connect the six-volt accumulator to the correct terminal, place the filament switch in the "off" position and insert three valves. Place the lever of the change-over switch to the right, turn all three filament rheostats back to zero, move the filament switch to the "on" position and light the filament of each valve in turn by means of its own rheostat. With all three valves alight, move the change-over switch to the left, which should extinguish the two amplifying valves. Moving the filament

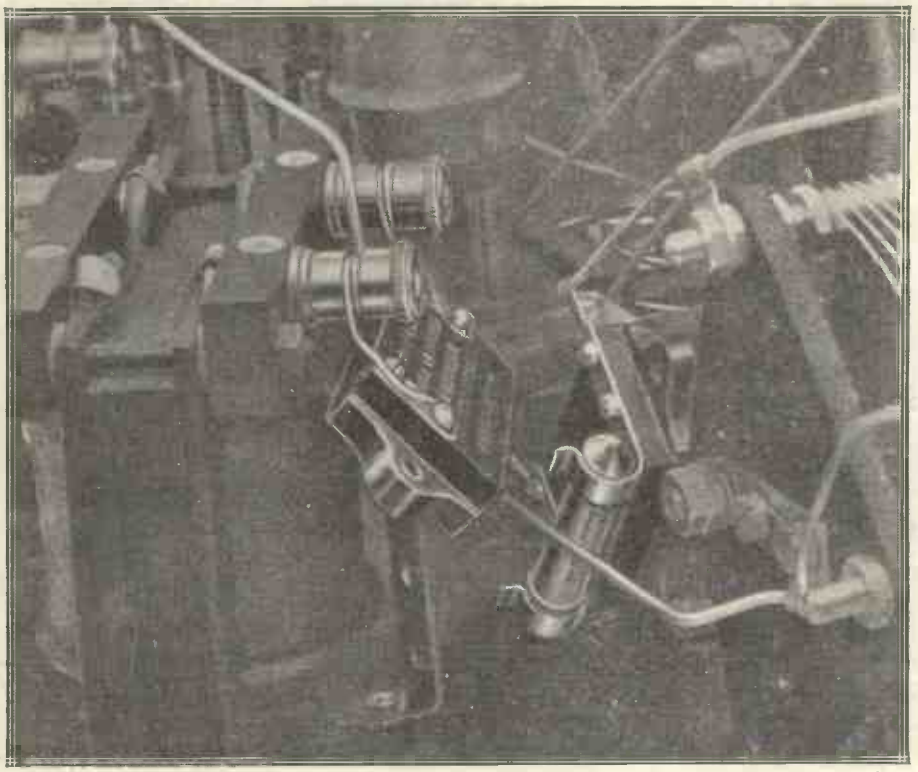


Fig. 9.—This photograph shows how the grid condenser is supported.

LISSENIUM

TYPES OF MAGNETIC CONCENTRATION——

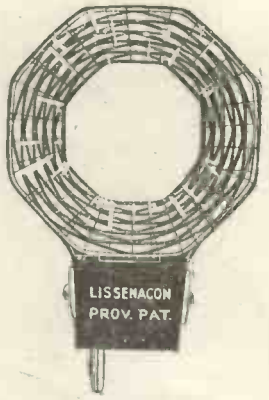
With many types of coils the magnetic field is mostly concentrated in the centre of the coil, and the field does not extend to any appreciable degree. The characteristics of the magnetic field in such coils is closely analogous to the ordinary solenoid inductance.

In the case of LISSENAGON (pronounced LISSEN-AGON) coils, however, the magnetic field, in addition to being very strong in the centre of the coil, is also distributed on each side of the coil. This accounts for the remarkably strong magnetic linkage obtained with LISSENAGON coils in reaction circuits, and ALSO FOR THE PECULIAR EFFICIENCY OF THE COILS WITH EDDY CURRENT TUNING.

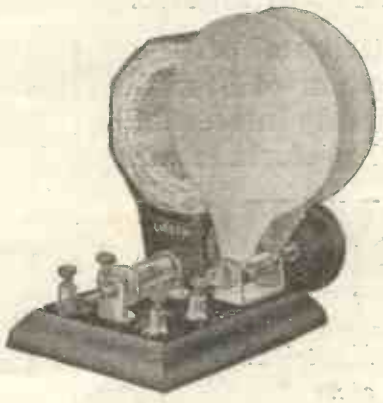
LISSENAGON TUNING CHART.

Note the Intermediate coils, 30, 40 and 60.

TABLE I. Wavelength range when used as Primary Coils with Standard P.M.G. Aerial and ·001 mfd. condenser in parallel.			TABLE II. Wavelength range when used as Secondary Coils with ·001 mfd. condenser in parallel.		
No. of Coil.	Minimum Wave-length.	Maximum Wave-length.	Minimum Wave-length.	Maximum Wave-length.	PRICE.
25	185	350	100	325	4/10
30	**235**	**440**	**130**	**425**	4/10
35	285	530	160	490	4/10
40	**360**	**675**	**200**	**635**	4/10
50	480	850	250	800	5/–
60	**500**	**950**	**295**	**900**	5/4
75	600	1,300	360	1,100	5/4
100	820	1,700	500	1,550	6/6
150	965	2,300	700	2,150	7/7
200	1,885	3,200	925	3,000	8/5
250	2,300	3,800	1,100	3,600	8/9
300	2,500	4,600	1,400	4,300	9/2



IF YOU EVER WANT COILS WHICH INTENSIFY TUNING — USE LISSENAGON COILS



SIGNALS ARE ALWAYS STRONGER —

when capacity is low and inductance is high. If, where, say, a No. 35 coil is ordinarily used with added capacity to tune it to a given wavelength, a No. 60 coil can be used, AND WITHOUT ADDED CAPACITY, other things being equal, it follows that signals would be stronger.

In the new LISSEN CRYSTAL SET a form of tuning has been introduced which permits of a No. 60 LISSENAGON (pronounced LISSEN-AGON) coil being used, and dispenses with the need of added capacity to tune it. A big signal voltage is built up. But apart from its high inductance efficiency, too, there are other considerations which place this receiver far above all other crystal sets, NO MATTER WHAT THE PRICE.

THERE IS AN UNDISTURBED ELECTRICAL CIRCUIT, for instance. The only moving part is the metal plate, and although this is entirely unconnected with the electrical circuit, its influence on the inductance is effectively applied through the medium of the magnetic field created.

In conjunction with the principle of EDDY CURRENT TUNING employed in this new LISSEN CRYSTAL SET, LISSENAGON COILS ARE PECULIARLY EFFICIENT. No other coils give the same results.

By fitting the appropriate LISSENAGON (pronounced LISSEN-AGON) coil, the LISSEN CRYSTAL SET can be used for any station within range. Two coils would be needed for London and Chelmsford, for instance—to change over from one station to the other, take one LISSENAGON coil out, and plug the other one in.

On long aerials it would be possible to use a coil one size less in each case e.g., No. 40 instead of 50 ; 50 instead of 60 ; 60 instead of 75 ; 200 instead of 250.

NOTE.—One LISSENAGON coil must be ordered with each set—the receiver will not be sold without a LISSENAGON coil because the use of these coils ensures very high efficiency.

Price of receiver (includes crystal), patent pending ..	10/-
No. 50 LISSENAGON coil (covers 300 to 850 metres on this receiver)	5/-
No. 60 LISSENAGON coil (covers 350 to 400 metres on this receiver)	5/4
No. 75 LISSENAGON coil (covers 400 to 500 metres on this receiver)	5/4
No. 250 LISSENAGON coil for Chelmsford	8/9

No paper—no cardboard—no loose contacts—no loose wires—connections are stamped-out strips—the whole receiver is an instrument throughout—robust—and THE MOST EFFICIENT CRYSTAL SET MADE—WITH THE MOST EFFICIENT INDUCTANCE.

LISSEN LIMITED,

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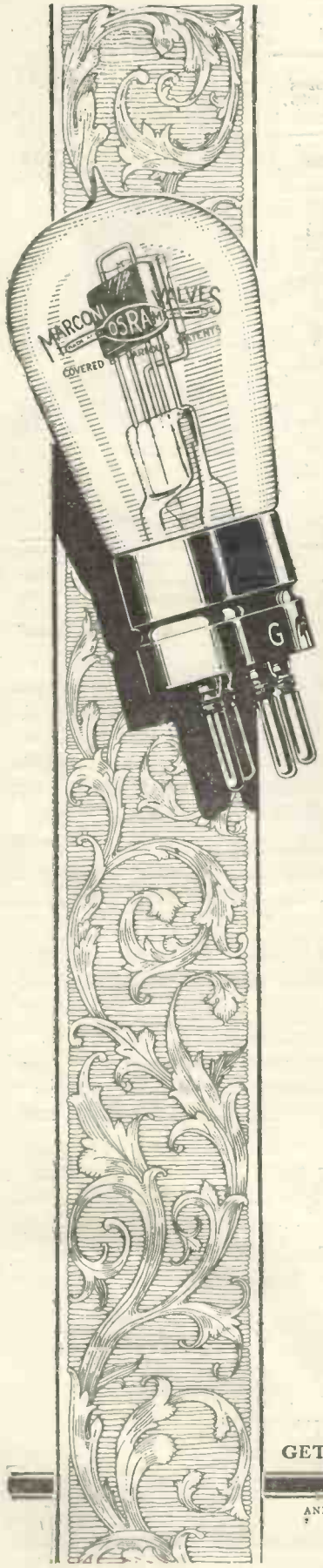

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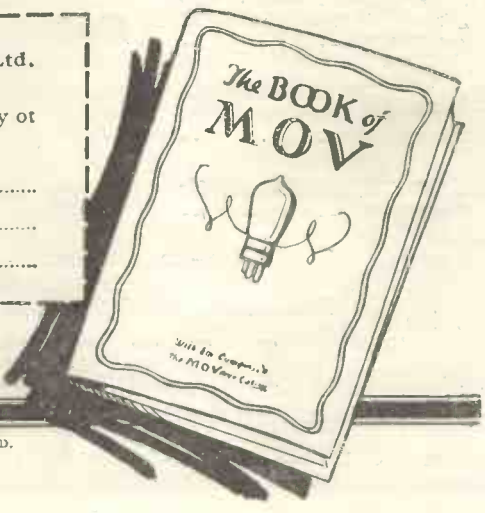

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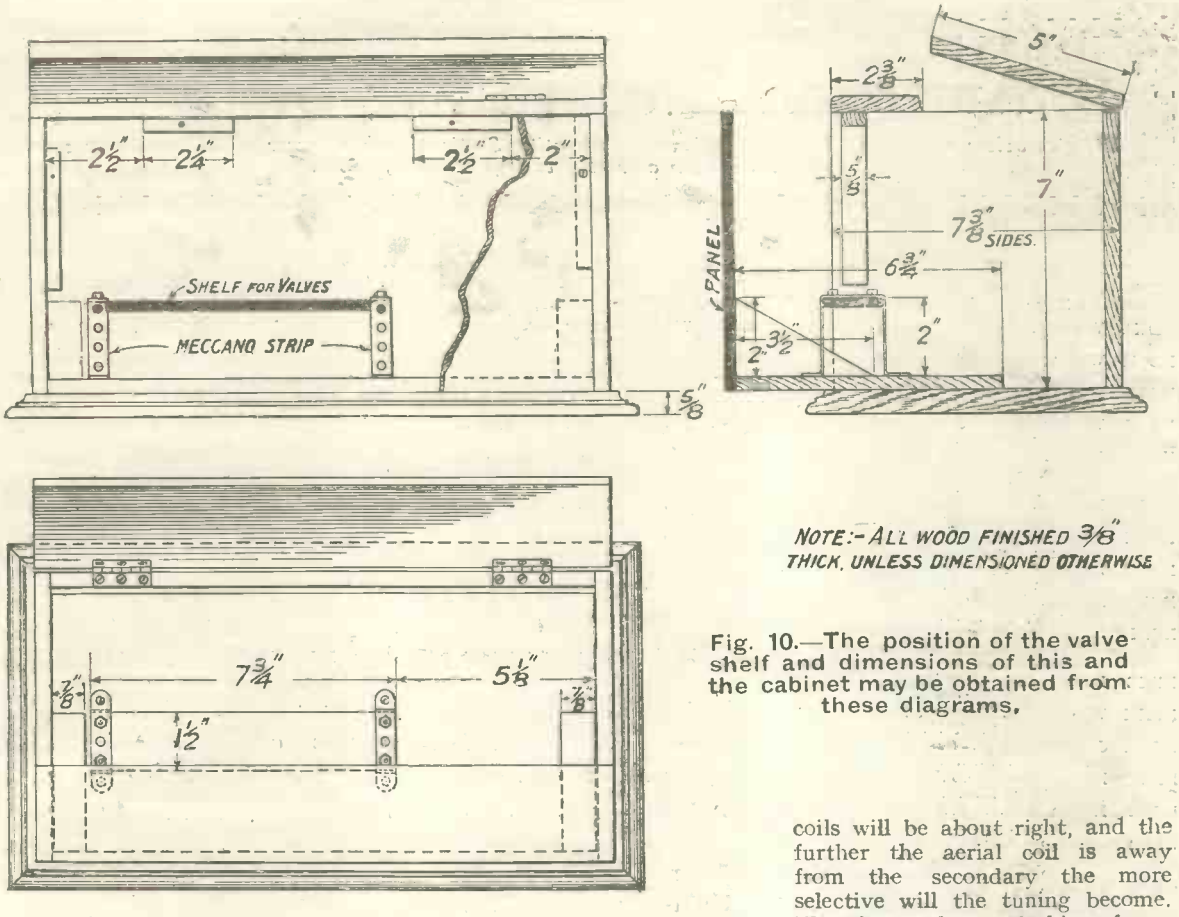


Fig. 10.—The position of the valve shelf and dimensions of this and the cabinet may be obtained from these diagrams.

switch to the "off" position should extinguish one or all valves.

Coils to Use

If this preliminary test is satisfactory, connect up telephones, loud-speaker and high-tension battery. Also connect the earth lead to terminal E and, to commence, the aerial lead to terminal A_2. This, it will no doubt be remembered, gives a direct coupled single circuit receiver. Two coils only are required, a No. 35 or a No. 50 turn coil in the fixed holder and a No. 50 (or possibly a No. 75) coil in the reaction coil-holder.

Switch over to "one-valve-and-telephones" and, keeping the reaction coil well away from the aerial coil, search for signals by slowly rotating the variable condenser.

Reaction Effects

When signals are received, moving the reaction coil nearer to the aerial coil should strengthen signals considerably, but care must be taken not to make the coupling between the coils too tight or distortion of the speech, music, etc., will occur, whilst still further tightening of the coupling, i.e., increase of reaction effect, will cause the set to generate oscillations, and not only prevent satisfactory reception, but most certainly cause considerable interference with other receiving sets in the vicinity. If the proper reaction effect is not obtained at the first attempt, reverse the leads on the coil-holder.

The change-over from direct to inductively-coupled tuning is effected by transferring the aerial lead from terminal A_2 to terminal A_1, inserting a No. 25 coil in the left-hand movable holder, a No. 50 or 75 turn coil in the fixed holder and a 35 turn coil in the reaction or right-hand holder.

It will now be found that tuning with the variable condenser is very much sharper, the reaction effect is easier, and, provided that the correct coupling between the aerial and secondary coil is obtained, signals from the local broadcasting station will be at least as strong as with the previous arrangement.

The Coupling

Generally an angle of about 25 to 30 degrees between the coils will be about right, and the further the aerial coil is away from the secondary the more selective will the tuning become. Therefore, when searching for a more distant station, commence by having the aerial coil fairly close to the secondary coil and bring up the reaction coil to the safe limit. If the aerial coil is now moved further away from the secondary coil, the set may break into oscillation and it may be found necessary to reduce the reaction coupling.

Test Report

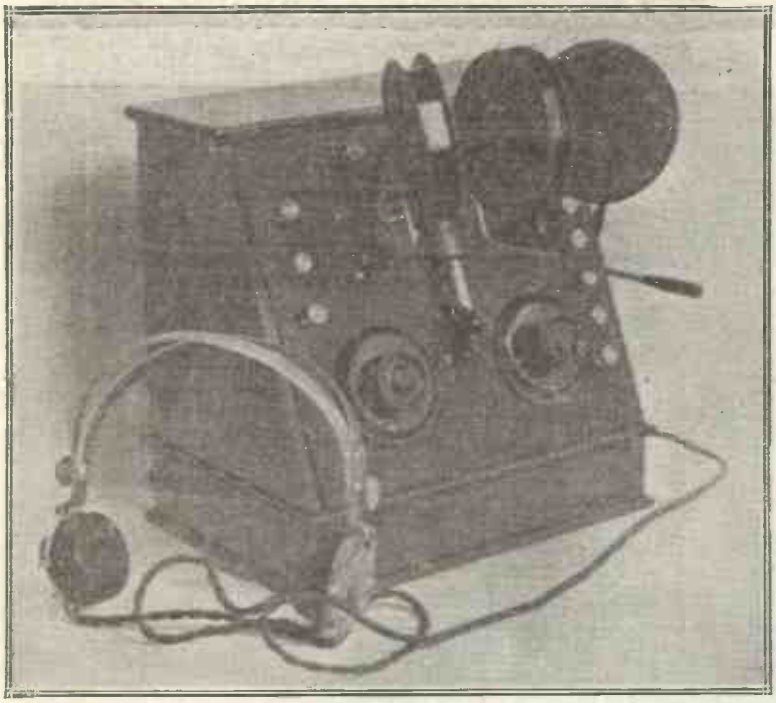
Within a few hours of experimenting with the set, very loud signals from the local station, 15 miles distant, were obtained; reasonably loud music, etc., from Newcastle, Glasgow, and Birmingham, and moderate loud-speaker signals only from Cardiff and Aberdeen.

All these of course were audible in the telephone receivers, using only one valve. Unless they are, it is of little avail to add low-frequency amplifying valves and the loud-speaker. The experiences of readers who construct the set, particularly with regard to the slight departure from the ordinary in the tuning arrangement, will be received with interest by the writer.

American Broadcasting Stations

We give below a complete list of American Broadcasting Stations with a power of 250 watts or over, which has been corrected to September 2, 1924.

Call Letters	Name	Location	Power and Wave Length
KDKA	Westinghouse Electric & Mfg. Co.,	East Pittsburgh, Pa.	1000—326
KDPM	Westinghouse Electric & Mfg. Co.,	Cleveland, Ohio	500—270
KFAE	State College of Washington,	Pullman, Wash.	500—330
KFAF	Western Radio Corporation,	Denver, Colo.	500—278
KFCL	Leslie E. Rice,	Los Angeles Union Stock Yards, Los Angeles, Calif.	500—236
KFGH	Leland Stanford University (P. O.),	Stanford Univ., Calif.	273—360
KFGX	First Presbyterian Church,	Orange, Texas	500—250
KFGZ	Emmanuel Missionary College,	Berrien Springs, Mich.	500—286
KFI	Earle C. Anthony, Inc.,	Los Angeles, Calif.	500—469
KFIX	Reorganised Church of Jesus Christ of Latter Day Saints,	Independence, Mo.	250—240
KFKB	Brinkley-Jones Hospital Association,	Milford, Kan.	500—286
KFKX	Westinghouse Electric & Mfg. Co.,	Hastings, Neb.	1000—286
KFMX	Carleton College,	Northfield, Minn.	500—283
KFNF	Henry Field Seed Co.,	Shenandoah, Iowa	500—266
KFOA	Rhodes Dept. Store,	Seattle, Wash.	500—455
KFPO	Colorado National Guard, Forty-fifth Division Tank Co.,	Denver, Colo.	500—231
KFPR	Los Angeles County Forestry Department,	Los Angeles, Cal.	500—231
KFPT	Cape & Johnson,	Salt Lake City, Utah	500—263
KFQX	Alfred M. Hubbard,	Seattle, Wash.	250—233
KFQZ	Taft Radio Co.,	Hollywood, Calif.	250—240
KFSG	Echo Park Evangelistic Association,	Los Angeles, Calif.	500—278
KGO	General Electric Co.,	Oakland, Calif.	1000—312
KGU	Marion A. Mulrony,	Honolulu, Hawaii	500—360
KGW	Portland Morning Oregonian,	Portland, Ore.	500—492
KHJ	Times Mirror Co.,	Los Angeles, Calif.	500—395
KJS	Bible Institute of Los Angeles,	Los Angeles, Calif.	750—360
KLS	Warner Bros. Radio Supplies Co.,	Oakland, Calif.	250—360
KLX	Tribune Publishing Co.,	Oakland, Calif.	250—509
KLZ	Reynolds Radio Co.,	Denver, Colo.	500—283
KOB	New Mexico College of Agriculture and Mechanic Arts,	State College, N.M.	500—360
KOP	Detroit Police Dept.,	Detroit, Mich.	500—286
KPO	Hale Bros.,	San Francisco, Cal.	500—423
KQV	Doubleday Hill Electric Co.,	Pittsburgh, Pa.	500—270
KSD	Post Dispatch (Pulitzer Pub. Co.),	St. Louis, Mo.	500—546
KTW	First Presbyterian Church,	Seattle, Wash.	750—360
KWH	Los Angeles Examiner,	Los Angeles, Calif.	250—360
KYW	Westinghouse Electric & Mfg. Co.,	Chicago, Ill.	1000—536
WAAC	Tulane University,	New Orleans, La.	400—360
WAAM	I. R. Nelson Co.,	Newark, N.J.	250—263
WAAW	Omaha Grain Exchange,	Omaha, Neb.	500—286
WABN	Ott Radio, Inc.,	LaCrosse, Wis.	500—244
WABX	Henry B. Joy,	Mount Clemens, Mich. (near)	500—270
WBAA	Purdue University,	West Lafayette, Ind.	250—283
WBAP	Wortham-Carter Publishing Co. (Star-Telegram),	Fort Worth, Texas	750—476
WBAV	Erner & Hopkins Co.,	Columbus, Ohio	500—423
WBAY	The Western Electric Co.,	N.Y.	500—492
WBBG	Irving Vermilya,	Mattapoisett, Mass.	500—248
WBBR	Peoples Pulpit Association,	Rossville, N.Y.	500—273
WBT	Southern Radio Corp.,	Charlotte, N.C.	250—360
WBZ	Westinghouse Electric & Mfg. Co.,	Springfield, Mass.	1000—337
WCAD	St. Lawrence University,	Canton, N.Y.	250—280
WCAE	Kaufman & Baer Co.,	Pittsburgh, Pa.	500—462
WCAJ	Nebraska Wesleyan University,	University Place, Neb.	500—283
WCAL	St. Olaf College,	Northfield, Minn.	500—360
WCAP	Chesapeake & Potomac Telephone Co.,	Washington, D.C.	500—469
WCAU	Durham & Co.,	Philadelphia, Pa.	250—286
WCAY	Milwaukee Civic Broadcasting Station,	Milwaukee, Wis., Hotel Antlers	250—266
WCBD	Wilbur G. Voliva,	Zion, Ill.	500—345
WCBK	E. Richard Hall,	St. Petersburg, Fla.	500—266
WCBT	Clark University,	Worcester, Mass.	250—238
WCX	The Detroit Free Press,	Detroit, Mich.	500—517
WDAE	Tampa Daily Times,	Tampa, Fla.	250—360
WDAF	Kansas City Star,	Kansas City, Mo.	500—411
WDAR	Lit Bros.,	Philadelphia, Pa.	500—395
WDBY	North Shore Congregational Church,	Chicago, Ill.	500—258
WEAF	American Telephone & Telegraph Co.,	New York N.Y.	1000—492
WEAI	Cornell University,	Ithaca, N.Y.	500—286
WEAO	The Ohio State University	Columbus, Ohio	500—360
WEAY	Will Horwitz, Jr.,	Houston, Texas	500—360
WEBH	Edgewater Beach Hotel Co.,	Chicago, Ill.	1000—370
WEBJ	Third Ave. Ry. Co.,	New York, N.Y.	500—273
WFAA	The Dallas News, The Dallas Journal,	Dallas, Texas	500—476
WFAV	University of Nebraska, Dept. E. E.,	Lincoln, Neb.	250—275
WFBH	Concourse Radio Corp.,	New York, N.Y.	500—273
WFI	Strawbridge & Clothier,	Philadelphia, Pa.	500—395
WGAZ	The South Bend Tribune,	South Bend, Ind.	250—360
WGL	Thomas F. J. Howlette,	Philadelphia, Pa.	500—360
WGN	Drake Hotel-Whitestone Co.,	Chicago, Ill.	1000—370
WGR	Federal Telephone Mfg. Co.,	Buffalo, N.Y.	750—319
WGY	General Electric Co.,	Schenectady, N.Y.	1000—380
WHAS	Courier-Journal and Louisville Times,	Louisville, Ky.	500—400
WHAZ	Rensselaer Polytechnic Institute,	Troy, N.Y.	500—380
WHB	Sweeney School Co.,	Kansas City, Mo.	500—411
WHN	George Schubel, Loew's State Theatre Bldg.,	New York, N.Y.	500—360
WHO	Bankers Life Co.,	Des Moines, Iowa	500—526
WIAK	Journal-Stockman Co.,	Omaha, Neb.	250—278
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WJAG	The Norfolk Daily News,	Norfolk, Neb.	250—283
WJAR	The Outlet Co. (J. Samuels & Bro.),	Providence, R.I.	500—360
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Pa.	250—286
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJJD	Mooseheart,	Mooseheart, Ill.	500—278
WJY	R. C. A.,	New York, N.Y.	750—405
WJZ	R. C. A.,	New York, N.Y.	500—455
WKAR	Michigan Agriculture College,	East Lansing, Mich	500—280
WKBF	Dutee W. Flint,	Cranston, R.I.	500—286
WLBL	Wisconsin Department of Markets,	Stevens Point, Wis.	500—278
WLS	Sears, Roebuck & Co.,	Chicago, Ill.	500—345
WLW	Crosley Radio Corp.,	Cincinnati, Ohio	500—423
WMAF	Round Hills Radio Corp.,	Dartmouth, Mass.	100—500—360
WMAK	Lockport Board of Commerce,	Lockport, N.Y.	500—273
WMAQ	Chicago Daily News,	Chicago, Ill.	500—448
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	500—250
WMC	Commercial Memphis,	Tenn.	500—500
WMH	Ainsworth-Gates Radio Co.,	Cincinnati, Ohio	750—309
WNYC	City of New York,	New York, N.Y.	1000—526
WOAI	Southern Equipment Co.,	San Antonio, Texas	500—385
WOAW	Woodmen of the World,	Omaha, Neb.	500—526
WOAX	Franklyn J. Wolff (Monument Pottery Co.),	Trenton, N.J.	500—240
WOC	The Palmer School of Chiropraetice,	Davenport, Iowa	500—484
WOI	Iowa State College,	Ames, Iowa	500—360
WOO	John Wanamaker,	Phila., Pa.	500—509
WOQ	Western Radio Co.,	Kansas City, Mo.	500—360
WOR	L. Bamberger & Co.,	Newark, N.J.	500—405
WOS	Missouri State Marketing Bureau,	Jefferson City, Mo.	500—441
WPAB	Pennsylvania State College,	State College, Pa.	500—283
WQAA	Horace A. Beale, Jr.,	Parkesburg, Pa.	500—360
WQJ	Calumet Rainbo Broadcasting Co.,	Chicago, Ill.	500—448
WRBC	Immanuel Lutheran Church,	Valparaiso, Ind.	500—278
WRC	Radio Corp. of America,	Washington, D.C.	500—469
WRL	Union College,	Schenectady, N.Y.	500—360
WRM	University of Illinois,	Urbana, Ill.	500—360
WRW	Tarrytown Radio Research Laboratory (Koenig Bros.),	Tarrytown, N.Y.	500—273
WSAC	Clemson Agricultural College,	Clemson College, S.C.	500—360
WSAI	United States Playing Cards Co.,	Cincinnati, Ohio	500—309
WSAJ	Grove City College,	Grove City, Pa.	250—360
WSAP	Seventh Day Adventist Church,	New York N.Y.	250—263
WSB	Atlanta Journal,	Atlanta, Ga.	500—429
WSY	Alabama Power Co.,	Birmingham, Ala.	500—360
WTAM	Willard Storage Battery Co.,	Cleveland, Ohio	1000—390
WTAS	Charles E. Erbstein,	Elgin, Ill. (near)	500—286
WTAW	Agricultural & Mechanical College,	College Station, Texas	250—280
WTAY	Oak Leaves Broadcasting Station,	Oak Park, Ill.	500—283
WWI	Ford Motor Co.,	Dearborn, Mich.	250—273
WWJ	Detroit News (Evening News),	Detroit, Mich.	500—517



The complete receiver is of very handsome appearance.

A Long-Distance Single-Valve Receiver

BY

JOHN W. BARBER.

THOSE readers who habitually use two or more valves in their receivers, and who have not given much thought to the modest one-valve set, will have missed a great deal of interesting work, and also, incidentally, a lot of valuable instruction. A single valve receiver, on a reasonably efficient aerial, will give results which are, in frequent cases, envied by users of two or more valves, the reason being that an experimenter who really means to get the best out of his one-valver gets right down to it, and traces out all possible causes of inefficiency in his apparatus, while his fellow worker may be content to add another valve. Many examples of excellent long-distance reception are known in cases where one-valve sets are in use, and when the experimenter is desirous of getting the utmost out of every valve he uses, he will do well to study thoroughly the possibilities of the single-valve set first before proceeding further.

The Circuit

The present receiver is modelled on the lines of a modification of the well-known Flewelling circuit, and has given excellent results in at least three cases well known to the writer. This modification of the circuit is very easy to handle, and as a loosely coupled aerial circuit is employed the circuit is exceedingly selective. A beginner even, therefore, may have no qualms about making up this set, as he will find both the construction and operation quite simple, and he will gain much valuable knowledge which will be of great benefit to him when he decides to "graduate" to more valves.

General Considerations

Owing to the proximity of my station to 2LO, I am, naturally, troubled by interference from that station, and hence have to use selective circuits in order to hear any other transmissions. The set in question was used first of all at a friend's station further away from the local station, a direct-coupled aerial circuit being employed. Severe interference was experienced, however, as was expected, and it was therefore decided to incorporate a loosely coupled aerial circuit in the present receiver, in order to help others who are in a similar position. At close range it is always difficult to eliminate the local station, in the fullest sense of the word, and as telephony occupies a wave-band on either side of the true wavelength, there will always be a difficulty in getting rid of one station and receiving another whose wavelength is only slightly different from that of the interfering station. In the present receiver, however, 2LO can be so reduced in strength as to be practically inaudible, while the other British stations, with the exception of Cardiff and Manchester, whose wavelengths are too close to that of 2LO, may be brought in without any unpleasant undercurrent of talk and so on from London.

It is realised, however, that a loosely coupled aerial circuit may prove awkward to use, at first, if the user has had no previous experience of such a method of coupling, and two terminals have therefore been included A_2 and E_2,

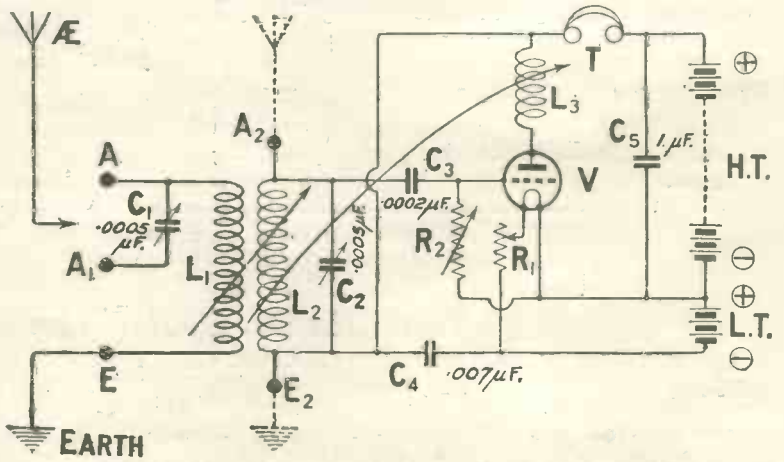
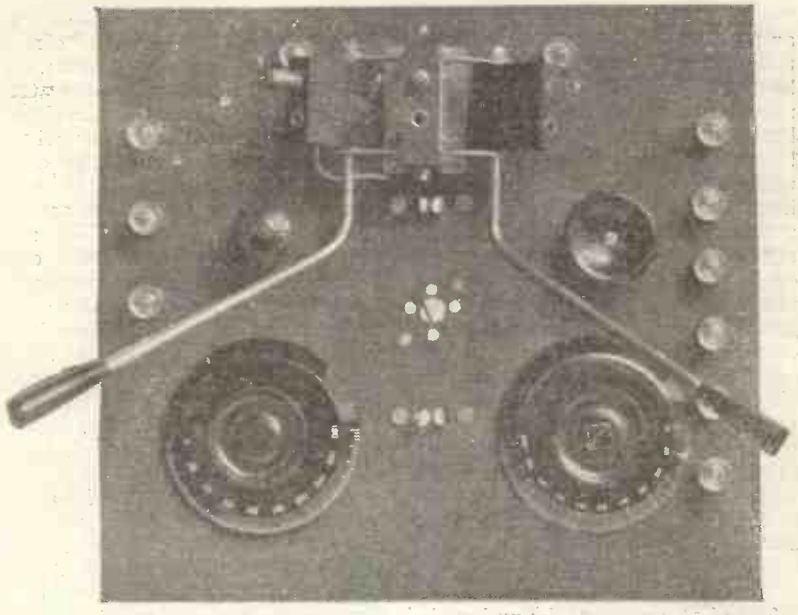


Fig. 1.—The circuit arrangement of the receiver.

A loosely coupled Receiver which employs a modification of the well-known Flewelling circuit.



A plan photograph of the panel. Note that Myers or four-pin valves may be used.

by means of which the direct type of aerial coupling may be employed. The user is thus able to use the simpler coupling if he is not much troubled by interference, and it may prove useful when first operating the receiver. Some slight loss may be experienced when using the loose coupling, but this is compensated for by the added selectivity obtained. When skill has been attained, there will not be much to choose between the two forms of coupling, and to my mind the loose coupled aerial circuit wins every time.

Some readers may feel a little dubious about attempting this receiver, on account of the circuit having been dubbed a "super," but let me at once dispel any fears on this account. This set is no more difficult to handle than a "straight" single valve circuit, and, as far as I have been able to ascertain, causes no interference by oscillation to other listeners, provided that the coil L_3 is kept at a reasonable distance from L_2, the secondary circuit inductance.

Grid Leak

A variable grid leak seems absolutely essential in this receiver, and I have therefore included one which is very satisfactory and quiet in action. The condenser C_4 is not at all critical, any value from around ·005 up to ·01 being quite suitable.

A Point regarding Valves

I am a great believer in low-capacity valves, and like to use them in all possible cases, so this receiver is provided with clips for Myers valves, as it is intended for use with this type of valve. There is also included a low-capacity mounting for an ordinary four-pin valve in order that either type may be used at will. Should readers desire, they may omit the holder for the type of valve they do not intend to employ. The double socket arrangement is very useful, however, as it permits four-pin valves to be compared with the low-capacity type. For those who so desire, clips for the V24 or QX valve may be substituted for the Myers clips.

Components required

For the benefit of those who like to know just what parts are used in a set, the names of the manufacturers are given, but it must be understood that there is no obligation for the parts used to be of the make specified, it merely being necessary to be sure that good quality material is employed. As regards values, those given should be adhered to, as I have tried different capacities and so on, and have decided upon those marked. As I said previously, C_4 is not critical, and constructors may use just what capacity condensers they may have at hand.

- 1 ebonite panel, 10 in. by 9 in. by ¼ in. (Paragon).
- 1 3-way coil holder (Magnum, Burne Jones and Co.).
- 1 ·0005 μF square law condenser (Bowyer-Lowe).
- 1 ·0005 μF square law condenser (Jackson Bros.).
- 1 .0002 μF fixed condenser (Dubilier).
- 1 ·007 μF fixed condenser (McMichael).
- 1 set of clips for Myers valves.
- 1 valve holder (H.T.C. Type C).
- 1 1 μF condenser (T.C.C.).
- 1 filament resistance (Shipton).
- 1 variable grid leak (Bretwood).
- 11 nickel-plated terminals (Burne-Jones and Co.).

Square section wire for wiring up.

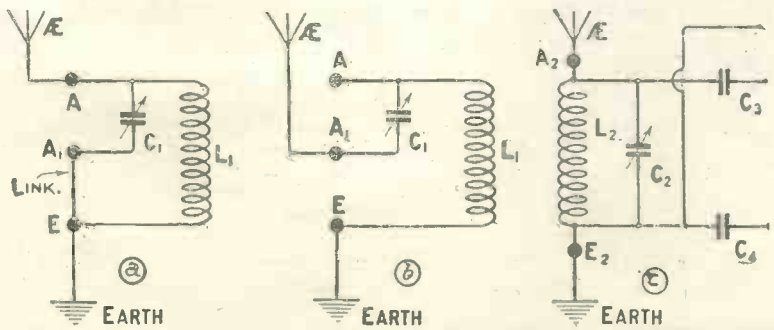


Fig. 2.—How the various aerial circuit arrangements are obtained.

The Panel

This is made from the ebonite appearing at the head of the above list, and is to be drilled in accordance with the figure showing the layout. Constructors should always satisfy themselves that the

ebonite they use is of good quality and free from surface leakage, the most satisfactory way being to buy only branded ebonite. Should unguaranteed material be used, however, the shiny surface should be removed by rubbing both sides with emery cloth after the holes have been drilled. The black appearance may be restored to the ebonite by means of a little oil on a piece of clean rag. Do not use too much, but make a little go a long way, and rub with a circular motion.

The holes for the terminals have all been tapped to the correct size (4 B.A.), but it is understood that some may not possess the necessary taps, in which case clearance holes may be drilled, and the terminals secured with nuts in the usual manner.

Wiring

The photographs of the underside of the panel will reveal the simplicity of the wiring, and the actual connections can be clearly seen in the wiring diagram. It must be pointed out here that Radio Press, Ltd., have developed a new system of showing wiring on practical diagrams. The older method consisted of showing "loops" where two wires crossed but were not joined. The new method, which saves much confusion once the idea is fully grasped, is simply that wires run from point to point, as in the actual receiver, joins being shown by a black square. Thus, if two wires cross but do not join, there is no loop, but there is no black square, so it will be perfectly clear which wires join and which do not.

While on the subject of wiring, I should like to draw readers' attention to the terminals I have used. The bottom of the shank is drilled out, to take the end of a piece of square section wire of the size usually referred to as No. 16, and thus the task of soldering a piece of this wire to a terminal shank, in the "end-on" fashion, is considerably simplified, all that is necessary being to insert the wire, touch with flux, and apply the iron in the usual manner.

Naturally, if the constructor desires he may use No. 16 tinned copper wire of round section, many people, in fact, preferring this to the square wire. In any case, follow the usual practice of spacing the wires as much as possible.

Valves

Almost any good general purpose valve will work well in this receiver, provided the makers' instructions regarding anode voltage and filament current are adhered to. I have incorporated a bright emitter rheostat in my receiver, but if dull emitter valves are to be used, a suitable type of rheostat should replace that used.

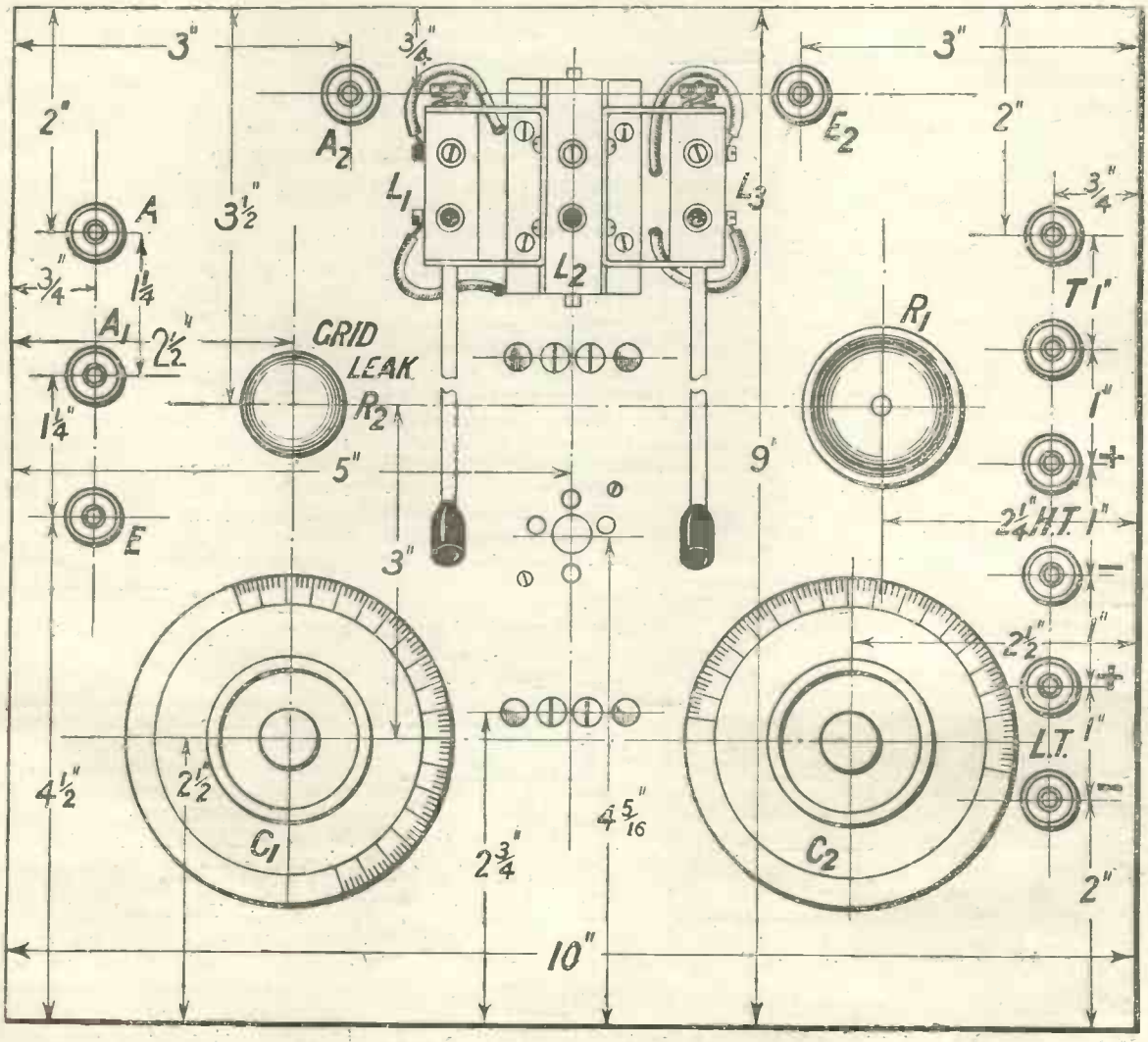
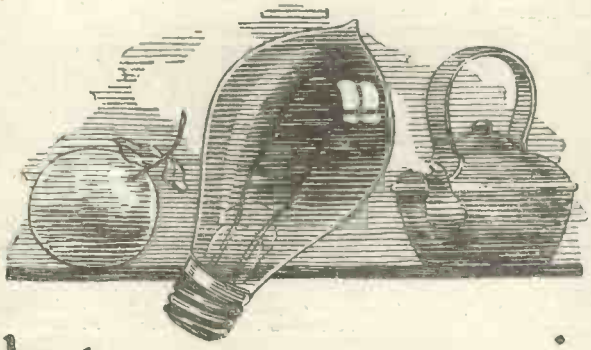


Fig. 3.—The panel layout. Blue Print No. 80A.



What one man saw in a blackened bulb

THE history of progress is tied up with trivialities. Newton made history under an apple tree; Watts saw it in a tea kettle. Modern "wireless" came from a blackened bulb. It was an ordinary carbon filament lamp. Everybody knew that it turned black as it grew older. One man wondered why—and made it his business to find out. What he found was the principle of the thermionic valve. Dr. Fleming was the man and his experimental valve was made in the Ediswan Laboratories.

That was 30 years ago. Since then many developments have taken place in the evolution of the valve. Ediswan Valves retain the lead they won in the early days of wireless. They are wholly reliable — experienced workers and careful testing see to that.

Ediswan Valves will bring the best out of your Wireless set—get some on the way home and enjoy a better programme from to-night onwards. All dealers sell them.

THE EDISON SWAN ELECTRIC CO. LTD
QUEEN VICTORIA ST., LONDON, E.C. 4

An interesting study of early wireless history may be made at the Science Museum, South Kensington, London, where the complete series of Dr. Fleming's experimental valves can be seen.

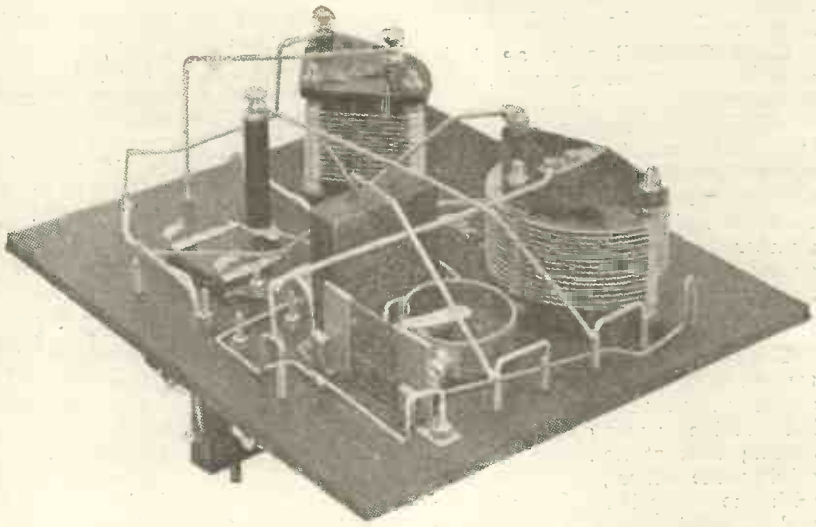
EDISWAN VALVES

162-12

Operating Details

To use loose coupling, the aerial is connected to terminal A for parallel aerial tuning condenser, the earth being joined to E, while A_1 and E are linked together. For series condenser the aerial is joined to A_1, earth to E, terminal A being left free. In both these cases the terminals A_2 and E_2, at the back of the receiver, are left free, as they relate only to the direct-coupled circuit. When it is desired, for reasons of simplicity, say, to use the direct-coupled circuit, the aerial and earth leads are joined to A_2 and E_2 respectively, the terminals A, A_1 and E being left free.

Tuning is carried out by simultaneous variation of the tuning condensers, the coil L_3 being kept fairly well away from L_2. The aerial coil L_1, for the most selective reception, should not be kept too close to the secondary coil L_2,



A view of the underside of the panel, showing how the wiring is carried out.

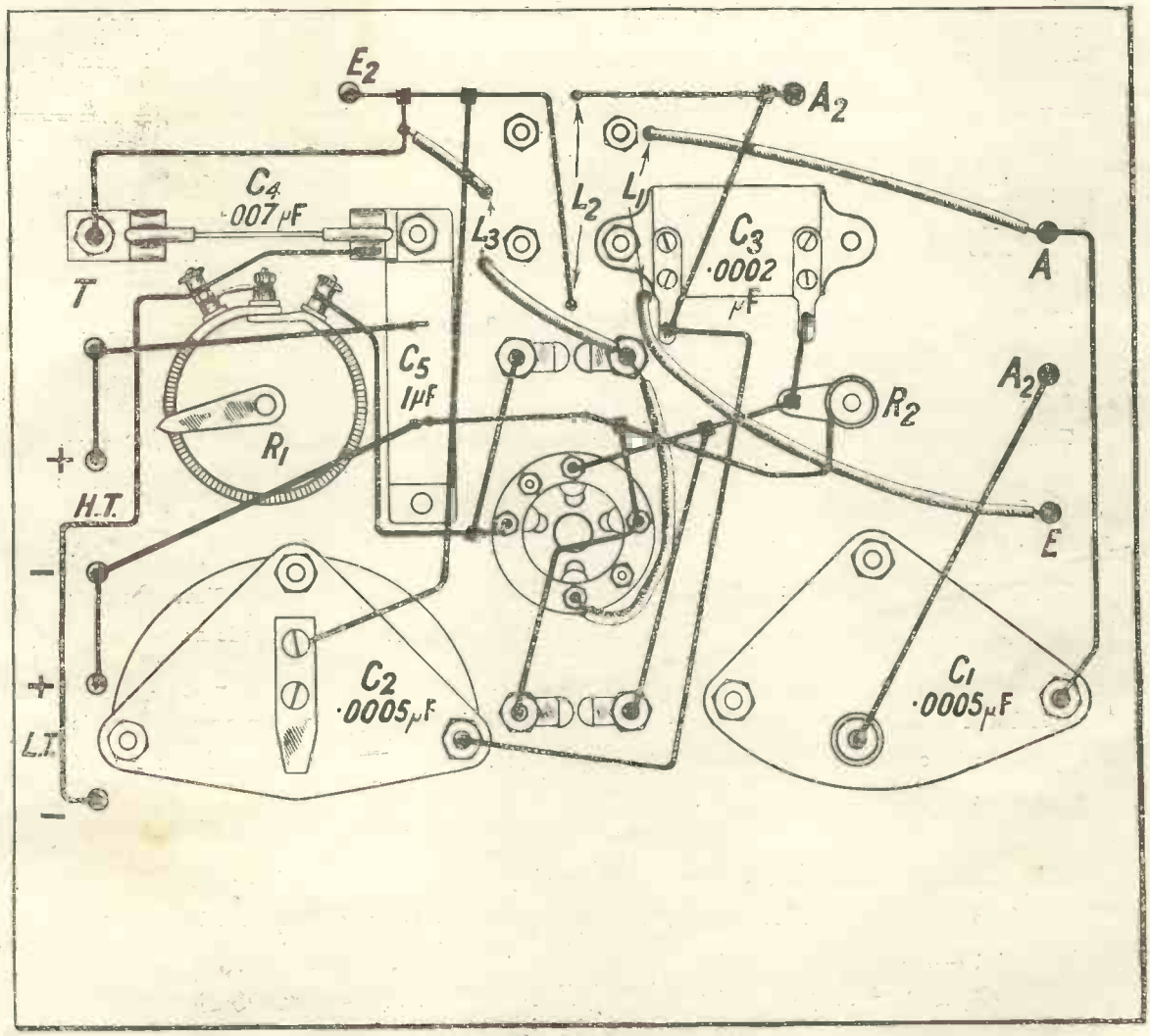


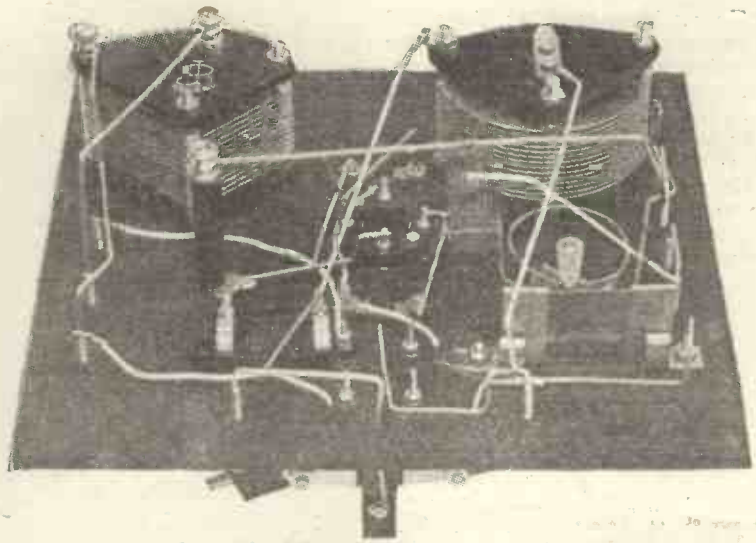
Fig. 4.—The wiring diagram. Note that where two wires join a black square is placed, no loop being shown where there is no join. Blue Print No. 80B.

there being a best position for each station.

Using Gambrell coils, an A is required in the aerial circuit, a B in the secondary, while another A is suitable for reaction. The size of this last-named coil may vary in different cases, especially when the direct-coupled circuit is used, owing to aerial resistance. In the usual numbered ranges of coils, a No. 50, 75 and 50 will be suitable for L_1, L_2 and L_3 respectively.

Test Report

The set as described was given a test on my aerial in S.E. London, about six miles from 2LO. Very little difficulty was experienced in cutting that station out and receiving the others, all of which, with the exception of Manchester and Cardiff, were received at good 'phone strength. Radio-Paris and 5XX came in well, using Nos. 150, 200 and 100 in the respective positions, aerial, secondary, reaction. L'Ecole Supérieure was also heard at good strength, while Madrid was audible at about two feet from the 'phones. Several low-power amateur stations at long distance were received well.



Another view of the wiring.

Given a reasonably good aerial, this receiver will provide much interesting work, and will give excellent results with a little patience and care in handling.

THE CHRISTMAS PROGRAMME FROM 2LO

MONDAY, 22nd December, 1924.—The opera, "Hansel and Gretel," conducted by Mr. Percy Pitt, will be simultaneously broadcast to all stations.

TUESDAY, 23rd December, 1924.—In order to give the London staff a short rest, Bournemouth, Cardiff, Birmingham and Manchester stations will each give simultaneous broadcast turns of half-an-hour to the London area.

WEDNESDAY, 24th December, 1924.—John Coates (tenor) will give a recital of Christmas songs from 8.40 to 9.20 p.m. At midnight carols and waits will be broadcast.

THURSDAY, 25th December, 1924.—Each station will broadcast its own programme, which will consist of light seasonable items, dance music, etc. Only one News Bulletin will be issued—at 10 p.m.

SATURDAY, 27th December, 1924.—For the benefit of children a modified version of "Hansel and Gretel" will be broadcast. The "Roosters" Concert Party will broadcast the pantomime "Cinderella."

The Savoy Bands will play each evening until about midnight.

IGRANIC
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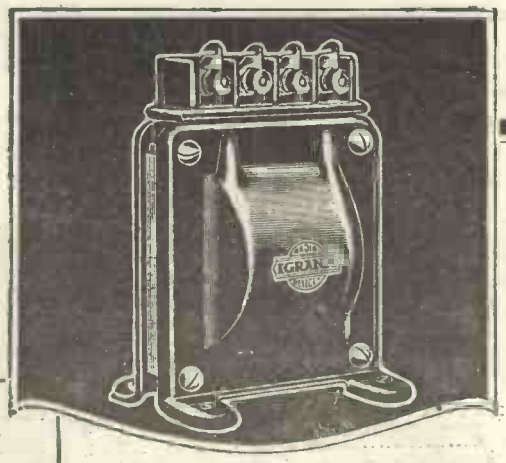
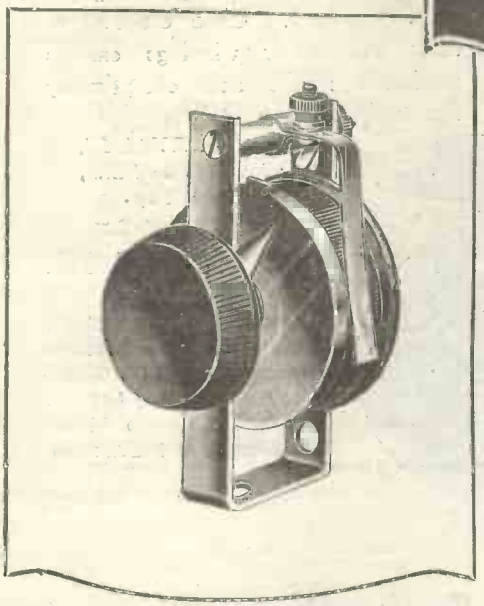
Transformer





IGRANIC
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(30 ohms)

Two *strong* links in a radio set

That old saying "a chain is as strong as its weakest link" affords an apt simile applied to wireless. For an inferior component, though serving *a* purpose in a radio set, weakens your circuit and cannot produce the first-class results you expect and assuredly get from quality components such as bear the name IGRANIC.

The two Igranic Devices illustrated are but two strong links with which you should build your set. For when *all* Igranic parts are used in correct circuit, then are you assured that perfect team-work which results in perfect reception.

Igranic components are obtainable of all Reputable Dealers.

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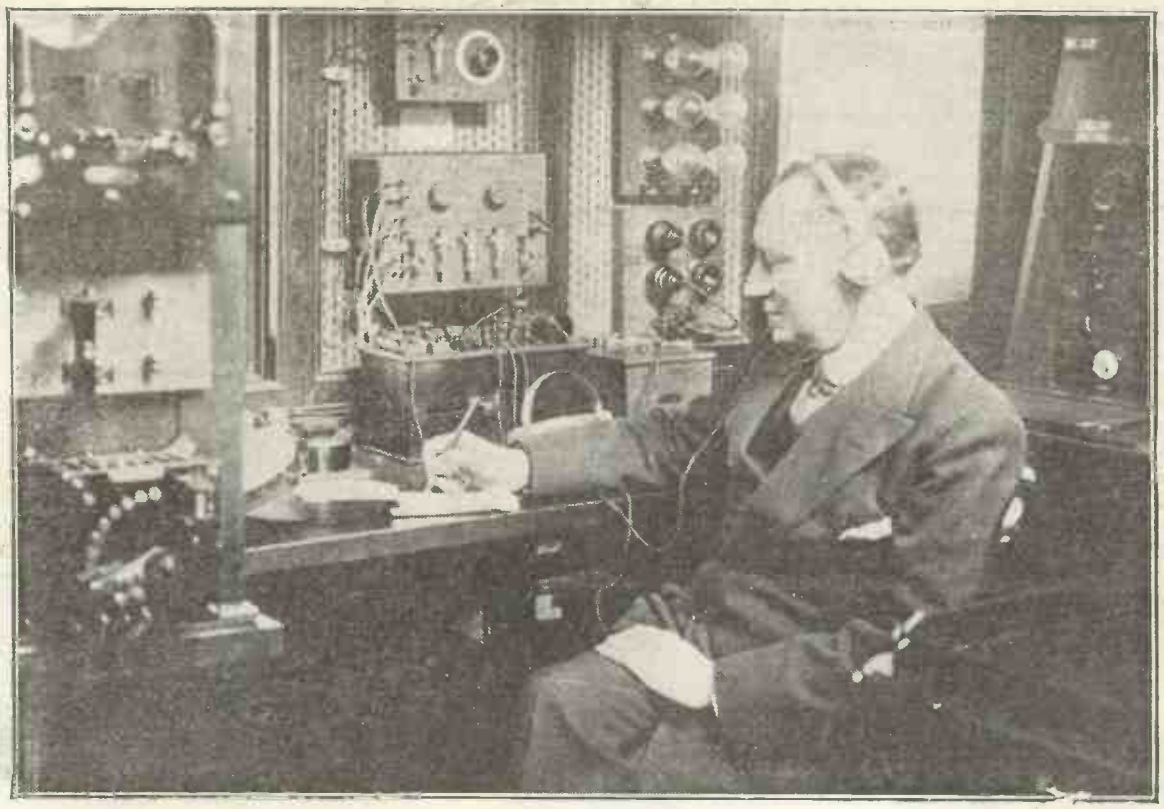
BRADFORD: 18, Woodview Tce., Manningham.
NEWCASTLE: 90, Pilgrim Street.
CARDIFF Western Mail Chambers.



Senatore G. Marconi on his yacht "Elettra."

Marconi's Wireless Beam

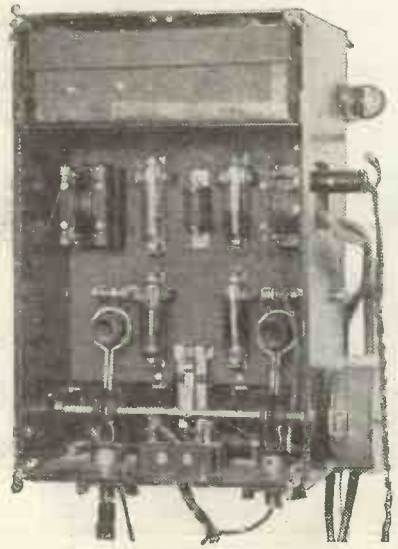
By Lt.-Col. Chetwode Crawley, M.I.E.E.,
Deputy-Inspector of Wireless Telegraphy, G.P.O.

WE all know now that wireless communication over long distances does not necessarily entail the use of high-power and long waves; but it was only four years ago that Mr. Alexanderson, one of the world's foremost wireless engineers, stated in a paper read before the American Institute of Radio Engineers that "in radio communication it has been observed that the distance over which reliable communication can be maintained is about 500 times the length of the ether wave used."

Shorter wavelength and greater distance

Now, Marconi, using only 25 kilowatts and a wavelength of about 90 metres, has established reliable communication, at any rate during darkness, not only over about 45,000 metres (about 28 miles), but over 2,800 miles.

The range given by Alexanderson must have seemed to many, even four years ago, to be absurdly small. From his statement an ordinary ship's installation could not then be expected to give "reliable communication" over more than about 200 miles, whereas such installations were commonly used for communicating over far greater distances by day, and sometimes even up to ten times that distance by night.



The ship type of Marconi Beam Receiver.

Now Alexanderson, of course, knew all about these ranges, but was careful in his statement to use the expression "*reliable* communication," and it is just this expression which has always been so troublesome to the wireless enthusiast.

The first long-range work

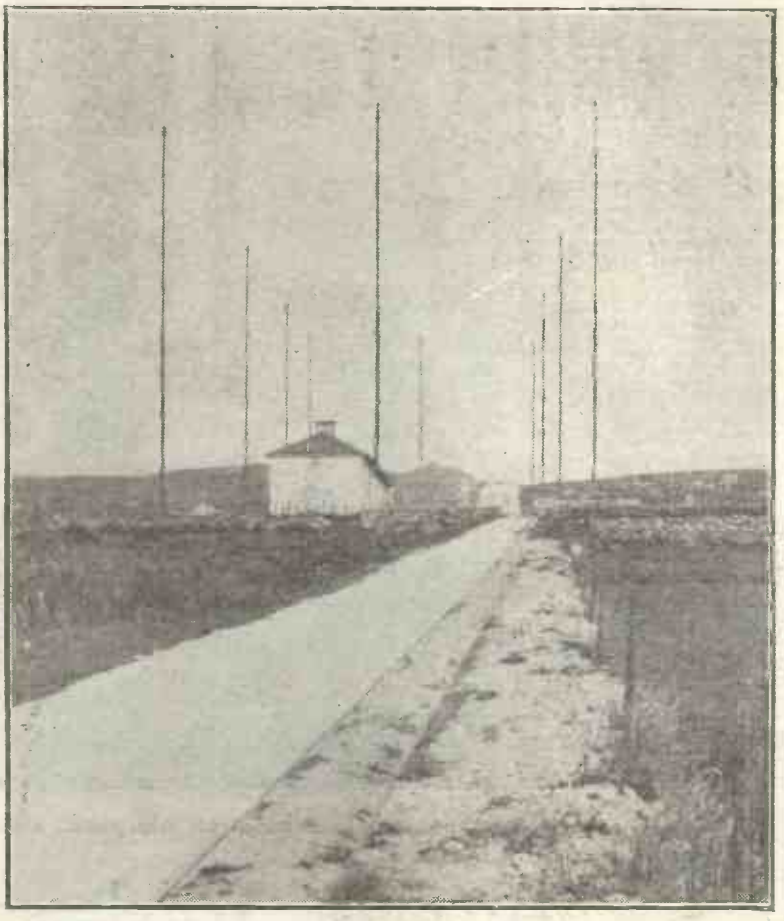
The first long-range wireless telegraph service was that established by Marconi in 1902 between stations in England and Newfoundland, which were installed with quite small power, in fact about the same power as that proposed for the new "beam" stations for our imperial communications. But this Transatlantic working twenty-two years ago could not by any legitimate stretch of imagination be called

reliable. It was very slow and only possible at all under good atmospheric conditions; in fact, it was distinctly unreliable, but it was the brilliant opening of a completely new system of world communication.

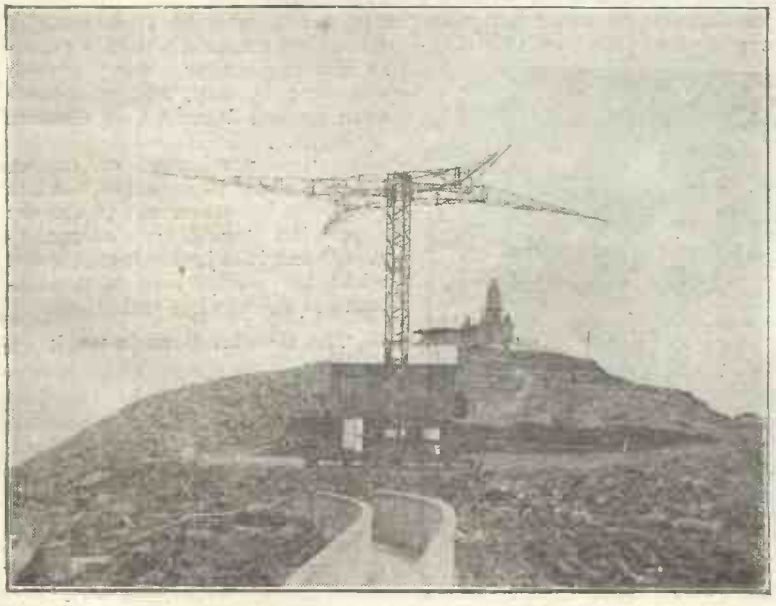
Reliability

Up till now nearly all improvements at the transmitting stations have involved the use of more and more electrical power; in fact, the 30 horse-power first used for Transatlantic communication has now been increased tenfold, and this although the sensitivity of the receiving instruments has been enormously improved. The cry has always been, "Give us more powerful transmitting stations and then we shall show you what we can do"; and at the present moment the Government are erecting at Rugby one of the most powerful wireless stations in the world.

This steady increase of power has produced a very marked improvement in the efficiency of communication, so that now Transatlantic working is reasonably reliable and the speed of signalling has been increased about tenfold, which makes the service comparable with that given by cables. At the moment, however, there are only two stations in this country, and, for the matter of that, in the Empire, capable of providing a satisfactory long-range service—the Post Office station near Oxford and the Marconi Company's station at Carnarvon. The Oxford station carries out services with Canada, Egypt, and with ships; and the Carnarvon station works with America.



The Marconi Carnarvon Station represents a modern long wave high-power station.



The Parabolic Rotating Beam Transmitter at Inchkeith Island.

Facilities in Other Countries

This state of affairs compares most unfavourably with the facilities for long-range wireless communication in the United States of America and in France. The United States have thirteen large stations, and France has five, apart from stations in their possessions overseas. Five of the United States stations are worked by private enterprise and conduct services with England, France, Germany, Norway and Japan, the eight other stations being worked by the Government for State purposes. Two of the French stations are worked by private enterprise and conduct services with the United States of America, Argentine, and Syria, the three others are worked by the Government for State purposes and commercial services to French possessions abroad.

In Italy there are two large stations which communicate with her Colonies and with the United States, and in Germany there are three, which are used principally for communication with the United States.

A DELIGHT TO USE

SUCCESS Vernier Coil Holder

The absolute and definite control which the SUCCESS Vernier Coil Holder gives over coil coupling demonstrates the increased efficiency gained when accurately tuned coils are accurately adjusted for any given wavelength. It requires not more than five minutes of operation to discover that this accuracy—so easily obtained—is a delightful enthusiasm for which the SUCCESS Vernier Coil Holder is responsible.

It cannot be demonstrated quite so emphatically that good components do give better reception than when you have carried out one or two experiments with the SUCCESS Vernier Coil Holder. The ability to tune up to the razor-sharp point requires a balance of coupling and capacity.

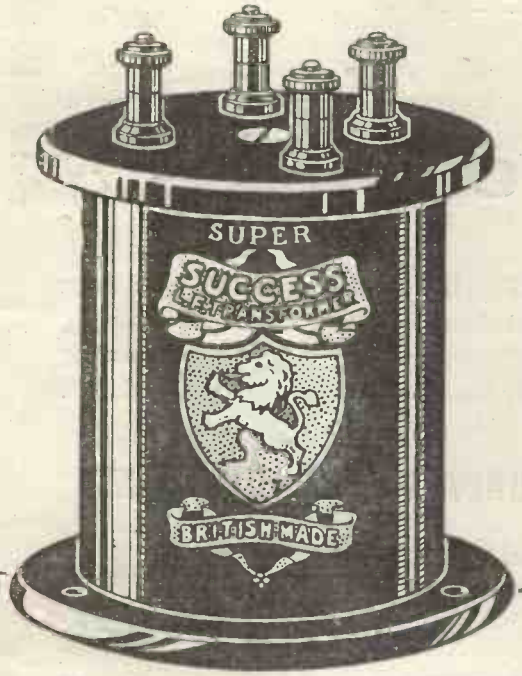
Accuracy is sometimes obtained—by a fluke—but that fine point seems just beyond the persuasion of skilful tuning.

Incorporate the SUCCESS Coil Holder—its rigidity, combined with a quick and micrometer action, will persuade the very utmost from your aerial tuning system.

Price 5/6 (For Panel Mounting).

As used in the T.A.T. Receiver described by Mr. JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E., in the current issue.

Experimenters working on the very short-wave Transatlantic transmissions are recommended to use the SUCCESS Vernier Coil Holder. Its design—simplicity in itself—reduces capacity effects to the irreducible minimum: a very desirable feature for the critical short wave receivers.



Successful reception of the short waves requires the simplest of arrangements—detector and one note magnifier—which involves one very important component—the low frequency transformer. Choice of this instrument cannot be too deliberate. It need not be emphasised how, in so critical a receiver as one designed for the reception of KDKA on 68 metres, an ill-designed L.F. Transformer can mar your reception beyond skilful tuning. Tested under every conceivable condition, the SUPER-SUCCESS unconditionally gives you power amplification, and represents a new experience with which you should not delay your acquaintance.

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Birmingham: Cooke & Whitfield Wireless, Ltd., 24, St. Paul's Square.
Bristol: Fred. Burris & Sons, 7/15, Redcliffe Street.
Wholesale Fittings Co., Ltd., 14, North Street, Stokes Cross.

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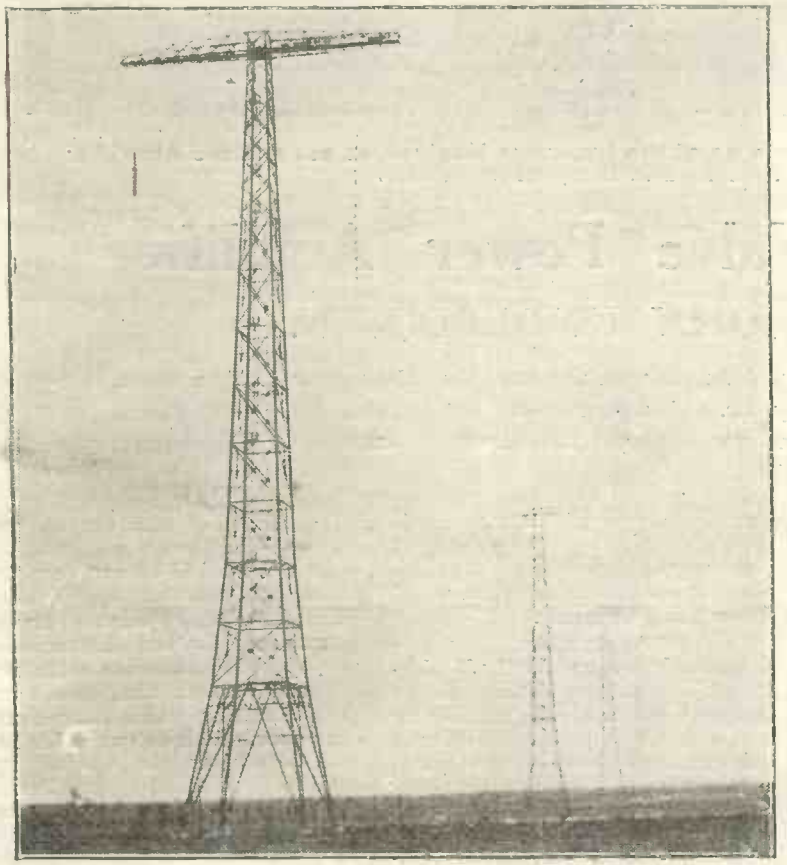
Full list of wholesale distributors appears in the Manufacturers Directory, November "Broadcaster and Wireless Retailer."

Advertisement of Messrs. Beard & Fitch, Ltd., London, E.C.1

Barclays Ad.

Such then is the position at the moment as regards facilities for long-range wireless communication with the principal countries in the world, and the need for increasing such facilities in the British Empire is obvious, and was recognised as long ago as 1913, when the Government signed an agreement with the Marconi Company for the erection of long-range stations throughout the Empire. This scheme was abandoned owing to the war, and in 1920 a new scheme was adopted by the Government.



[*Photo: Underwood & Underwood, N.Y.*

Will Beam wireless abolish tall towers like these of the Radio Corporation of America at Long Island?

The Beam System

At this juncture Mr. Marconi made known the results which he had recently obtained with the Beam system, and in July last the Government entered into an agreement with the Marconi Company for the erection of a Beam station for communication with a corresponding station in Canada, with provision for its extension so as to provide similar communication with corresponding stations in South Africa, India and Australia.

The Beam system is an arrangement for transmitting wireless signals on short wavelengths in the form of a beam, somewhat similar to the searchlight's beam of light waves, which of course consist also of ether waves but of far shorter wavelengths than those used for wireless signalling.

The Use of Short Waves

The lengths of the waves used by Marconi for signalling over long ranges were about 100 metres whereas those used by the latest long-range stations are as great as 20,000 metres, and the power used by Marconi was about 20 kilowatts compared with 500 to 1,000 kilowatts used by some of the present large stations.

Short wireless waves were used by Hertz in his classical experiments at the birth of wireless, nearly forty years ago, and about ten years later were used as a beam by Marconi at his first demonstrations in this country, after which the rapid and spectacular progress made with long-wave working completely overshadowed those early results, and diverted research into channels which have given us the long-wave high-power station of to-day. Nothing further in fact was done with short-wave beams until 1916, when Marconi again returned to his long-abandoned investigations in connection with certain war requirements.

Concentrating the Beam

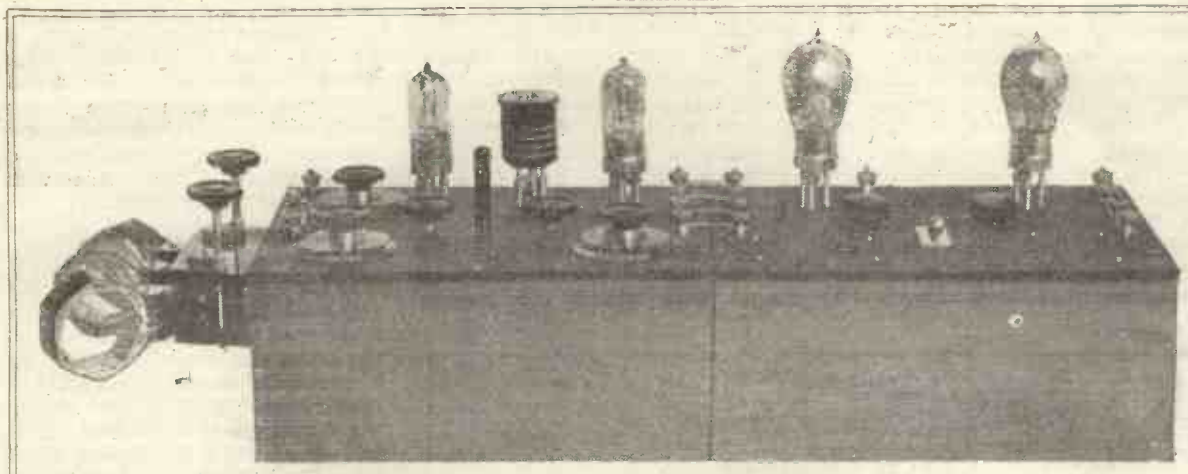
In his present Beam system the reflector used at the transmitting and receiving stations consists of a number of wires placed parallel to the aerial and spaced around it on a parabolic curve of which the aerial forms the focal line, and in the Government agreement it is laid down that the power input should be at least 20 kilowatts, and that the emitted waves shall be concentrated within 30 degrees. The station for communication with Canada is to be able to communicate each way at a speed of 100 words a minute, exclusive of repetitions, during a daily average of 18 hours. Additional units are to be similarly guaranteed except that the periods of working with South Africa, India and Australia are to be respectively 11, 12 and 7 hours daily.

The speed of working contemplated is thus much greater than would be expected from high-power stations, as high-speed signalling is facilitated by the use of low-power and short waves. But the daily average periods of working are smaller than would be expected from high-power stations, as the intensity of signals on these short waves varies inversely in proportion to the mean altitude of the sun when above the horizon; in other words, very great distances are not obtained in daylight.

Beam Stations and High Power Stations

From these considerations it will be seen that beam stations working between fixed points may be able to exchange as many words in 24 hours as high-power stations, and as the capital cost of the beam station should be only about an eighth of the large station, and the running expenses also much less, it is obvious that this new system of communication has great possibilities.

On the other hand, the fact that the high-power stations can transmit to any part of the world at any time during the 24 hours is obviously a point of great importance, so much so indeed that the Government are, as already mentioned, erecting such a station at Rugby in addition to arranging for the erection of the Beam stations.



A complete receiver made up of the two-valve Neutrodyne set and the Amplifier described in the present article.

A Two-Valve Power Amplifier

By JOHN UNDERDOWN.

Although primarily designed for use with the two-valve Neutrodyne receiver shown above and described by Mr. Underdown in our last month's issue, this efficient two-valve unit may be used with many sets, both crystal and valve, where powerful loud-speaking is required.

IN last month's article on "A Double-circuit Neutrodyne Receiver," it was expressly stated that the set therein described was eminently suited for long-distance work rather than great volume on a nearby station. Listening on phones, although fascinating to the wireless enthusiast, is rather an unsociable affair, restricting movement and conversation amongst the rest of the family, and the two-valve unit about to be described is primarily designed so that ample loud-speaker strength may be readily obtained, allowing all to participate in the general enjoyment of the excellent programmes now transmitted from an ever-increasing number of stations.

Cross-Connections

The unit is of the same dimensions as the high frequency and detector set, and is so arranged that when standing side by side they are simply connected together by straight-through links eliminating many unnecessary and unsightly wires straggling about the table. Since it is particularly convenient to be able to obtain pleasant strength for the average room or great volume for dancing or large halls, a two-way switch has been provided. This, by throwing from one position to the other, permits the use of one or two note-magnifying valves without any other alterations or attention whatsoever being necessary.

Applications

Although designed for the Double-circuit Neutrodyne, it must not be imagined that it is only suitable for use with this receiver. With any other set, crystal or valve, it works equally efficiently, and is particularly adaptable for the experimenter, as with the majority of circuits the low-frequency side is very much standardised.

Form of Coupling

The amplifier is transformer coupled since this method of coupling gives the maximum step-up of signal voltage per valve of any system of low-frequency amplification, with no noticeable signs of distortion with well-designed modern transformers and valves working under their correct conditions. Although much has been written against the use of low-frequency iron-cored transformers, with the well-designed instruments now obtainable from a number of manufacturers the purity of reproduction obtained is easily comparable with that given by resistance coupling-added to which fact two transformer,

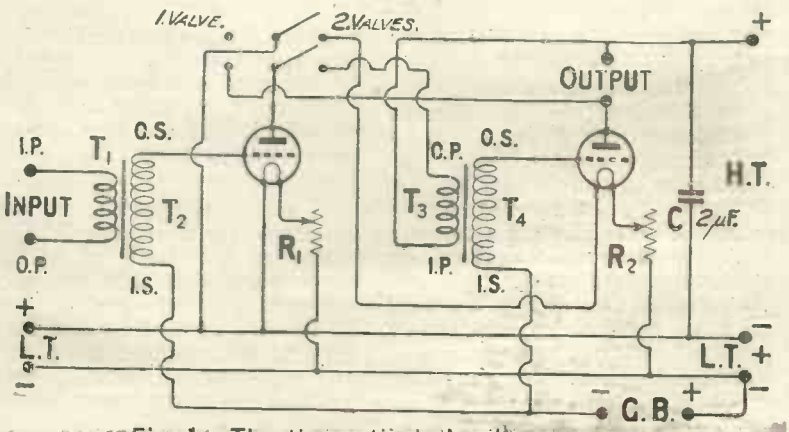


Fig. 1.—The theoretical circuit.

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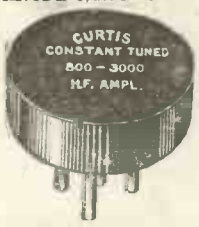
The Curtis "Constant-Tuned" High-Frequency Amplifier is the only automatic high-frequency amplifier which, when connected in circuit, guarantees high efficiency for two stages of radio amplification on any wavelengths between 300 and 3,000 metres, and requires no additional controls, NOR MORE EFFORT, SKILL OR PATIENCE IN TUNING, THAN IS REQUIRED FOR THE OPERATION OF THE USUAL ORTHODOX SINGLE STAGE TUNED ANODE CIRCUIT.



THE CURTIS CONSTANT-TUNED HIGH-FREQUENCY AMPLIFIER CHANGES THE WHOLE CHARACTER AND QUALITY OF WIRELESS REPRODUCTION.

With its automatic simplicity, combined with increased selectivity and power, is destined to make two stages of high-frequency amplification a sine qua non of every Wireless Receiver for the Experimenter and Home Constructor, or the purchaser who prefers to buy a professionally constructed instrument.

For the greater convenience of the constructor, and so as to conform with existing panel design, the Curtis Constant-Tuned High-Frequency Amplifier is designed for use (and must be connected up in exactly the same way) as an ordinary High-Frequency Transformer.

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BUILD your own automatically tuned **LONG-DISTANCE RECEIVER.** Complete set of parts, including drilled and engraved Paragon Panel and Polished Mahogany Cabinet, with suitable circuit diagrams. From **£4 15s. 0d.**

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Two Stages of High-Frequency Amplification.

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In the Duodyne III the fullest advantage has been taken of the extraordinary virtues of the Curtis Constant-Tuned High-Frequency Amplifier. The first valve functions through the Curtis High-Frequency Amplifier, the second tuned anode, and the last as a rectifier. Guaranteed perfect reception at full power and of extraordinary purity from anywhere in the United Kingdom of any broadcasting station from Aberdeen to Madrid. Used in conjunction with the CURTIS EJECTOR will cut out local station at 1½ miles (Relay Station 200 yards) and tune in **ANY** British Station at will. **Price £10.**

DUODYNE V combines the Duodyne III with a two-stage power Amplifier. **Price 18 Guineas.**

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American Stations WGY and KDKA, also Canadian amateurs and most European Stations, have been consistently received with a singular absence of distortion.
Bechsteins are almost the equivalent of a valve amplifier when used in conjunction with a crystal set, the range of which is increased by roughly ten miles.
With a one-valve set, employing no amplification, the range covers a vastly increased radius over which formerly no signals have been logged.
Get what you are missing—and improve what you are getting in wireless, by insisting on the "Headphones that Amplify." Bechsteins are the last word in comfort, and every pair is guaranteed.
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coupled valves give equal volume to that of three using the latter method.

The Circuit

No claim for originality is made for the circuit. It is merely the well-known one for the form of coupling adopted. A common high tension voltage is used on both valves, and also a common grid biasing voltage. This means that in most cases two similar valves will be required here, and the small type of power valve such as the B.T.H. B4 or similar type valves by other makers are advised. First and second stage low-frequency transformers have been adopted, and in practice a high order of amplification is obtained without distortion. A double-pole double-throw switch permits of the use of one or two valves without it being necessary to make any external alteration to the amplifier connections. In the one-valve position the first valve only is used, the second being completely out of circuit. On throwing over to the second switch position the other valve is lit, and the loud-speaker transferred from the anode circuit of the first to that of the second valve.

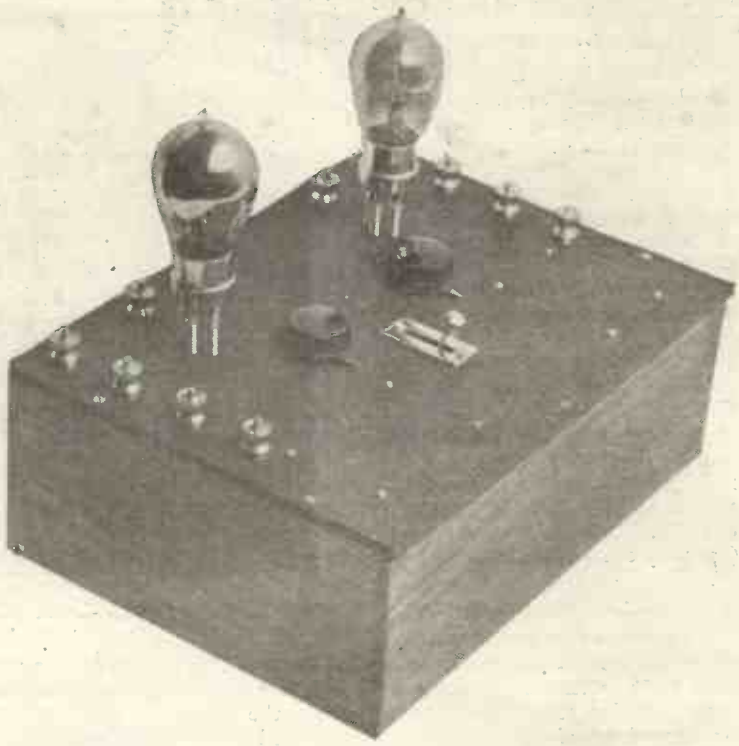


Fig 2.—With the switch in this position one valve only is in use.

Terminal Arrangements

Reference to the photographs and drilling diagram will show that there are four terminals at each side of the panel. Two pairs of these are common terminals, arranged thus for convenience in connecting to the companion receiver previously mentioned, so as to obviate duplicating battery connections. The two pairs to the rear of the sides of the panel are for the low-tension supply.

Of these the ones in the corners are common terminals to L.T. + and H.T. — ; whilst the other two are for L.T.—. This is all made perfectly clear by the diagrams.

On the left side of the panel the other pair of terminals is for the input from either a crystal or valve detector. The remaining two on the right hand side marked "Output" in the drilling diagram serve for the loud-speaker. At the back of the panel there are three terminals, the functions of which are, reading from left to right, Grid Volts +, Grid Volts —, and H.T. +.

Panel Layout

The two sets of valve sockets are near the back of the panel, and are tapped into the panel, but readers can use nuts and washers here without any detrimental effects. The filament rheostats are in front of the valve sockets, and are of the bright emitter type, although these can be easily changed for dull emitter or dual types if desired, as ample panel space has been left with this object in view.

To the front centre of the panel is situated the switch controlling the number of valves used. When the lever of this is pointing towards the valves both are in circuit; pointing away the last valve is extinguished and thrown out of circuit.

At the back of the panel the two low-frequency transformers are arranged one at either side of the switch and towards the front. That to the right is a first stage instrument, whilst the other is a special second stage transformer, so placed as to have its longitudinal axis at right angles to the former to minimise interaction effects if any.

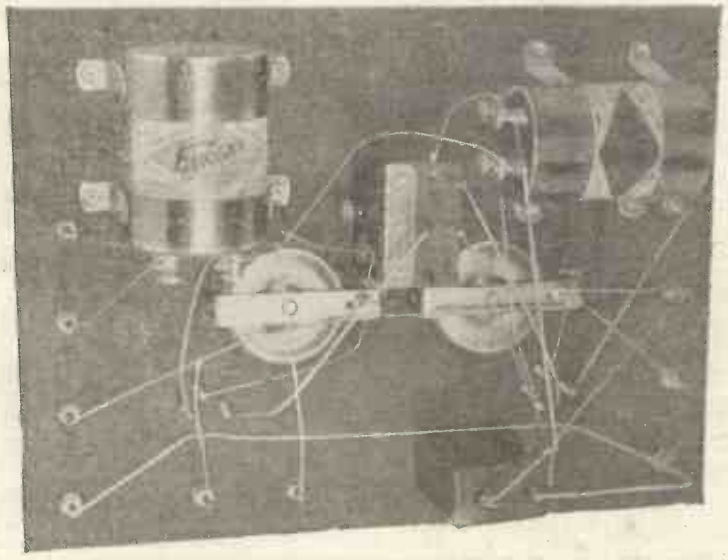


Fig. 3.—This photograph clearly shows the valve connections.

Notes on Components required

In order to assist readers who wish to exactly duplicate the amplifier, the names of manufacturers are given together with the components used. Should changes be made only the best material is really advisable and

unnamed components should be avoided.

1 Ebonite panel measuring 12 inches by 9 inches by ¼ inch thick, either with matt surface or guaranteed free from surface leakage. (Paragon, Peter Curtis, Ltd.).

1 Oak or mahogany tray to take the above panel. That used was 5 inches deep and of wood ⅜ inch thick.

8 Valve sockets or two-valve holders.

2 Filament resistances (Igranic).

1 2-pole 2-way anticapacity switch (Utility).

1—First stage L.F. transformer (Eureka Concert Grand, Portable Utilities.)

1—Second-stage L.F. transformer. (Eureka No. 2.).

1—2 μF Mansbridge Condenser.

11 4 B.A. W.D. type terminals.

8 6 B.A. ½ inch screws and nuts.

Quantity of 16 gauge tinned copper wire.

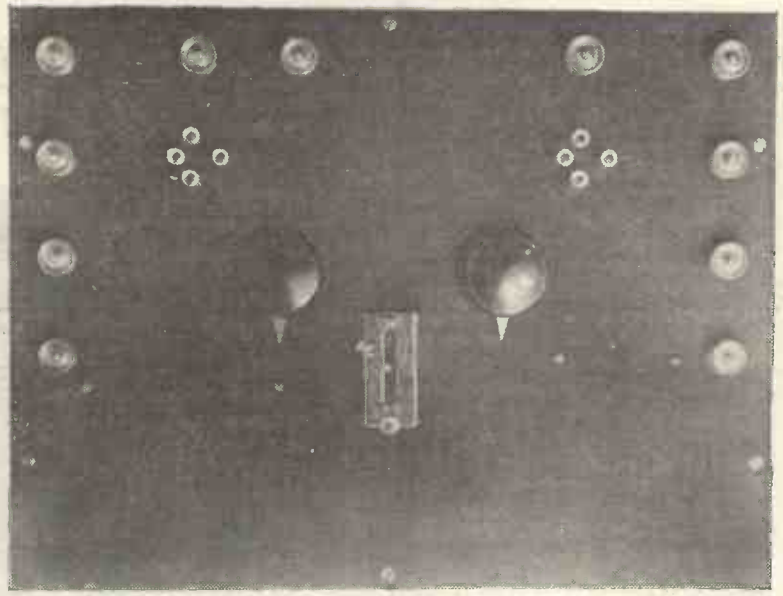


Fig. 4.—A plan view of the panel.

Drilling the Panel

If the panel is guaranteed free from surface leakage the drilling may be carried out without preliminary matting of the panel with emery paper and oil, after it has been set out by reference to the drilling diagram. Those who wish for the minimum amount of trouble can obtain a full-size blue print, which may be placed over the panel and the centres obtained with a centre-punch. Failing this the templates supplied with the resistances and switch should be used, and one of the many drilling templates for valves now on the market, *e.g.*, the Morris template. The slot for the switch lever arm can easily be made by drilling two ¼ inch holes, 1¼ inches apart, and cutting

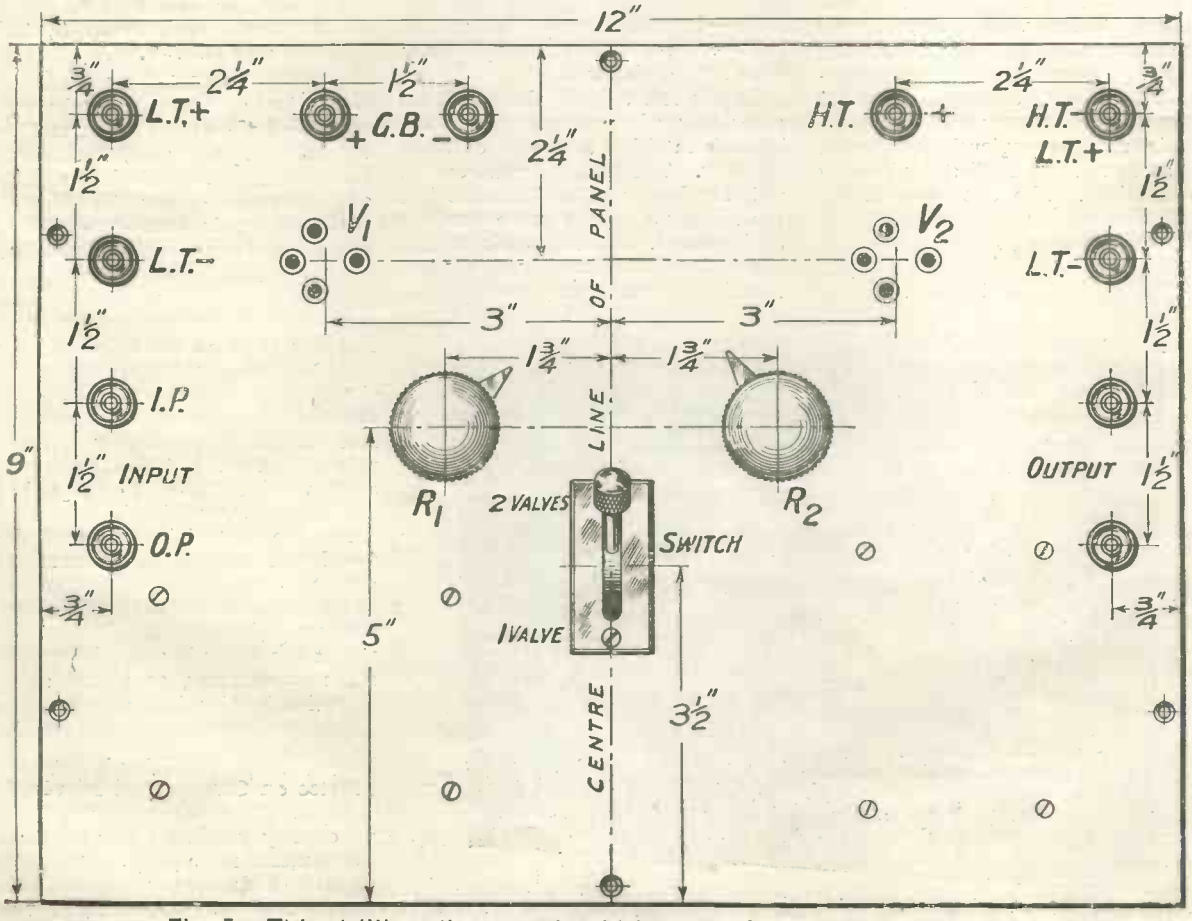


Fig. 5.—This drilling diagram should be used for marking the panel.

LISSENIUM.

GIVE THE VALVE A FAIR CHANCE—

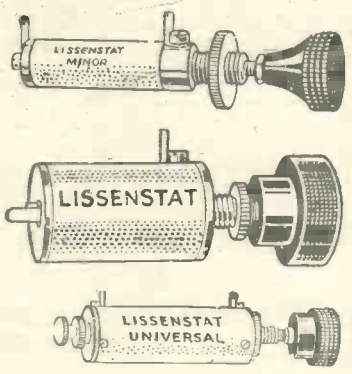
Your valve will detect with extraordinary power with LISSENSTAT control. Only by accurate control of critical electron emission can success in distant telephony be achieved—and with no other rheostat can the performance of the LISSENSTAT be duplicated. A separate LISSENSTAT for the detector valve, one for each H.F. valve, and (desirable, but not quite so important) one for each L.F. valve, too, and you will get sharper tuning than ever you have known before. By its structure and its composition, *LISSENSTAT control gives the valve a capacity to detect as no other rheostat can.*

Made in three types.

LISSENSTAT MINOR (patents pending) —is replacing thousands of discarded and inefficient rheostats. Provides LISSENSTAT control at a popular price. LISSEN ONE-HOLE FIXING, OF COURSE **3/6**

LISSENSTAT MAJOR (patents pending) —gives the most acute tuning possible. LISSEN ONE-HOLE FIXING.. .. **7/6**

LISSENSTAT UNIVERSAL (patents pending)—with its protective device for dull emitters. LISSEN ONE-HOLE FIXING, OF COURSE **10/6**



RECEIVERS FITTED WITH LISSENSTAT CONTROL ARE EQUIPPED FOR THE FINEST DETECTION POSSIBLE.

THE APPROPRIATE LEAK VALUE—

Every different condition of reception may call for a different leak value—you can get it with the LISSEN Variable Grid Leak (patents pending). Distant stations—near-by transmissions—strong signals or weak—reaction or not— hard valves or soft—straight circuit or reflex—if you are using the LISSEN Variable Grid Leak you are certain of getting the utmost sensitivity out of your tuning. Every range of resistance value required of a leak is covered, with minute variation throughout.

LISSEN ONE-HOLE FIXING, OF COURSE. **2/6**

LISSEN VARIABLE ANNODE RESISTANCE

20,000 to 250,000 ohms, same outward appearance as the LISSEN Variable Grid Leak **2/6**

SMOOTH OUT YOUR LOUD-SPEAKER DISTORTION BY PUTTING A LISSEN VARIABLE GRID LEAK ACROSS THE SECONDARY of the last transformer or across the loud-speaker itself. First position is better, last may be easier. The difference will be very noticeable.

PARTS THAT PULL TOGETHER—When you know that every vital part in your receiver is pulling strongly with each other, you know that you have a receiver which is the best you can ever get.

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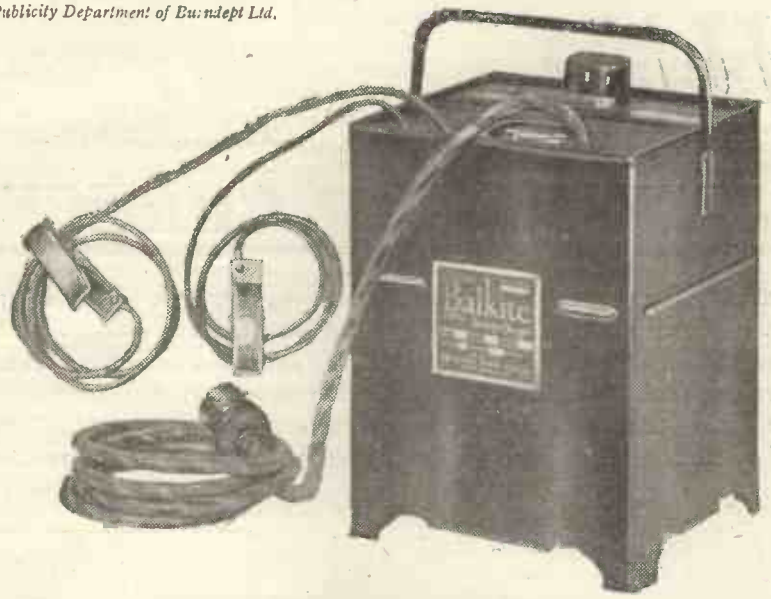

No. 491. Balkite Battery Charger.
200–240 volts, 50–60 cycles (alternating current) without acid or oil.
£5 15s. 0d.

A *noiseless* Battery Charger
without valves, vibrators or moving parts

YOUR wireless set will give the best results if you keep your battery fully charged—and the life of the battery will be considerably prolonged. If your electric supply is alternating, the Balkite Charger is the cheapest, simplest, cleanest and most convenient method—you only plug it into your electric light socket.

The Balkite Battery Charger is entirely noiseless. It is based on a new principle, the use of Balkite, a rare metal which changes the ordinary A.C. current used for lighting to the D.C. current necessary for charging accumulator batteries, without the use of noisy vibrators, contact points, fragile bulbs or valves.

This Charger has no moving parts, and nothing to break, adjust or get out of order. It cannot deteriorate through use or disuse. It delivers a taper charge, and cannot discharge, short circuit, or damage the battery by overcharging. It needs no attention other than an occasional filling with distilled water. Its operation does not create disturbances in your set or your neighbours'. It is simple, efficient, cannot fail to operate if properly connected, and is practically indestructible except through abuse.

It operates on a supply from 200–240 volts, at a frequency of 50–60 cycles. Several other voltages and frequencies can be supplied to order. The charging rate being 2½–3 amps., a 6-volt 50-ampere accumulator will be completely charged in 20 hours at a cost of less than ½d. per hour.

Can be obtained through leading Radio dealers everywhere, and at Burndept Agents and Branches.

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BURNDEPT
WIRELESS APPARATUS

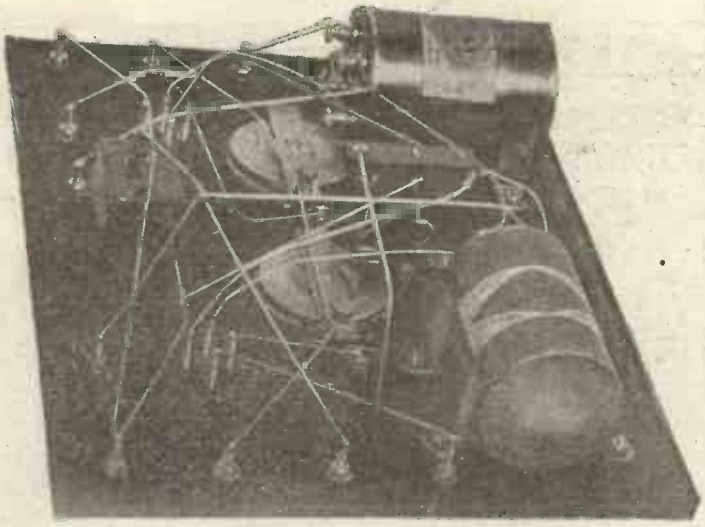


Fig. 6.—Notice that the transformers are arranged at 90°.

away with a fret-saw a ¼ inch strip between them. This may finally be cleared smoothly by using a flat file.

Mounting the Components

Mounting the components is a simple and straightforward procedure, so that little need be said here. It is easiest first to mount the valve sockets and terminals; next follow the switch and the rheostats and finally the transformers. These latter are held by 6BA screws through the panel and nuts. As the fixing holes vary slightly it is advisable to mark their positions with the transformers in place.

The Wiring

Wiring is carried out with 16 gauge tinned copper wire which was obtained on a reel. To straighten this out the best proceedure to follow is to secure one end to some fixture run off two or three yards and stretch until it is felt to give. It can then be cut off in suitable lengths, giving a perfectly straight and professional appearance to the finished wiring. Joints as far as possible should be soldered rather than secured by lock-nuts, and a few soldering hints may not be amiss here. Before soldering file the tops of terminals and valve leg shanks to give a perfectly bright surface. Give them the merest touch of flux and then tin with a really hot clean iron. An iron at the right temperature assures that the tinning is quickly done before the shanks become heated and tend to become loose. As a precautionary measure the nuts may be given a half-turn when tinning is completed. Now, referring to the photographs and wiring diagram, proceed with the remainder, keeping the leads short and well spaced. So that no difficulty should arise with the switch connections a close-up photograph of these is given in Fig. 8, and the points to which individual wires are taken is indicated. Comparison of this with the other photographs of the wiring

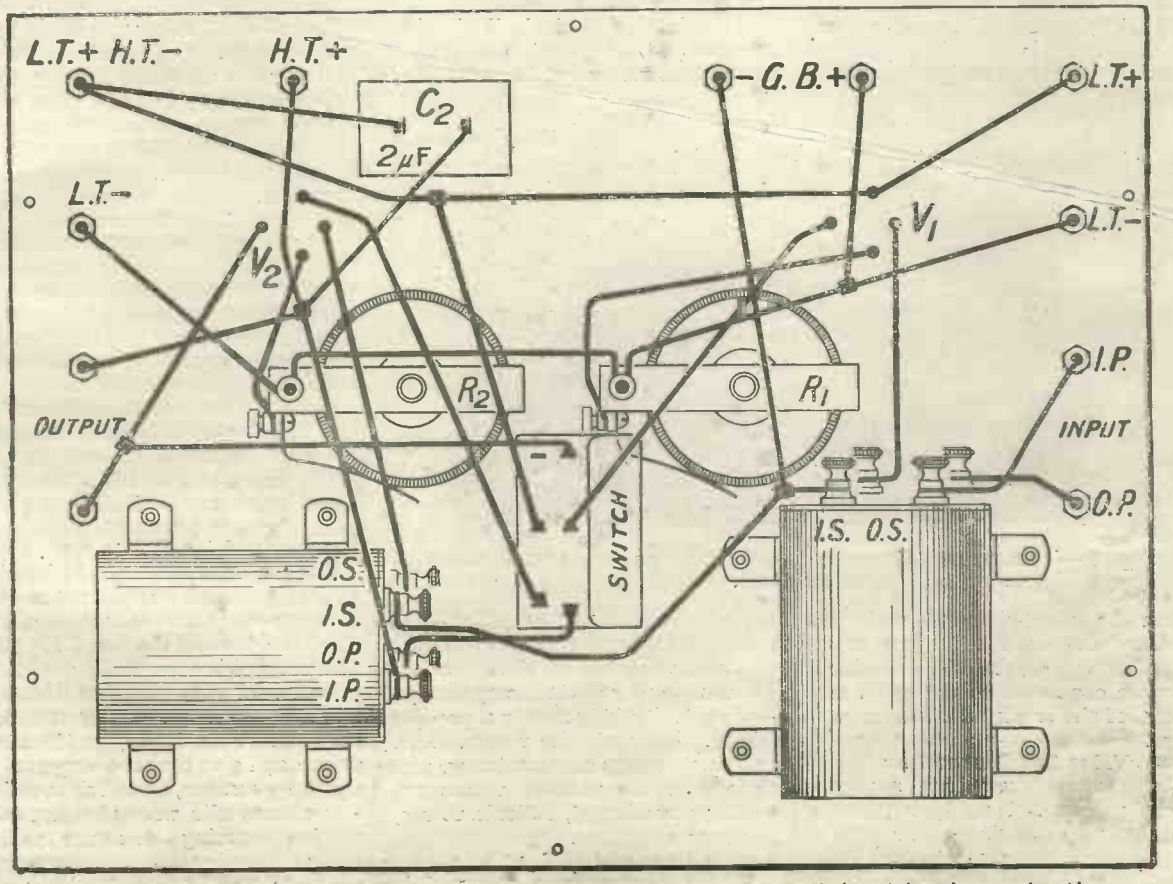


Fig. 7.—Back of panel wiring diagram. Where wires are joined is shown by the black squares.

will clearly show how the leads go. The 2μF reservoir condenser across the H.T. supply is not fixed to the panel, but is securely held by its soldered connections. In the case of connections to the transformers which are not soldered, the terminals should be firmly screwed up, as any noise due to loose contacts is amplified to the same degree as the received signals.

Fixed Condensers

From the circuit diagram it will be seen that no condenser is placed across the Input terminals. This is omitted since in most sets there is already one across the telephone terminals. If this is omitted on the detector unit one of .001 to .002 μF may be connected externally across the Input terminals.

Connections for a Crystal Receiver

When a crystal receiver is used as the detector unit the connections are as follows :—

The telephone terminals are taken to Input terminals of the amplifier, and the L.T. terminals on the left of the panel are left free. H.T. and L.T. connections are made to the appropriate terminals to the right of the panel; H.T. — and L.T. + being taken to the corner one. Phones or loud-speaker are connected to the Output terminals. Depending on the type of valve and H.T. voltage used a suitable grid battery should be connected to the terminals marked Grid Bias + and —, care being taken to get the polarity right. If a low value of H.T., usually under 60 volts or so is used these terminals may often be short-circuited and this battery dispensed with. In many cases, as is usual, the L.T. — terminal may be connected to the earth terminal of the crystal set with advantage.

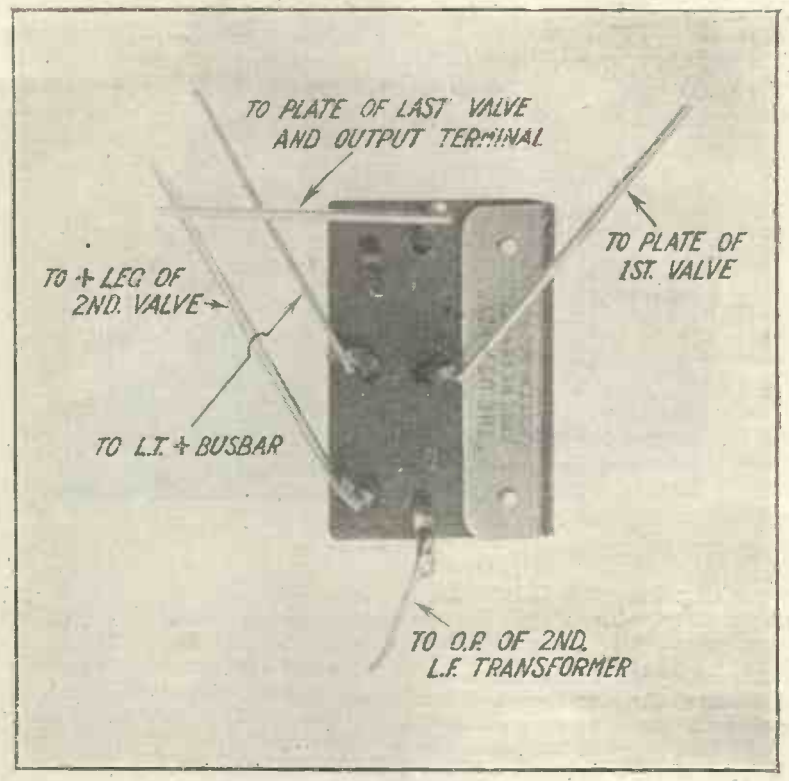


Fig. 8.—A close-up view of the switch connections.

Valve Set Connections

With the Neutrodyne set previously described straight through connections are made by cross-linking as shown in the photographs of the two units, whilst battery connections are made in similar manner to that previously described. With other valve sets than this no difficulty should be experienced in connecting up.

Power Amplification

When the word "power" is connected with that of "amplifier," the uninitiated usually jump to the conclusion that the amplifier is much too complex for the ordinary man to deal with. This is merely a popular fallacy. Only suitable valves, H.T., and transformers are necessary, and these with the modern valves are neither complicated, difficult to use, nor very expensive.

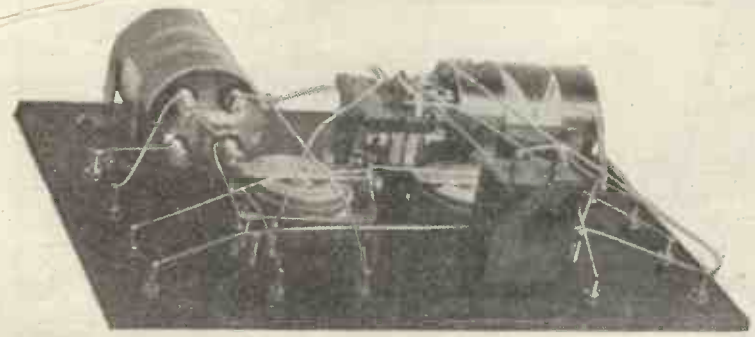


Fig. 9.—The connections to the first transformer are seen to the left.

Valves and H.T. to Use

Where large volume of sound is desired the modern small power valves of the 6 volt. .25 ampere type will be found quite suitable with 60 to 100 plate volts and from 3 to 5 volts negative on the grid. Ordinary general purpose valves may be used, and in this case with a 100 volts a suitable grid bias value is of the order of 3 volts.

Test Report

On an extremely poor temporary aerial of flex, 100 feet in length and 15 feet average height some 15 or so miles S.E. of 2LO, that station gave excellent loud-speaker strength with 2 valves and crystal, being pleasantly audible in the next room.

With the Neutrodyne set several of the B.B.C. and Continental stations gave uncomfortable volume on the loud-speaker even with the poor aerial which was available.

Blue Prints

For the benefit of readers who wish to have a minimum amount of trouble in constructing the instrument, a full-size blue print of the panel No. 78 A and of the wiring No. 78 B is available, price 1s. 6d each post free from our Sales Department. Panel transfers may also be obtained from the same source, and give the set a very professional appearance, as well as avoiding any chance of a wrong battery connection burning out the valves through leaving the terminals unmarked. To the beginner their use is particularly advised.

INDISPENSABLES TO MAXIMUM RADIO EFFICIENCY

PARAGON CURTIS

GOOD COMPONENTS DESERVE A GOOD PANEL

UNIFORM FINE GRAIN DEAD MATT FINISH GUARANTEED NON-METALLIC SURFACE FREE OF LEAKAGE

PARAGON EBONITE PANELS

Radio Quality Post Office Specification

"The Best Made."

Special panels for Receivers described in this or any previous issue of "Modern Wireless"—CUT, EDGES SQUARED and GROUND, ¾d. per square inch. Postage 6d.

TESTED AND RECOMMENDED BY "MODERN WIRELESS"

STANDARD SIZES.

8	× 6 ×	3/16	2/6	24	× 10 ×	¼	14/6	18	× 6 ×	¼	6/9
8	× 6 ×	¼	3/3	24	× 12 ×	¼	17/6	12	× 8 ×	¼	6/-
10½	× 8½ ×	¼	5/3	8	× 5½ ×	¼	2/9	10	× 8 ×	¼	6/9
12	× 10 ×	¼	7/3	10½	× 7 ×	¼	4/7	7	× 5 ×	¼	2/3
12	× 12 ×	¼	8/6	12	× 6 ×	¼	4/6	10	× 9 ×	¼	5/8
14	× 12 ×	¼	10/-	22	× 11 ×	¼	15/3	9	× 5½ ×	¼	3/5
16	× 12 ×	¼	11/6	16	× 9 ×	¼	9/-	10	× 5 ×	¼	3/3
18	× 12 ×	¼	13/-	12	× 11 ×	¼	8/3	12½	× 9½ ×	¼	7/6

PARAGON POLISHED MAHOGANY EBONITE

Is NOT a composition, but GUARANTEED POST OFFICE QUALITY EBONITE, and is of similar specification to the now universally used PARAGON EBONITE.

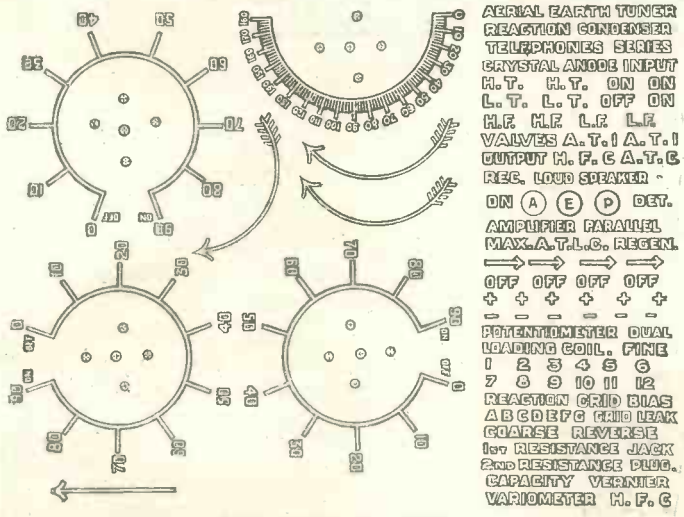
PANELS CUT TO SIZE, Squared, edges ground, 1d. per square inch.

THE Nu-GRAVING

PANEL MARKING PROCESS

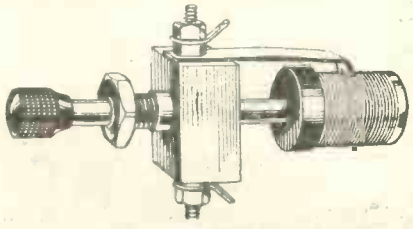
This name on every envelope is your only guarantee against spurious imitations. Nu-graving is guaranteed for an indefinite period against chipping or cracking.

COMPLETE AS SHOWN, 6d.



REDUCTION IN PRICE.

The following reduced prices for Nu-graving series operate from 15th Nov.: Series 1, 2 and 8, 3d. each. Series 3, 4, 5, 6 and 7, 2d. each.



CURTIS FILAMENT RHEOSTAT.

That better reception is obtained if filament control is perfect can only be understood by fitting the CURTIS. 0 to 40 ohms; quick and slow action; D.E. valves may be used in conjunction with 6-volt battery if your Rheostats are CURTIS.

Price 5/-

PARAGON-CURTIS ONE PIECE MICA CONDENSER

Accurate and Uniform Capacity.

Technical and Constructional Authorities reiterate their opinion that the successful home construction of receivers implies the close adherence to the original specification. The ordinary method of fixed condenser manufacture prevents any guarantee of uniform capacity. The method adopted, however, in the PARAGON-CURTIS not only guarantees uniform capacity throughout production, but guarantees also 5 per cent. accuracy. It will be realised that in any published circuitous specification of fixed condensers of a specific value—the PARAGON-CURTIS you buy is uniform with its fellow used in the original design.

An Important Consideration.

.0008 to .006	2/6
Complete with Grid leak Clips	2/9
Grid leak	1/8

Home constructors who wish to build a successful receiver should apply for our 16 pp. catalogue of "Raw Materials and Accessories" free on request.

Paragon-Curtis Products are always of uniform and dependable quality. Ask your local agent for full particulars and illustrated catalogues.

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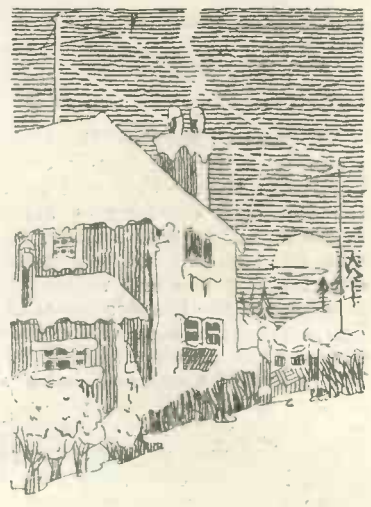
In conjunction with

THE PARAGON RUBBER MFG. CO., LTD.

How the Advent of Radio and Broadcasting has Changed our Christmas



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

AT Christmas time the natural human instinct for enjoyment and freedom from the worry and strain of everyday life asserts itself. Remembering the origin of this time-honoured festival we can appreciate how the spirit of festivity and carnival has been fostered through the ages. Modern conditions and the progress of civilisation have rendered it even more prominent and more general. Let us then picture the Christmas before the era of wireless and broadcasting, and show how the latter has influenced Christmas and the manner in which we spend it. People in all stations of life make preparations for some time beforehand in the hope of spending those few days in a manner appropriate to the occasion.

What the Old Time Christmas lacked

Take, for instance, the town-dwellers. Their Christmas provided them with new pleasures, sources of fresh activities, a rest, in the sense of a change from their normal existence, and also the opportunities of forming new friendships. To country folk some of these enjoyments and privileges were denied. Yet they, in their simpler manner, perhaps, also made arrangements and preparations to celebrate the occasion in a fitting manner. Others, less fortunate, living in isolated and possibly desolate regions, sought to break the monotony of their existence as best they could. Constituting another section of the community to whom Christmas means more than is sometimes realised are the invalids and occupants of our hospitals, many of whom are destined to suffer until the end of their days. Only those responsible for the care of such unfortunates realise to what an extent they look forward to an occasion such as Christmas, when they enter, temporarily it is true, upon a new existence, when the clouds of despair lift and reveal the promise of a brighter future. But what did all these people lack, not only during their everyday lives, but particularly at Christmas? Their unity of purpose was

well defined, but something was lacking to provide, so to speak, a link between them. The science of wireless has provided this link. The wide appeal of wireless and broadcasting cannot be denied. Children and adults, poor and rich alike, have succumbed to its charms. In recent years science has given us many things, some of which are luxuries, and others are regarded as a necessary part of our daily life. To the latter category belongs the science and art of broadcasting, which has assuredly come to stay.

Broadcasting in everyday life

Before we analyse how the introduction of broadcasting has influenced our Christmas, it will be interesting to see what effect it has had on our daily life. Apart from the training in aural observations as an aid to stimulating the imagination, which it must necessarily give, it has widened our outlook on life in general. The lectures have incited further interest to read more, to get to know more of the world, its history, its peoples and their activities—more, in fact, than we should ever learn while confined to the comparatively narrow channels of our own small spheres. The musical programmes, dramas and plays have given us additional pleasures and food for meditation and thought. The time signals, weather forecasts and news bulletins have proved of interest to many, and a boon to those who previously lived a life of comparative isolation. The educational value of broadcasting, its power to give pleasure to all classes under varied conditions, and its extensive appeal are indicated very briefly in these few remarks.

Creating the right atmosphere

Its appeal will doubtless be more extensive at Christmas time. It will forge that link between not only our own people, but between them and the inhabitants of other countries, giving them a common interest. On this occasion it will be both a national and an international aid for our enlightenment and our pleasure. It will serve to unite the people in their common

rejoicing, help to create the essential atmosphere, and spread it throughout the land.

Christmas entertainment at home

We can well imagine the evening scene in a typical family during Christmas time. Gathered round the fire, each comfortably settled in his or her favourite chair, they will be listening to the music, speeches and concerts transmitted from one of the broadcast stations. The darkness outside will enhance the comfort and security within. The spirit of Christmas, with all its attendant joys and pleasures, will pervade the air. No doubt the programmes will be arranged to heighten the effect, and help to create and maintain that atmosphere which only Christmas brings. For family use the loud-speaker will probably be most used, but others will derive equal enjoyment by listening with the telephones. They are all happy and comfortable in their own home and have no need to seek their pleasure farther afield. The state of the weather does not inconvenience them ; they are at home but still in touch with the outer world, invisibly but realistically linked. Thousands of others, in common with them, share the same pleasure. The people who will appreciate it most are undoubtedly those who live in the less densely populated parts of our country.

The Broadcasting of Church Services

Here may be mentioned an innovation, which, due to the characteristic enterprise of broadcasting companies, has been carried out successfully. I refer to the broadcasting of church services. Many, it is true, object to the use of broadcasting for such purposes. This may be due to prejudice, or inability to keep pace with the times. However, it is a matter for personal opinion, and there are others, particularly those whose disabilities confine them to their homes or to the seclusion of hospitals and similar institutions where they are almost cut adrift from external affairs and happenings, who appreciate the enterprise and courage of the broadcasting companies in this direction. An occasion such as Christmas is perhaps more fitting than any other for the broadcasting of some form of church service. Doubtless this will be arranged as a special part of the programmes from the various broadcasting stations.

Simultaneous Broadcasting

The progress of wireless is fully illustrated in the great strides recently made in the matter of simultaneous broadcasting. During the Christmas period this, again, should prove a powerful factor in, so to speak, uniting all sections of the community in various parts of the country, and perhaps in forging the links of greater international friendship. Christmas is such a time when people are more susceptible to these influences. Our large cities and towns will be linked to, say, London through the medium of simultaneous broadcasting. All listeners, even those possessing the humblest set, will be able to participate in the enjoyment of the same programme. It is wonderful to picture the state of affairs at Christmas time, for instance, existing in a country where simultaneous broadcasting has been developed into the complex, yet reliable, system we have in th..

country. Entertainment will be provided for millions of listeners. To those unfamiliar with the technical side of the question the wonder of such an achievement is still more remarkable.

There is, however, still another side to the matter. How will the more serious wireless man, the experimenter, spend his Christmas ? Frankly, one cannot say. Will he take this opportunity to have a rest from the work which constantly claims his attention, keeps him deeply interested night after night, and which is of great importance and value to the advancement of the science ? Or will he be only too pleased to avail himself of this extra spare time to do further work. One is at a loss to know, but so great is the hold which experimental wireless has on many amateurs that one would not be surprised if they adopted the latter course. Their work alone is to many a pleasure, and so they will be amply compensated for what they may miss of the enjoyment of broadcasting, and of the more usual Christmas pastimes. In the course of their work they may even get into touch with very distant lands through the medium of wireless, and one can imagine the exchange of seasonal greetings which would take place. Another tie of friendship would thus be made, and this on a particularly appropriate occasion.

Catering for the Dancer

A further influence of broadcasting on our Christmas festivities concerns those interested in dancing. Here the medium of broadcasting proves of immense value. Dance music will be broadcast from many of the stations during the Christmas period, and dancers provided with the proper receiving equipment, and having access to a suitable room or hall, will have the pleasure of dancing to the accompaniment of some of the best orchestras and bands in the country.

Such enjoyment is by no means confined to the actual dancers, for many who do not take an active part in the dancing still enjoy the music and the atmosphere of pleasure.

A Better Christmas

Sufficient has been indicated to show how the advent of wireless, its expansion and simplification, its application to broadcasting, so that it has become both the hobby and the pleasure for millions of people, has changed our Christmas. We now enjoy this festival more collectively and in a wider sense, and no one can doubt that it is to our benefit. It has helped to spread a broader spirit of comradeship, a wider outlook, and last, but not least, a better appreciation of our common needs and troubles.

In conclusion, we owe to broadcasting a linking together of the peoples, a breaking down of their insularity, and consequent spread of a better spirit of co-operation, and at Christmas time the influence of these factors is more strongly felt.

As a source of Christmas entertainment nothing is more adaptable, and so far-reaching, as the medium of broadcasting. Always a difficult problem, the provision of satisfactory programmes may perhaps be a little easier at Christmas, for all listeners will have only one object, that of being entertained by light music, good humour, and, say, an interesting play or opera. A few may be disappointed, but it is certain that good entertainment will be provided for the vast majority to pass the happy hours, and promote a bright atmosphere for their Christmas activities.

Mullard Double

Mullard H.F. & L.F. Dull Filament Master Valves

THE introduction of the dull filament valve was met with sincere appreciation from those who realised the marked advantages made possible by this design. With customary thoroughness, the Mullard dull filament type valves showed steady improvements in this design, till to-day you can obtain Mullard specialised dull filament valves for both H.F. and L.F. operation.

Mullard Double Ring Valves (named to distinguish them from the Bright Filament H.F. and L.F. Single Ring Valves) have an efficiency in operation that will surprise you, the secret of their reliability and power being the wonderful precision in design and assembly that is maintained during their manufacture, and the extreme care that is taken to ensure their perfect evacuation and final testing. Their sensitivity does not become weakened in service, and their mechanical strength does not permit any possible internal contact between the filament and electrodes.

Mullard

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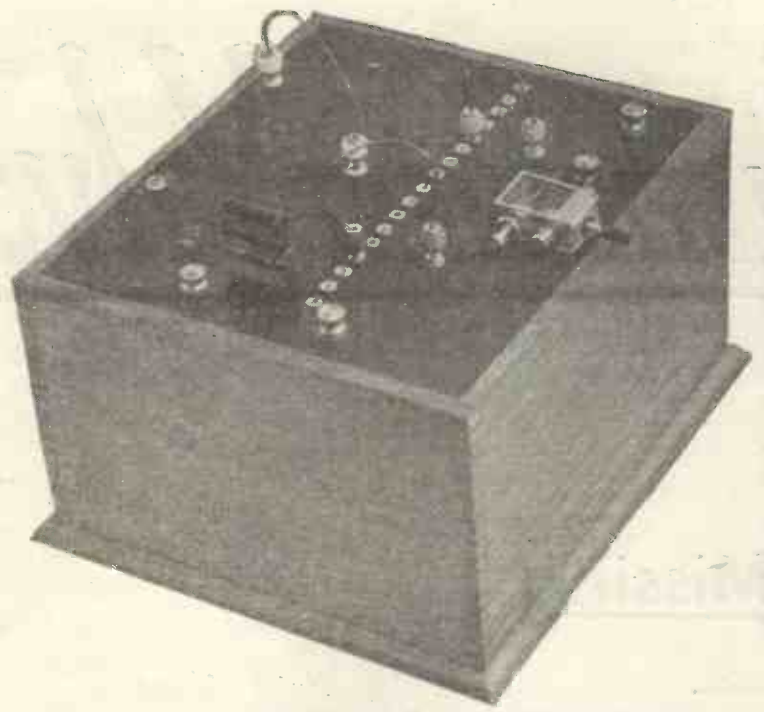

A Low-loss Crystal Set.

By STANLEY G. RATTEE,
Member I.R.E., Staff Editor.

A simple set which may be used on short waves and yet covers the ordinary B.B.C. waveband and 5XX. with a loading coil.

The finished receiver presents a neat appearance.

IT is almost safe to say that every crystal user finds his main interest in the reception of his local broadcasting station or else in the tuning to 5XX. In such circumstances it may be of further interest to listeners to know that there are many fascinating experiments which may be carried out in the reception of stations using wavelengths below those devoted to B.B.C. transmissions, as, for instance, the many amateur transmitters. These stations using low powers are for the most part to be heard working on wavelengths well below 300 metres, and apart from the C.W. telegraphic communications in which they indulge, and which incidentally cannot be received upon the straightforward crystal set, there are a good many telephony transmissions which offer considerable scope in the practice of short-wave reception.

Clix Arrangements

The crystal set about to be described is particularly suitable for work of this kind, in that the tuning arrangements permit by various movements of the Clix plugs, one, two, three, four, five, up to sixty-five turns of the inductance to be connected in the aerial circuit. These sixty-five turns are of large gauge wire and are wound upon a special former which will be described later.

For the reception on the B.B.C. wavelengths these same turns are used plus thirty-five turns of a smaller gauge wire wound upon a separate former, also to be described later. The tuning arrangements in this case are carried out in precisely the same way as for the short waves, by varying the positions of the Clix plugs.

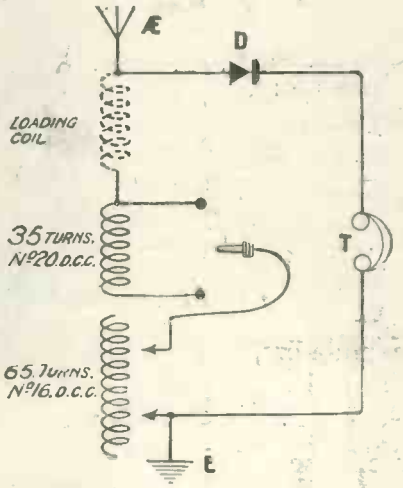

Fig. 1.—The theoretical arrangement.

Those desirous of receiving the longer wavelengths, including Chelmsford, are also catered for in that the receiver is fitted with a coil socket for suitably loading the inductance within the set; tuning in these circumstances being carried out as before by changing the positions of the plugs until the correct number of turns is in circuit.

Neat Appearance

The photographs of the receiver will give the reader some indication of the appearance of the instrument and will also make clear how the scheme of things relative to tuning is made practicable. Those photographs showing the back of the panel will indicate that no very great skill in wiring is called for, and also give some indication of how the coils are made and mounted. The coil with the vertical winding is for the reception of short waves, whilst the same coil connected in series with the second coil, the turns of which are wound horizontally and crossing each other, permits of the reception of the B.B.C. stations. In some circumstances, such as when the receiver is connected to a large aerial, the B.B.C. stations will be best received upon the sixty-five turn coil alone.

Terminal Connections

Looking, for the moment, at the photograph showing the face of the panel, the two terminals on the left are for the aerial and earth connections, whilst between them will be seen the coil mount for the loading coil; this socket will be short-circuited, of course, when it is desired to receive either short wavelengths or the B.B.C. stations exclusive of 5XX. The two terminals in the bottom right-hand corner of the panel are for the telephone receivers. Referring now to the long line of Clix sockets which extends across the panel,

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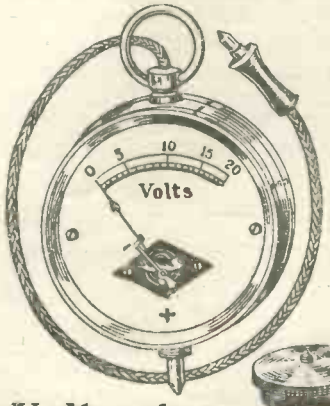

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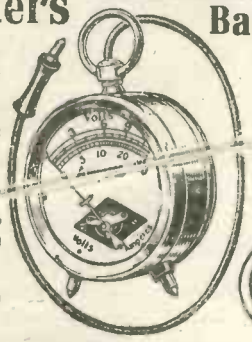

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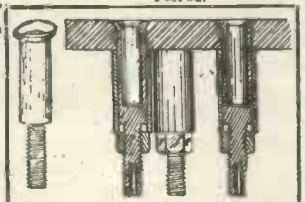

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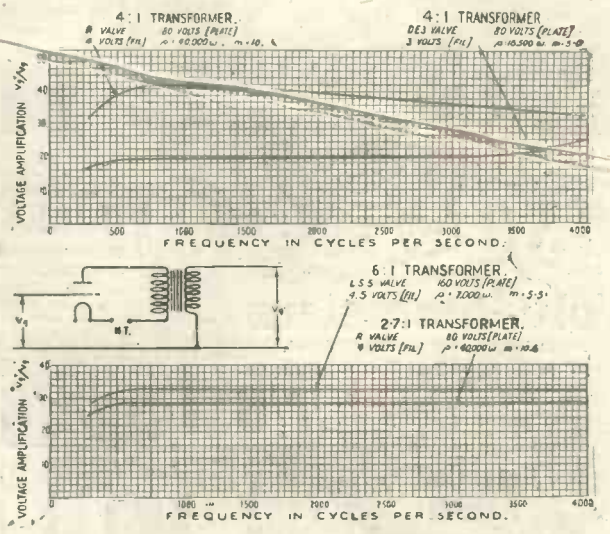

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which goes with each Marconiphone "Ideal" Transformer guarantees that the amplification curve at all points comes within five per cent. of the example shown above, when used with a valve with the same constants as quoted. The guarantee also provides for free replacement where a break in the winding occurs within six months.

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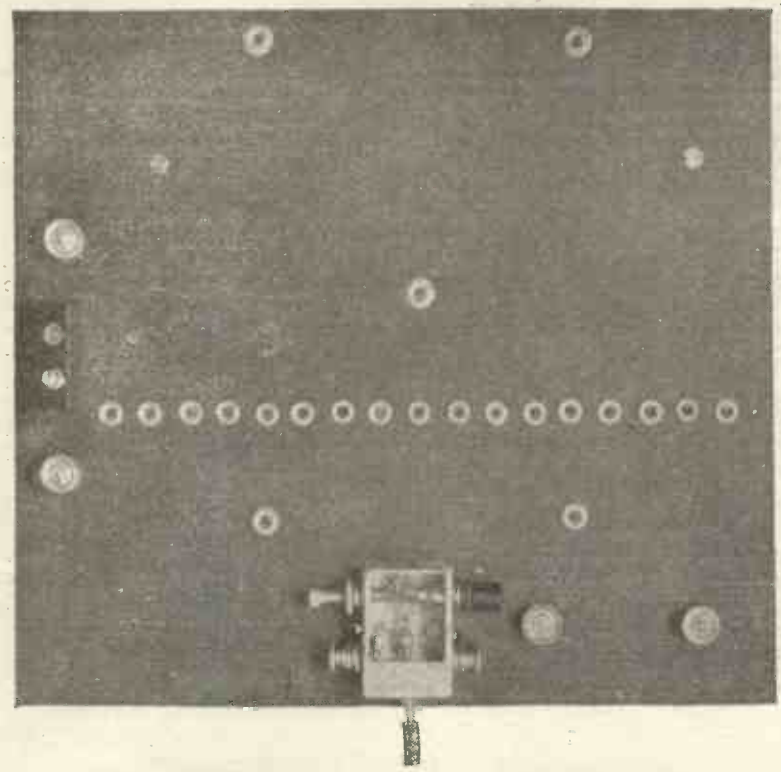


A plan view of the panel showing the lay-out.

these are connected to tappings made upon the sixty-five turn coil; reading from the left the first eleven sockets have one turn between them, the eleventh and twelfth have five turns between them, and the twelfth, thirteenth, fourteenth, fifteenth, sixteenth and seventeenth have each ten turns between them.

The Smaller Coil

The two sockets which may be seen below the seventeenth just referred to represent as it were the connecting links between the coil and the remainder of the circuit, the number of turns of the coil in use being connected to these two sockets by means of Clix plugs and flexible wire.

The three sockets situated above the line of seventeen introduce or cut out the thirty-five turns coil, the socket in the centre of the panel being common to both conditions. With this socket connected externally by means of Clix plugs and flexible wire to the left hand socket of the three under discussion, the thirty-five turns coil is *not* in circuit, whilst with the connection taken to the right-hand socket the thirty-five turns are in series with the sixty-five turns coil, the whole being tuned by varying the number of turns of the larger coil, the minimum number in the whole circuit being thirty-six (35 turns plus 1 of the 65 turns), and the maximum being one hundred (35 plus 65).

Materials and Components

In accordance with the usual practice of this journal, the components and materials embodied in this receiver are given below, together with the names of the manufacturers concerned.

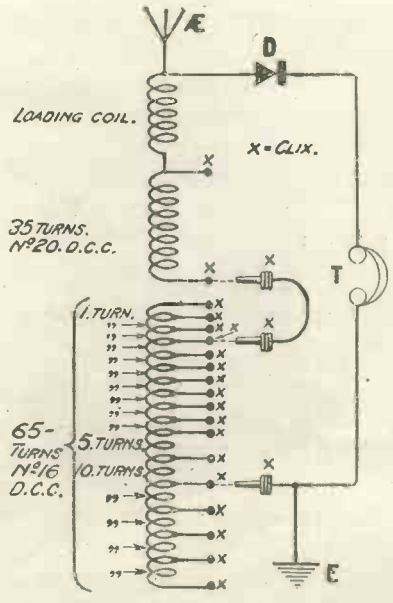


Fig. 2.—Shows how the coils are tapped.

One ebonite panel, measuring 9 in. by 10 in. by ¼ in.
Four brass terminals.
One coil mount (McMichael).
One crystal detector (Belling-Lee).
Twenty-eight Clix with lock-nuts.
Two Clix insulators (blue).
Two Clix insulators (red).
Two Clix insulators (one white, one yellow).
Five Clix bushes (one blue, one red, one white, two yellow) (Autoveyors, Ltd.).
One pound No. 16 d.c.c. copper wire (Burne-Jones).
One pound No. 20 d.c.c. copper wire (Burne-Jones).
Quantity No. 16 tinned copper connecting wire.
Two strips of ebonite, 8 in. by 3 in. by ¼ in.
Two wood blocks, 3 in. by 2 in. by 1 in.
Two pieces of ebonite, 3 in. by 2 in. by ¼ in.
Twelve ¾ in. wood screws.
Three pieces of rubber-covered flex, each 6 in. long.
Containing box to take panel 9 in. by 10 in. by ¼ in., and not less than 6 in. deep.

Constructing the Former

The former upon which the sixty-five turns coil is wound is rectangular in shape, being made up from the two ebonite strips, 8 in. by 3 in. by ¼ in., separated by the two wood blocks, 3 in. by 2 in. by 1 in.

First drill a 3-16 in. hole in each corner of the two ebonite strips as shown in the illustration giving constructional details of the former. Now set up on its 1-in. by 3-in. edge one of the wood blocks (3 in. by 2 in. by 1 in.) and along its top surface rest one end of the ebonite strip with its 3-in. edge flush with the 3-in. edge of the block. By means of a small bradawl make, through the drill holes in the ebonite, two small holes in the wood to act as guides for the screws, and then secure the ebonite to the block by means of two ¾-in. wood screws. With this operation completed, the same procedure is adopted with the other end of the same ebonite strip and the other block, the final shape being an inverted letter U but with right-angle corners. At this stage the former is laid with the strip of ebonite just secured, acting as its base, or in other words the former is turned over to make the letter U the right way up, the top of the arms being formed by the 3-in. by 1-in. edges of the two wood blocks. Along the tops of these two edges is now laid the remaining ebonite strip (8 in.

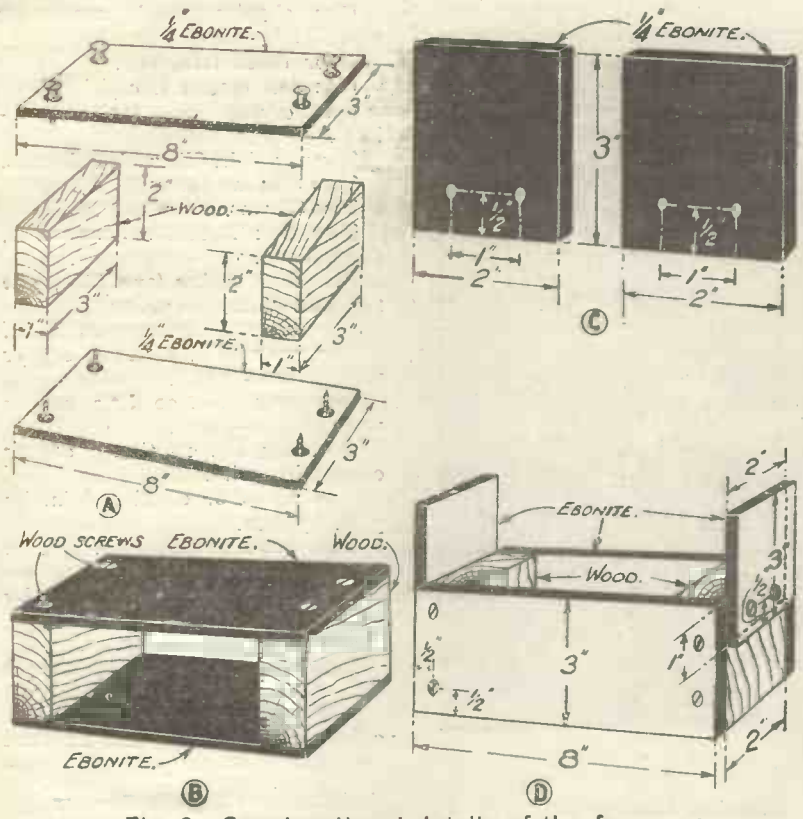


Fig. 3.—Constructional details of the former.

by 3 in. by ¼ in.), with the 3-in. edges of the ebonite flush with the 3-in. edges of the wood blocks, when the ebonite is secured to the wood as before; the former should have the appearance of the illustration B in Fig. 3.

The next operation in constructing the former is to secure the two ebonite pieces (2 in. by 3 in. by ¼ in.) to the outside faces of the wood blocks, as illustrated in Fig. 3, D, wherein all dimensions are given.

In making this former the ebonite used may be any old scrap that may be lying about, such as an old panel, but it must be remembered that the edges whereon the wire will rest must be perfectly straight, meaning that there must not be the remains of an old drill hole or saw cut or other similar disfigurement.

Winding the Inductance

The winding of the sixty-five turns coil is first carried out and is made upon the former, consisting of the two wood blocks and the two ebonite strips. First drill in one strip of ebonite, ¼ in. from the edge and ¼ in. from the block, a 1-16 in. hole through which pass from the inside about 6 in. of the No. 16 d.c.c. wire; bend back the coil wire so that the winding may begin at the same point as the hole just drilled. This method of threading the wire through a small hole and bending the remaining coil back gives a secure hold for commencing the winding, which may now be proceeded with.

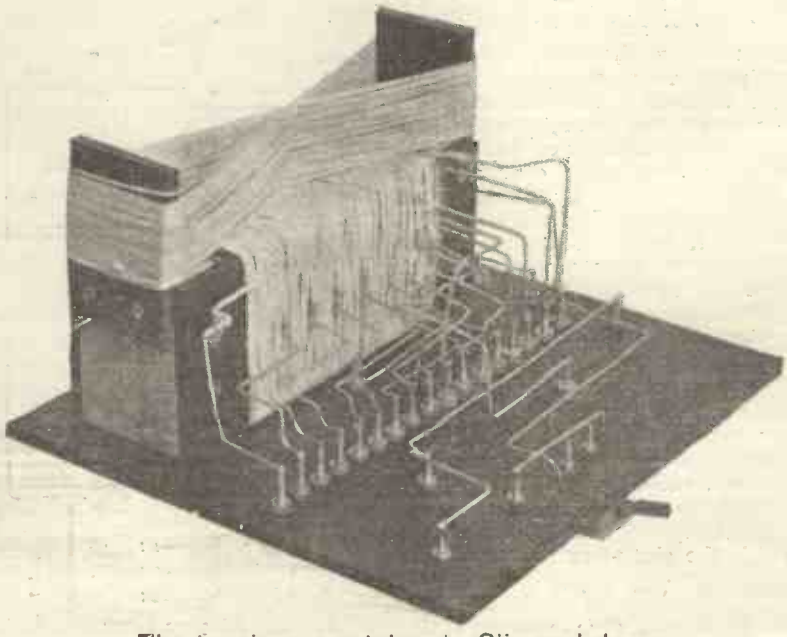
Method of Winding

The best method to adopt in winding a coil with so stiff a wire as No. 16 d.c.c. is to seek assistance in rotating the coil while the constructor himself rotates the former, taking up the slack as paid out by the assistant. In this manner sixty-five turns are wound tightly and closely together to prevent slipping, and finally secured by making another drill hole at the other end of the former, threading the wire through as before and giving the end a sharp bend close up to the ebonite.

The winding of the thirty-five turns coil is now commenced by drilling a 1-16 in. hole, ⅛ in. from the edge of one of the side ebonite pieces (2 in. by 3 in. by ¼ in.), and ¼ in. above the edge of the wood block.

Securing the Winding

Thread the end of the No. 20 d.c.c. wire through this hole, giving it about three turns round the ebonite between the hole and the near edge, and commence the winding by stretching the wire from this point of security to the opposite side of the other ebonite piece (diagonally) round the 2-in. edge of this support back to the first support, but on the opposite side so as to form an X. A glance at the photographs indicates exactly what is meant. In this manner thirty-five complete turns are wound and the end secured in precisely the same way as was done with the beginning of the coil, leaving about six spare inches of wire for connecting purposes. No shellac or other material should be used upon these coils.



The tappings are taken to Clix sockets.

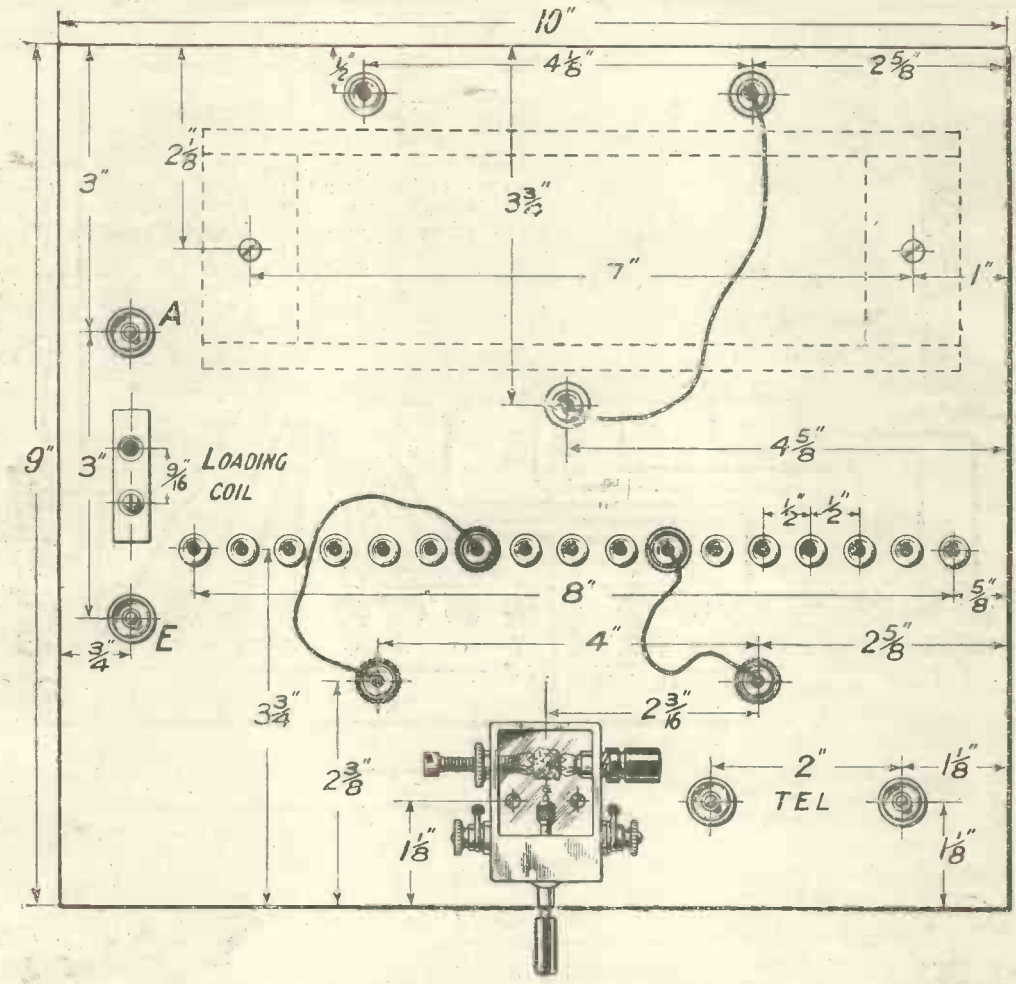


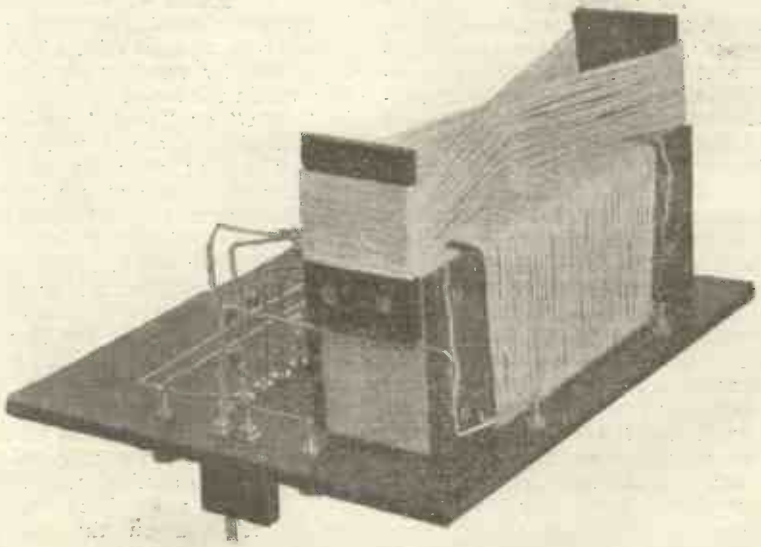
Fig. 4.—Front of panel drilling diagram.

The Panel

The details concerning the panel, drilling dimensions, and so on, are given in Fig. 4, and after all instructions have been carried out, the panel, unless guaranteed ebonite be used, should be treated with a thorough rubbing on both sides with fine emery paper in order to remove the surface skin. With guaranteed ebonite, which is now as easy to obtain as any other, the necessity of rubbing is of course eliminated. The inductance is mounted upon the panel by means of two brass wood screws, the holes through which these screws pass being shown in the lay-out. The inductance itself is mounted upon its 2-in. by 8-in. edges, with the thirty-five coil, as shown in the photographs. All other particulars are clearly marked in the illustration.

Wiring Up

The actual wiring up of the receiver may be seen from the photographs showing the underside of the panel, whilst a practical wiring diagram is also given. All connections are best soldered with this receiver, and for easy working it is best first to connect up the sixty-five turn coil. In this work of connecting the coil none other than ordinary skill is called for, and is best proceeded with as follows: Place the panel upside down so that the aerial earth terminals are on the right and the seventeen Clix are between you and the coil. Remove a little o the cotton covering from the ends of the wire at each end of the coil



A photograph showing the diagonal winding of the 35-turn coil

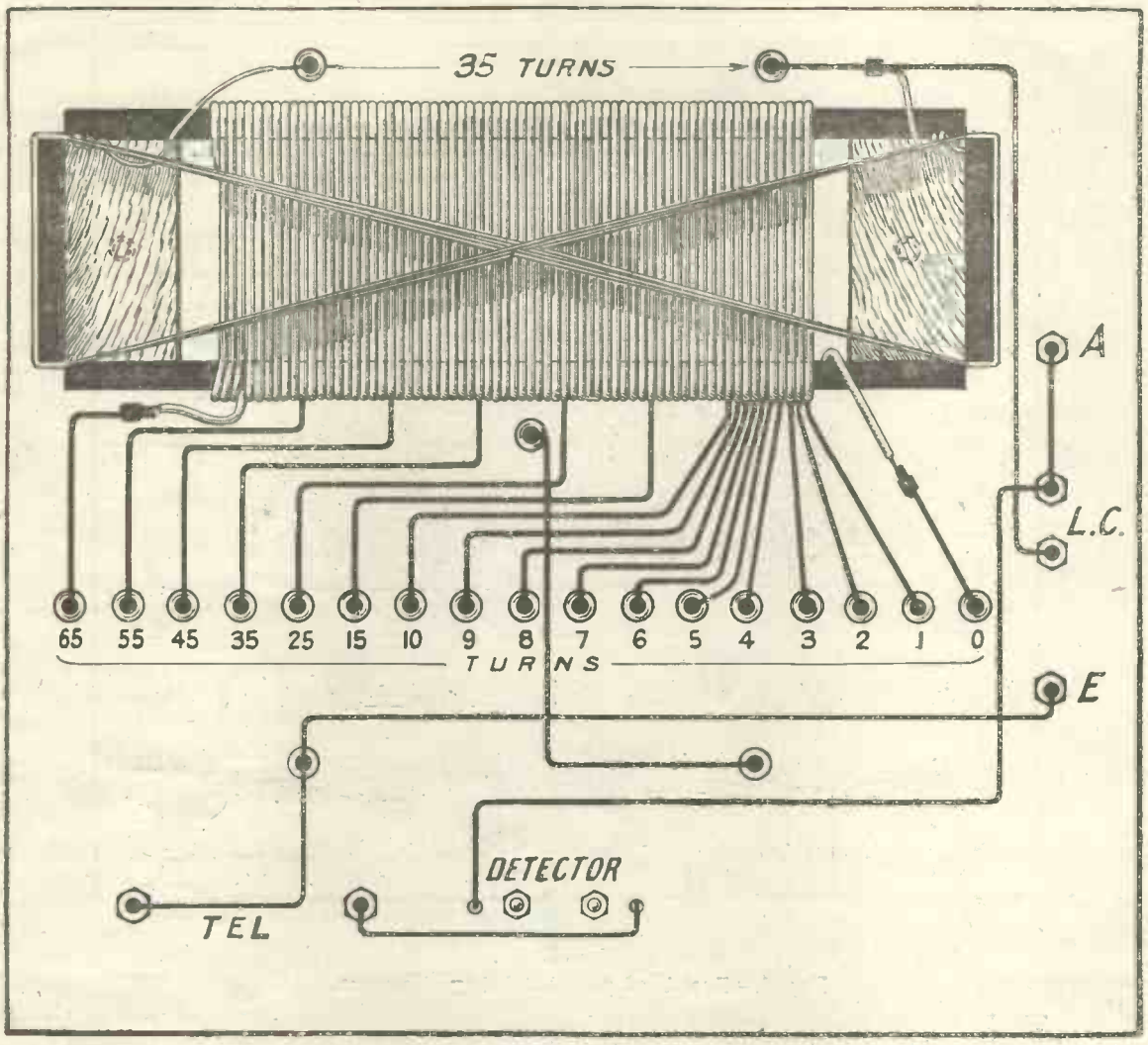


Fig. 5.—Back of panel wiring diagram.

and now, working from the left to the right, scrape the insulation away for about ¼ in. from the tenth, twentieth, thirtieth, fortieth, fiftieth, fifty-fifth, fifty-sixth, fifty-seventh, fifty-eighth, fifty-ninth, sixtieth, sixty-first, sixty-second, sixty-third, and sixty-fourth turns, and tin with a soldering iron. Again working from the left, first connect the end of the coil to the first Clix, the tenth turn to the second Clix, the twentieth turn to the third Clix, and so on until the fiftieth turn is connected to the sixth Clix. The fifty-fifth turn is now connected to the seventh Clix, and each succeeding turn is now connected to each succeeding Clix until the end of the coil is connected to the seventeenth Clix. Wiring the coil in this manner gives easy accessibility to all its connections, and once done makes easier the accessibility to other components.

Operating the Receiver

The operation of this receiver is perfectly straightforward and calls for no especial skill. Tuning is effected by varying the number of turns in the aerial circuit, either in "tens" or "ones" until the desired signals are heard, when further tuning may be effected by varying the inductance by one turn either one way or the other. The tuning for the reception of the B.B.C. stations will be found quite an easy accomplishment by plugging the 35 turns coil in circuit and varying the plugs in the line of seventeen sockets. With large aerials the tuning of these stations may be effected by using the 65 turns alone. On a given station the number of turns required to give the best signals will show whether or not that station can be received on the 65 coil alone.

Crystal Set (S. G. Rattee) Test Report

The set was tested in the evening about eight miles S.W. of 2LO on an average aerial 30 ft. high and 60 ft. long, unscreened, and using really efficient earth, signals from 2LO were of very good strength in the 'phones. A Baby Sterling loudspeaker was connected in their place, and the music was audible at 8 ft. from the L.S. Using only the thicker wire coil, tappings for the best results were taken at the first and the ninth sockets starting from the right. On the same aerial and using a loading coil, Chelmsford came in well, and there was little to choose between the strength of signals from this station and from 2LO. Morse was clearly heard on several settings, and one amateur (no call sign given) was also picked up after 2LO had closed down.

Regular Programmes from Continental Broadcasting Stations

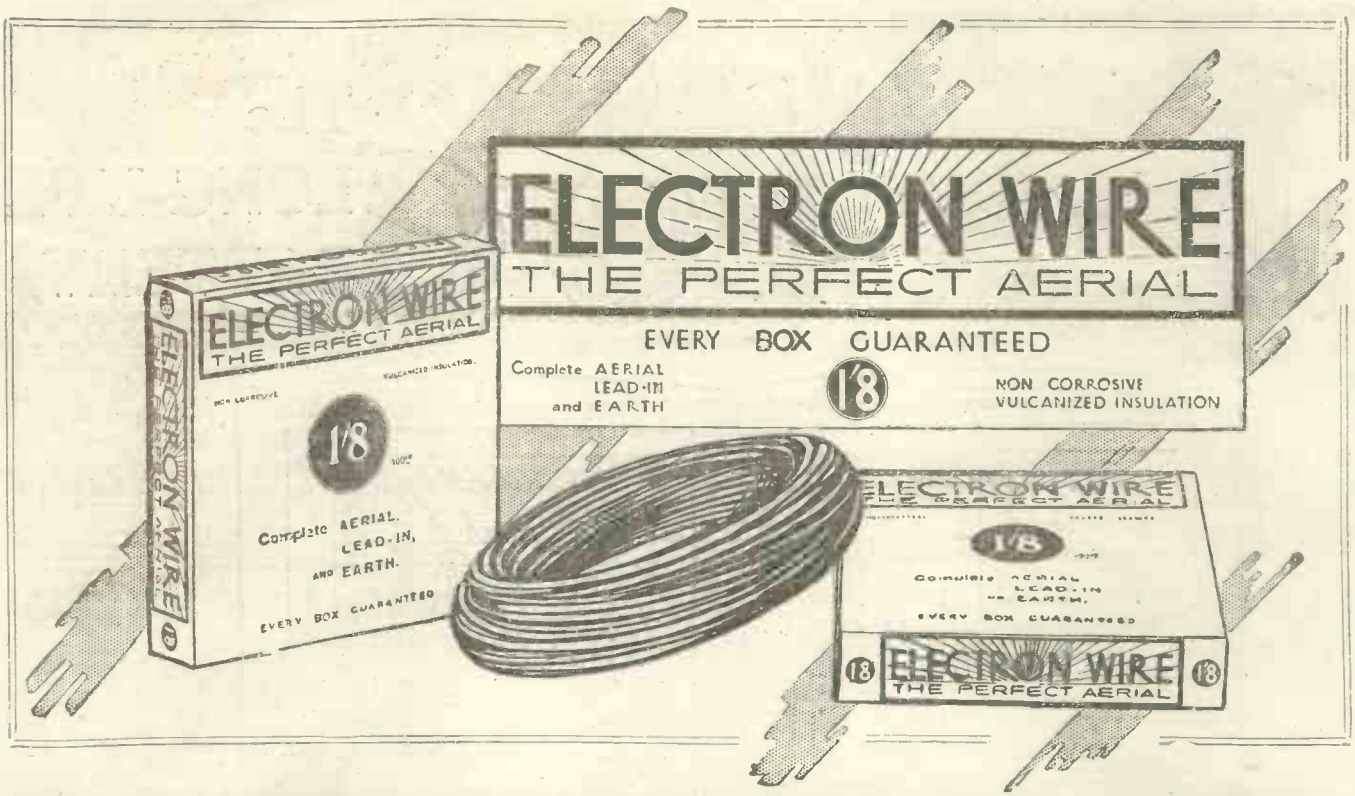
Telephony except when otherwise stated. Corrected up to November 20th, 1924.

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

WEEK DAYS.

Ref. No.	G. M. T.	Name of Station.	Call Sign and Wave-length.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used
	a.m.						
1	6.25	Hamburg	—— 395 m.	Germany	Time Signal in C.E.T.	5 mins.	700 Watts.
2	6.40	Eiffel Tower	FL 2600 m.	Paris	Weather Forecast	5 mins.	5 Kw.
3	6.55	Munster	—— 413 m.	Westphalia	Time Signal in C.E.T.	5 mins.	1.5 Kw.
4	7.05	Lausanne	HB2 850 m.	Switzerland	Weather Report	5 mins.	300 Watts.
5	7.55	Persbureau Vas Dias	PCFF 2125 m.	Amsterdam	Stocks, Shares and News	10 mins.	2 Kw.
8	9.23	Eiffel Tower	FL 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 mins.	—
9	9.55	Persbureau Vaz Dias	PCFF 2125 m.	Amsterdam	Stocks, Shares and News	10 mins.	2 Kw.
10	10.00	Eiffel Tower	FL 2600 m.	Paris	Time Signal in Greenwich Sidereal Time (Spark)	5 mins.	—
156	10.00	Radio Wien	—— 530 m.	Austria	Concert	Noon	1 Kw.
11	10.30	Lyons	YN 470 m.	Lyons	Gramophone Concert	30 mins.	500 Watts.
12	10.30	Kbel	—— 1150 m.	Prague	Exchange quotations	10 mins.	1 Kw.
13	10.44	Eiffel Tower	FL 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 mins.	—
14	10.55	Eiffel Tower	FL 2600 m.	Paris	Fish Market Quotations—Cotton Exchange.	10 mins.	5 Kw.
15	10.55	Frankfurt	—— 467 m.	Frankfurt	Time Signals (spoken) followed by News (in C.E.T.)	5 mins.	1 Kw.
16	11.00	Stuttgart	—— 443 m.	Wurtemberg	News and Opening Prices	10 mins.	1 Kw.
17	11.10	Persbureau Vaz Dias.	PCFF 2125 m.	Amsterdam	Stocks and Shares	20 mins.	2 Kw.
18	11.14	Eiffel Tower	FL 2600 m.	Paris	Time Signal in Greenwich Time (Spoken), followed by Weather Forecast.	5 mins.	5 Kw.
20	11.15	Voxhaus	—— 430 m.	Berlin	First News Bulletin and Weather Reports.	5 mins.	700 Watts.
19	11.55	Konigsberg	—— 460 m.	East Prussia	Time Signal in C.E.T.	5 mins.	1 Kw.
21	11.55	Voxhaus	—— 430 m.	Berlin	Time Signal in C.E.T.	5 mins.	700 Watts.
22	11.55	Leipzig	—— 454 m.	Germany	Time Signal Relayed from Baven	5 mins.	700 Watts.
23	11.57	Nauen	POZ 3100 m.	Berlin	Time Signal in G.M.T. (Spark)	8 mins.	—
157	12.00 noon	Zurich	—— 650 m.	Switzerland	Weather Forecast, Shares and News.	45 mins.	500 Watts.
24	12.00	Persbureau Vaz Dias.	PCFF 2125 m.	Amsterdam	Stocks and Shares	8 mins.	2 Kw.
	p.m.						
26	12.15	Geneva	HB1 1100 m.	Switzerland	Lecture	12.45 p.m.	300 Watts.
25	12.30	Kbel	—— 1150 m.	Prague	Exchange Quotations	10 mins.	1 Kw.
27	12.30	Lausanne	HB2 850 m.	Switzerland	Weather Reports, Time Signal in C.E.T. and News.	15 mins.	300 Watts.
30	12.45	Stockholm	—— 440 m.	Sweden	Weather Forecast	5 mins.	500 Watts.
31	12.45	Persbureau Vaz Dias.	PCFF 2125 m.	Amsterdam	Stocks and Shares	10 mins.	2 Kw.
32	1.00	Radio-Paris	SFR 1780 m.	Clichy	Concert followed by News	2 p.m.	8 Kw.
33	1.00	Haeren	BAV 1100 m.	Brussels	Weather Forecast in French and English.	8 mins.	150 Watts.
34	1.00	Munich	—— 485 m.	Bavaria	News and Weather Report	10 mins.	1 Kw.
36	1.00	Stockholm	—— 440 m.	Sweden	Time Signal	3 mins.	500 Watts.
37	1.15	Voxhaus	—— 430 m.	Berlin	Stock Exchange News	5 mins.	700 Watts.
35	1.15	Komarow	—— 1800 m.	Czecho-Slovakia.	Stock Exchange and Late News	10 mins.	1 Kw.
40	2.30	Munster	—— 410 m.	Westphalia	Stocks, Shares and News	10 mins.	1.5 Kw.
38	2.40	Persbureau Vaz Dias.	PCFF 2125 m.	Amsterdam	Stocks, Shares and News	10 mins.	2 Kw.
39	2.45	Eiffel Tower	FL 2600 m.	Paris	Exchange Opening Prices. (Sat. excepted).	8 mins.	5 Kw.
158	3.00	Zurich	—— 650 m.	Switzerland	Hotel Concert, Relayed	5 p.m.	500 Kw.
159	3.10	Radio-Wien	—— 530 m.	Vienna	Concert	5 p.m.	1 Kw.

Ref. No.	G. M. 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.						
42	3.30	Frankfurt	—— 467 m.	Germany	Light Orchestra	5 p.m.	1 Kw.
43	3.30	Konigsberg	—— 460 m.	East Prussia	Light Orchestra	1 hour.	1 Kw.
44	3.30	Voxhaus	—— 430 m.	Berlin	Concert, followed by News	5.30 p.m.	700 Wat's.
45	3.30	Munich	—— 485 m.	Bavaria	Concert	4.30 p.m.	1 Kw.
46	3.30	Leipzig	—— 454 m.	Germany	Concert	5 p.m.	700 Watts.
47	3.35	Eiffel Tower	FL 2600 m.	Paris	Exchange Quotations (Sat. excepted).	5 mins.	5 Kw.
48	3.55	Persbureau Vaz Dias.	PCFF 2125 m.	Amsterdam	Stock Exchange and News	10 mins.	2 Kw.
49	4.00	Kbel	—— 1150 m.	Prague	Shares and News	10 mins.	1 Kw.
160	4.00	Breslau	—— 418 m.	Silesia	Light Orchestra	5 p.m.	1.5 Kw.
51	4.30	Radio-Paris	SFR 1780 m.	Clichy	Concert preceded and followed by News.	5.45 p.m.	8 Kw.
52	4.30	Eiffel Tower	FL 2600 m.	Paris	Exchange Closing Prices (except Saturday).	8 mins.	5 Kw.
53	4.45	Stuttgart	—— 443 m.	Wurtemberg	Concert followed by Weather Report (Saturdays excepted).	6 p.m.	1 Kw.
54	5.00	Radio-Belg.	SBR 265 m.	Brussels	Concert followed by News	6 p.m.	2.5 Kw.
177	5.00	Barcelona	EAJ1. 325 m.	Spain	Tests	7.00 p.m.	650 Watts.
161	5.30	Munich	—— 485 m.	Bavaria	Light Orchestra	6.30 p.m.	1 Kw.
55	5.55	Lausanne	HB2 850 m.	Switzerland	Weather Report	5 mins.	300 Watts.
162	6.00	Eiffel Tower	FL 2600 m.	Paris	Concert followed by News Bulletin	6.55 p.m.	5 Kw.
163	6.00	Leipzig	—— 454 m.	Germany	Lecture (Saturdays excepted)	6.30 p.m.	700 Watts.
57	6.30	Kbel	—— 1150 m.	Prague	Concert and News	7.30 p.m.	1 Kw.
178	6.30	Seville	EAJ5 350 m.	Spain	Concert	7.45 p.m.	1 Kw.
58	7.00	Eiffel Tower	FL 2600 m.	Paris	General Weather Forecast	8 mins.	5 Kw.
60	7.00	Radio-Wien	—— 530 m.	Vienna	Concert	9 p.m.	1 Kw.
61	7.00	Konigsberg	—— 460 m.	East Prussia	Concert and News	8.30 p.m.	1 Kw.
62	7.00	Hamburg	—— 395 m.	Germany	Concert and Late News	9.50 p.m.	700 Watts.
63	7.00	Stuttgart	—— 443 m.	Wurtemberg	Concert and News	9.30 p.m.	1 Kw.
66	7.00	Lausanne	HB2 850 m.	Switzerland	Concert (Monday excepted)	9.30 p.m.	300 Watts.
179	7.00	Radio-Iberica	RI 392 m.	Madrid, Spain	Concert and News	8.00 p.m.	3 Kw.
64	7.15	Zurich	—— 650 m.	Switzerland	Concert followed by Late News	9.15 p.m.	500 Watts.
65	7.15	Leipzig	—— 454 m.	Leipzig	Concert and News	8.35 p.m.	700 Watts.
67	7.30	Frankfurt	—— 467 m.	Frankfurt	Concert and News	10 p.m.	1 Kw.
69	7.30	Breslau	—— 418 m.	Silesia	Concert	9 p.m.	1.5 Kw.
59	7.30	Munster	—— 410 m.	Westphalia	Concert followed by News	9 p.m.	1.5 Kw.
72	7.30	Voxhaus	—— 430 & 505	Berlin	Concert followed by News and Weather Report.	9.15 p.m.	0.7 and 1.5 Kw.
73	7.30	Munich	—— 485 m.	Bavaria	Concert and News	8.40 p.m.	1 Kw.
164	8.00	Radiofonica Italiana.	—— 422 m.	Rome	Concert followed by News	9.30 p.m.	4 Kw.
74	8.15	Radio-Belg.	SBR 265 m.	Brussels	Concert preceded and followed by News.	10.10 p.m.	2.5 Kw.
75	8.30	Ecole. Sup. des P.& Tg.	FPTT 450 m.	Paris	Concert, sometimes preceded by Lecture, usually outside broadcast.	9 p.m.	500 Watts.
76	8.30	Radio-Paris	SFR 1780 m.	Clichy	Detailed News Bulletin	9 p.m.	8 Kw.
77	9.00	Radio-Paris	SFR 1780 m.	Clichy	Time Signal followed by Concert	9.50 p.m.	8 Kw.
78	9.30	Radio-Iberica	—— 392 m.	Madrid	Concert, Advertisements	Midnight	3 Kw.
79	10.00	Eiffel Tower	FL 2600 m.	Paris	Time Signal in Greenwich Sidereal Time (Spark).	5 mins.	—
80	10.10	Eiffel Tower	FL 2600 m.	Paris	General Weather Forecast	5 mins.	5 Kw.
81	10.44	Eiffel Tower	FL 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 mins.	—
82	11.57	Nauen	POZ 3100 m.	Berlin	Time Signal in G.M.T. (Spark)	3 mins.	—
			SUNDAYS				
	a.m.						
83	7.00	Frankfurt	—— 467 m.	Germany	Morning Prayer	1 hour	1 Kw.
84	7.55	Hamburg	—— 395 m.	Germany	Time Signal	5 min.	700 Watts.
85	8.00	Leipzig	—— 454 m.	Germany	Morning Prayer	1 hour	700 Watts.
165	8.00	Konigsberg	—— 460 m.	E. Prussia	Morning Prayer	8.45 a.m.	1 Kw.
86	9.00	Komarow	—— 1800 m.	Czecho-Slovakia.	Sacred Concert	1 hour	1 Kw.
87	9.23	Eiffel Tower	FL 2600 m.	Paris	Time Signal in Greenwich Mean Time (Spark).	3 mins.	—
166	9.30	Munich	—— 485 m.	Bavaria	Sacred Concert	10.30 a.m.	1 Kw.
88	9.40	Konigswusterhausen.	LP 680 m.	—	Concert	1 hour	3 Kw.
89	10.00	Eiffel Tower	FL 2600 m.	Paris	Time Signal in Greenwich Sidereal Time (Spark).	5 mins.	—
90	10.00	Kbel	—— 1150 m.	Prague	Classical Music	1 hour	1 Kw.



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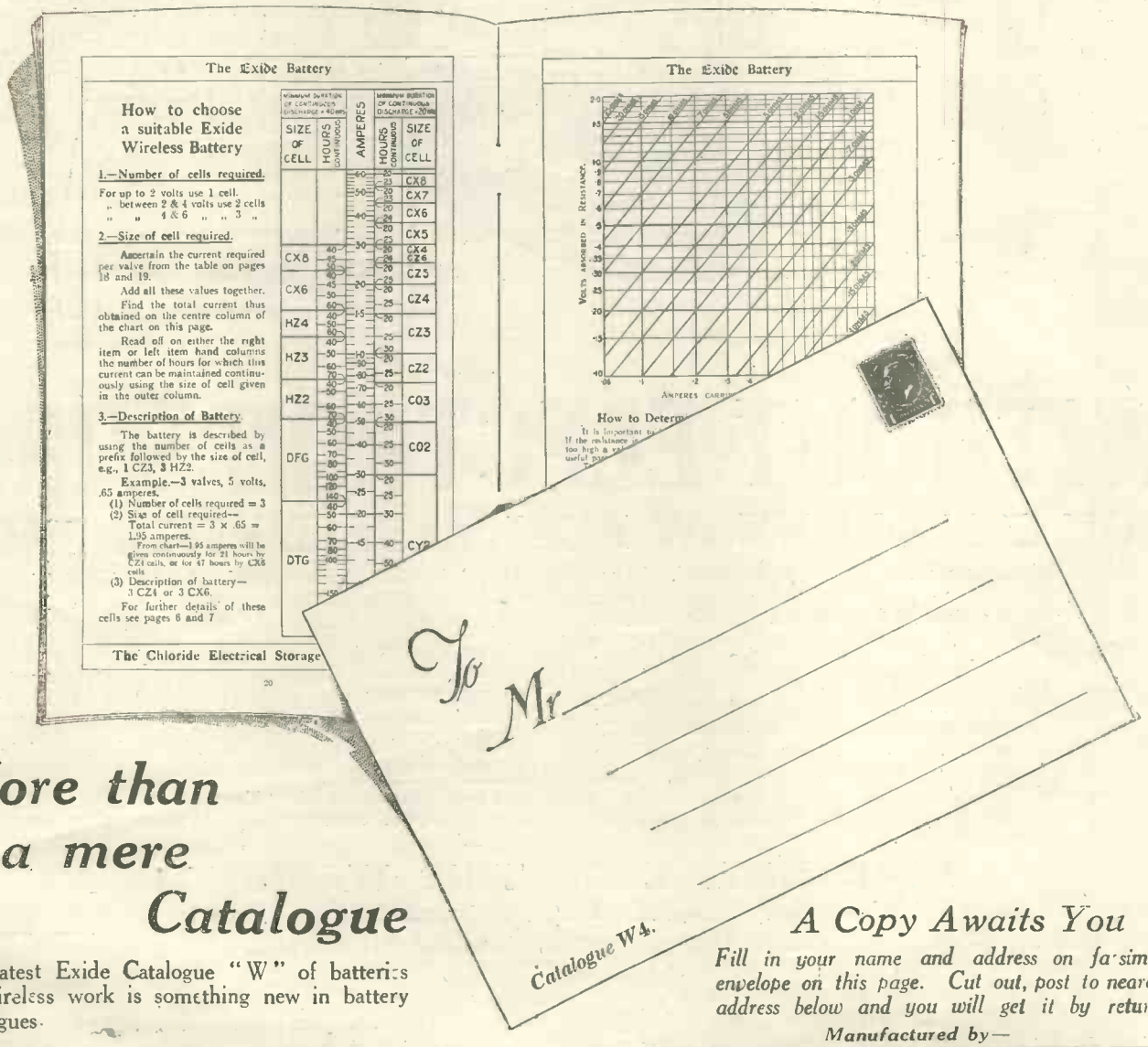

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Ref. No.	G. M. T.	Name of Station.	Call Sign and Wave-length.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
			SUNDAYS (contd.)				
	a.m.						
91	10.00	Breslau	—— 418 m.	Silesia	Concert	1 hour	1.5 Kw.
92	10.00	Radio-Wien	—— 530 m.	Vienna	Concert	2 hours	1 Kw.
93	10.30	Lyons	YN 470 m.	Lyons	Gramophone Records	11 a.m.	500 Watts.
94	10.30	Stuttgart	—— 443 m.	Wurtemberg	Classical Concert	1 hour	1 Kw.
95	10.44	Eiffel Tower	FL 2600 m.	Paris	Time Signal in G.M.T: (Spark)	3 mins.	—
96	10.50	Konigswusterhausen.	LP 2450 m.	Berlin	Concert	11.45 a.m.	6 Kw.
97	10.55	Eiffel Tower	FL 2600 m.	Paris	Fish Market Quotations, followed by Weather Report.	12 mins.	5 Kw.
98	11.00	Stockholm	—— 440 m.	Sweden	Divine Service	12.15	500 Watts.
101	11.57	Nauen	POZ 3100 m.	Berlin	Time Signal in G.M.T. (Spark)	3 mins.	—
	p.m.						
102	1.00	Radio-Paris	SFR 1780 m.	Clichy	Concert, followed by News	2.00 p.m.	8 Kw.
103	2.40	Ned. Radio Industrie.	PCGG 1070 m.	The Hague	Concert, followed by Announcements in English.	5.40 p.m.	1.3 Kw.
104	3.00	Breslau	—— 418 m.	Silesia	Children's Stories	3.45 p.m.	1.5 Kw.
105	3.00	Stuttgart	—— 443 m.	Wurtemberg	Light Orchestra	5.00 p.m.	1 Kw.
107	3.00	Frankfurt	—— 410 m.	Germany			1 Kw.
167	3.00	Zurich	—— 650 m.	Switzerland	Local Hotel Concert	5.00 p.m.	500 Watts.
106	3.10	Radio-Wien	—— 530 m.	Vienna		5.00 p.m.	1 Kw.
168	3.30	Konigsberg	—— 460 m.	E. Prussia	Light Orchestra	4.30 p.m.	1 Kw.
169	3.30	Voxhaus	430 & 505 m.	Berlin	Light Orchestra	5.15 p.m.	1 Kw.
170	3.30	Leipzig	—— 454 m.	Germany	Light Orchestra	5.00 p.m.	700 Watts.
108	3.30	Munich	—— 485 m.	Bavaria	Concert	5.00 p.m.	1 Kw.
171	4.00	Frankfurt	—— 410 m.	Germany	Children's Corner	5.00 p.m.	1 Kw.
172	4.45	Stuttgart	—— 443 m.	Wurtemberg	Concert	6.00 p.m.	1 Kw.
110	4.45	Radio-Paris	SFR 1780 m.	Clichy	Concert, followed by News	1 hour	8 Kw.
111	5.00	Radio-Belg.	SBR 265 m.	Brussels	Concert	1 hour	2.5 Kw.
180	5.09	Barcelona	EAJ1 325 m.	Spain	Tests	7.00 p.m.	650 Watts.
112	6.00	Eiffel Tower	FL 2600 m.	Paris	Concert, followed by News	1 hour	5 Kw.
178	6.30	Seville	EAJ5 350 m.	Spain	Concert	7.45 p.m.	1 Kw.
114	7.00	Radio-Wien	—— 530 m.	Vienna	Concert	8.30 p.m.	1 Kw.
115	7.00	Stockholm	—— 440 m.	Sweden	Concert	10.00 p.m.	500 Watts.
118	7.00	Konigsberg	—— 460 m.	E. Prussia	Concert	9.00 p.m.	1 Kw.
119	7.00	Hamburg	—— 395 m.	Germany	Concert	9.00 p.m.	700 Watts.
120	7.00	Eiffel Tower	FL 2600 m.	Paris	General Weather Forecast	8 mins.	5 Kw.
124	7.00	Breslau	—— 418 m.	Silesia	Light Orchestra	9.00 p.m.	1.5 Kw.
125	7.00	Stuttgart	—— 443 m.	Wurtemberg	Concert	9.15 p.m.	1 Kw.
173	7.00	Frankfurt	—— 410 m.	Germany	Entertainment provided by Frankfurter Zeitung.	10.00 p.m.	1 Kw.
121	7.15	Lausanne	HB2 850 m.	Switzerland	Concert	8.30 p.m.	300 Watts.
122	7.15	Zurich	—— 650 m.	Switzerland	Concert	9.15 p.m.	500 Watts.
123	7.15	Leipzig	—— 454 m.	Germany	Symphony Concert	8.40 p.m.	700 Watts.
116	7.00	Munster	—— 410 m.	Westphalia	Classical Concert	9.00 p.m.	1.5 Kw.
174	7.30	Munich	—— 485 m.	Bavaria	Concert	8.30 p.m.	1 Kw.
126	7.40	Ned. Seintoesl. Fabriek.	NSF 1050 m.	Hilversum	Concert	10.10 p.m.	1 Kw.
175	8.00	Radiofonica Italiana.	—— 422 m.	Rome	Concert, followed by Late News	9.30 p.m.	4 Kw.
176	8.00	Copenhagen	—— 750 m.	Denmark	Concert, followed by News	9.30 p.m.	2 Kw.
127	8.30	Radio-Belg.	SBR 265 m.	Brussels	Concert, followed by News	10.10 p.m.	2.5 Kw.
128	8.30	Radio-Paris	SFR 1780 m.	Clichy	Detailed News Bulletin	9.00 p.m.	8 Kw.
129	8.30	Ecole Sup. des P.et Tgs.	FPTT 450 m.	Paris	Concert or Lecture. May begin 15 mins, earlier or later.	10.30 to 12 p.m.	500 Watts.
130	9.00	Radio-Paris	SFR 1780 m.	Clichy	Concert, followed by Dance Music.	10.00 p.m.	8 Kw.
131	9.30	Petit Parisien	—— 340 m.	Paris	Concert (Items announced in English as well as French.)	11.30 p.m.	400 Watts.
132	9.30	Radio-Iberica	—— 392 m.	Spain	Concert	midnight	3 Kw.
133	10.00	Eiffel Tower	FL 2600 m.	Paris	Time Signal in Greenwich Sidereal Time (Spark).	3 mins.	—
134	10.44	Eiffel Tower	FL 2600 m.	Paris	Time Signal in G.M.T. (Spark)	3 mins.	—
135	11.57	Nauen	POZ 3100 m.	Berlin	Time Signal in G.M.T. (Spark)	8 mins.	—
			SPECIAL DAYS.				
	p.m.						
137	4.00	Lausanne	HB2 850 m.	Switzerland	Mon. Children's Stories	1 hour	300 Watts.
140	5.15	Zurich	—— 650 m.	Switzerland	Mon., Wed., Fri. Children's Corner	5.50 p.m.	500 Watts.
141	5.15	Zurich	—— 650 m.	Switzerland	Thurs., Sat. Lecture	30 mins.	500 Watts.

Ref. No.	G. M. T.	Name of Station.	Call Sign and Wave-length.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.	Approx. Power used.
			SPECIAL DAYS (contd.)				
142	p.m. 5.40	Ned: Seintoesl. Fabriek.	NSF 1050.m.	Hilversum	Mon. Children's Hour ..	6.40 p.m.	1 Kw.
146	7.00	Svenska ..	—— 470.m.	Stockholm	Wed. Concert	10 p.m.	300 Watts.
147	7.00	Stockholm ..	—— 440 m.	Sweden ..	Fri., Sat. Concert	10 p.m.	500 Watts.
148	7.40	Smith and Hooghoudt	PA5 1050 m.	Amsterdam	Wed. Concert	9.40 p.m.	500 Watts.
149	8.10	Middelraad ..	PCMM 1050 m.	Ymuiden ..	Sat. Concert .. .	9.40 p.m.	300 Watts.
150	8.40	Ned: Radio In	PCGG 1070 m.	The Hague	Mon. Concert .. .	10.10 p.m.	1.3 Kw.
151	8.40	Amsterdam ..	PX9 1050 m.	Holland ..	Tues. Concert .. .	10.40 p.m.	600 Watts.
152	8.40	Ned. Seintoesl. Fabriek.	NSF 1050 m.	Hilversum	Fri. Concert	9.40 p.m.	1 Kw.
153	9.00	Le Matin ..	SFR 1780 m.	Paris ..	2nd & 4th Sat. of mth. Special Gala Concert	10.50 p.m.	10 Kw.
154	9.30	Petit Parisien	—— 340 m.	Paris ..	Thur. Concert (Items announced in English as well as French).	11.30 p.m.	400 Watts.
155	10.00	Radio-Paris ..	SFR 1780 m.	Clichy ..	Wed., Fri. Dance Music ..	10.45 p.m.	8 Kw.

Buying a Loud-Speaker

By "OLD CHAP."

ONE of the new wireless converts in this district recently spoke to me in the following manner:—

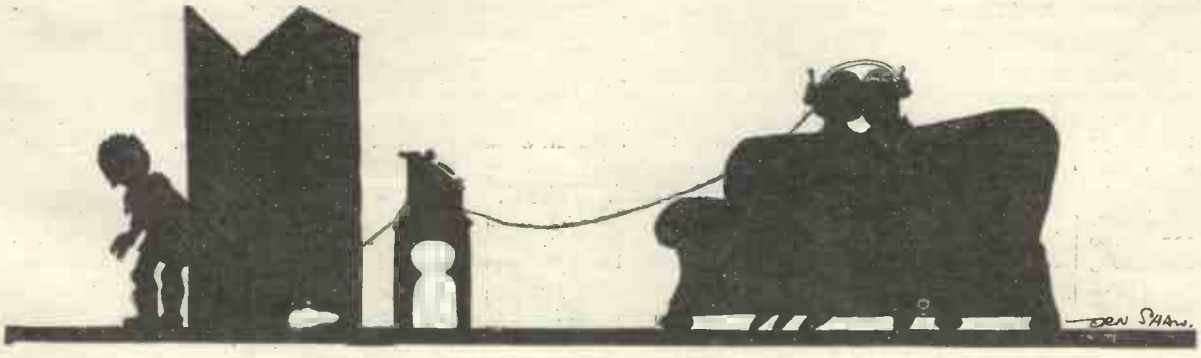
"Look here, old chap, I want to buy a loud-speaker and it's the dickens of a job to decide which one to have. You old hands at the game are so very confusing to a beginner. You still stick to your A——. Your next door neighbour has a B——. A couple of doors away there is a C——. Further down the road there is a U——. The father of us all, our worthy wireless president, has an S—— and a W——. Next door to my place there is an M——, which functions extraordinarily well on a Sunday afternoon, just when I am trying to make up for a little of the sleep I've lost the night before sitting up and listening-in to America. The funny thing about it all is that I like every blessed loud-speaker I've heard. What is the best thing to do?"

"Buy one of each sort and have a loud-speaker in every room. Call the upstairs rooms with loud-speakers Aberdeen; Glasgow and Edinburgh. Put a loud-speaker in the bathroom and call it Manchester. Have London, Birmingham, Bournemouth and Sheffield on the ground floor, hollow ground in the case of Sheffield. Put Cardiff and Newcastle in the coal-cellar and Plymouth on the rockery in the garden. Rig up a simultaneous broadcasting switchboard on the wall near your set, and there you are. Fine loud-speaker scheme, don't you think?"

"I'm talking seriously, and I want serious advice."

"Well, the best advice I can give you is to get your dealer to bring half a dozen loud-speakers to your house and for you to hear them demonstrated on your own set and in your own receiving room. Choose the one which behaves the best under your own actual working conditions and you will not go far wrong."

The wireless convert acted according to the advice given him. At his own house he heard all the loud-speakers he had mentioned to me, and he heard others also. His final choice lay on a loud-speaker of a type he had never heard before. Now he is going about telling everybody that such and such a loud-speaker is the best of the lot, which is a little unfair of him. What he should be telling everybody is that such and such a loud-speaker suits him the best when used with his own set in his own house.



Some Two-Valve Reflex Circuits

These Circuits afford a basis for interesting experiments for the two-valve man.

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

The S.T. 75

THE Fig. 1 circuit has achieved popularity on account of its sensitiveness and effective operation. It involves a stage of high-frequency amplification, a stage of low-frequency and a valve detector between the two stages.

The first valve V_1 acts as a high-frequency amplifier, the amplified currents appearing in the circuit $L_2 C_2$, which is the anode circuit of the first valve. For broadcast wavelengths L_1 may be a No. 35, 50, or 75 coil, L_2 a No. 50 or 75, the condenser C_1 being of ·0005 μF and C_2 of ·0005 or ·0003 μF capacity. A lead is taken, as shown, from the bottom of L_2 to the ·0003 μF grid condenser C_4, and then to the grid of the second valve V_2, which acts as the detector. Across the grid and positive filament of V_2 is connected a 2-megohm gridleak R_3. In the anode circuit of this second valve we have the reaction coil L_3, for which a No. 75 coil will be suitable, and also the primary T_1 of a step-up intervalve transformer T_1T_2, which conveys the low-frequency currents to the grid circuit of the first valve which thereupon amplifies them.

The amplified low-frequency currents pass through the loud-speaker LS, which is included between the anode of the first valve and the circuit L_2C_2, a condenser across it of ·002 μF (the best value may be found by experiment) being preferably provided. A condenser C_5, of not more than ·001 μF capacity, is connected across T_2 to allow the high-frequency currents to pass through. The condenser C_6 of, say, ·0003 μF capacity is optional, and experiment will prove if it is necessary with the particular apparatus used. Care should be taken to keep the loud-speaker away from the accumulator and the high-tension battery, and it should be well insulated. When telephones are used instead of the loud-speaker, there is frequently some difficulty in tuning.

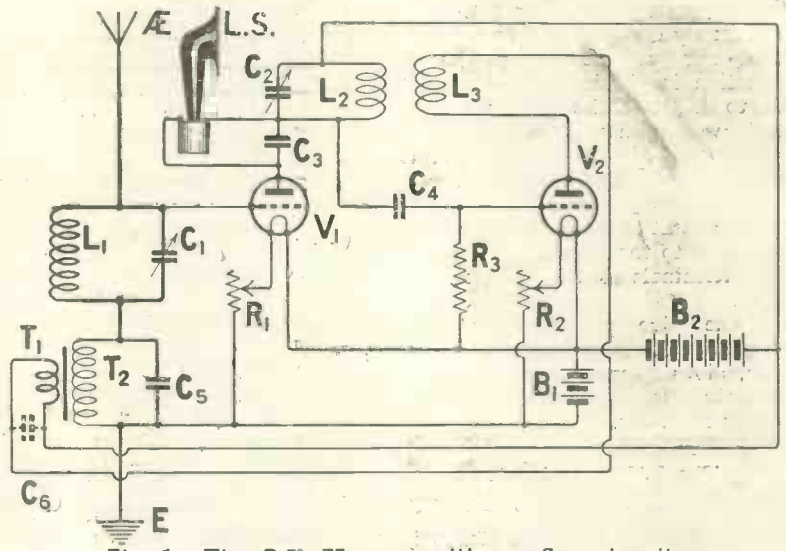


Fig. 1.—The S.T. 75, a sensitive reflex circuit.

The popular S.T. 100

Fig. 2 shows the well-known S.T. 100 circuit, in which the secondary T_2 of the step-up intervalve transformer T_1T_2 is connected directly in the aerial-earth circuit.

The first valve V_1 acts as a high-frequency amplifier, and its anode circuit contains the tuned circuit L_2C_2, which is tuned to the incoming wavelength. For the broadcast band of wavelengths the aerial coil L_1 may be a No. 50 or 75, and L_2 a No. 50 or 75. The condensers, C_1 and C_2 may both have a capacity of ·0005 μF. The crystal detector rectifies the amplified currents set up in L_2C_2, the resultant low-frequency currents being then amplified by the valve V_1, the transformer T_1T_2 applying the low-frequency currents to the grid of this valve.

The amplified low-frequency currents in the anode circuit of the first valve pass through the primary

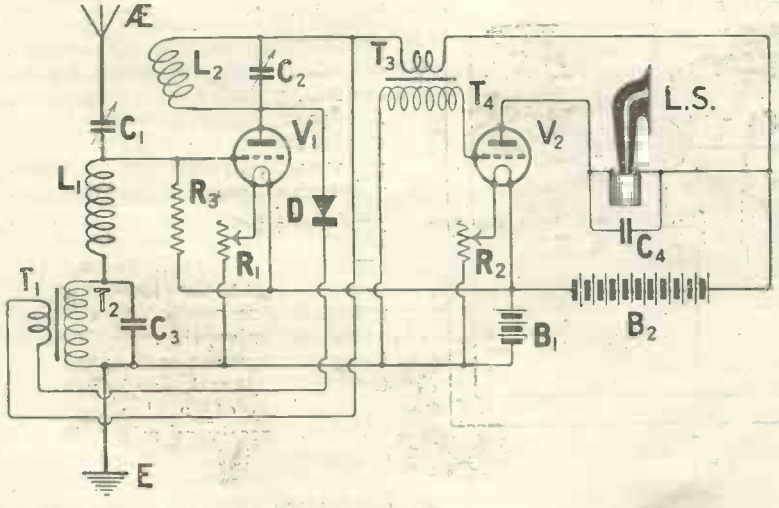


Fig. 2.—The theoretical circuit of the S.T. 100.

T_3 of the step-up transformer T_3T_1, the secondary of which is in the grid circuit of the second valve. In the anode circuit of the second valve we have the loud-speaker LS, preferably shunted by a condenser C_4, of about ·002 μF or ·004 μF capacity, which is for the purpose of improving the tone of the signals. The anode voltage should preferably be not less than 100 volts.

The condenser C_3, shunted across the secondary of the transformer T_1T_2, may conveniently be a fixed condenser of ·001 μF capacity. Reaction is obtained by coupling L_2 to L_1, but the circuit works quite well without reaction. The resistance R_3 is 100,000 ohms, and may, if desired, be variable. If there is any tendency on the part of the circuit to buzz, try changing the leads to the primary or secondary terminals of the transformer T_1T_2.

A negative potential on the second grid, and sometimes on both, gives improved results, particularly if the high-tension voltage is over 100 volts.

The S.T. 111 circuit

Fig. 3 shows another two-valve receiver in which there is a stage of high-frequency amplification accompanied by reaction, rectification by means of a crystal detector and two stages of low-frequency amplification. The circuit differs from the S.T. 100 in that the rectified currents are passed through the primary of a transformer T_1T_2, the secondary of which is connected in the grid circuit of the second valve instead of the first.

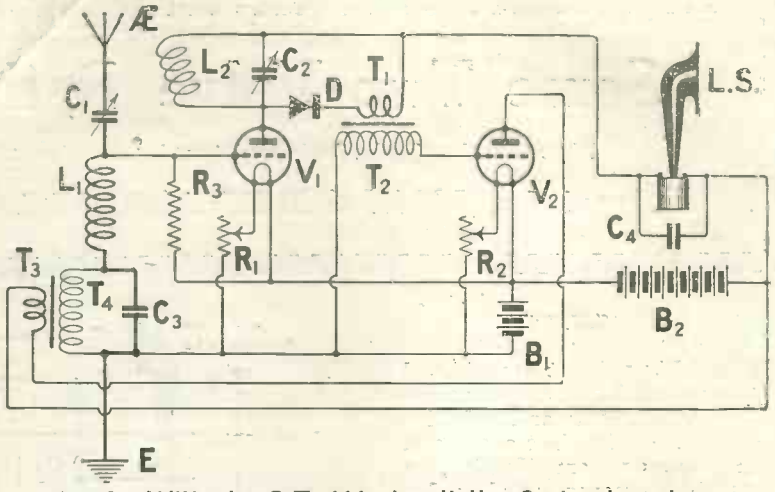


Fig. 3.—With the S.T. 111 circuit the first valve gives the last stage of note magnification.

It will be noticed that the anode circuit of the second valve contains the primary T_3 of a second inter-valve transformer T_3T_4. The secondary T_4 of this latter transformer is included in the grid circuit of the first valve, and the result is that the low-frequency currents, after two stages of amplification, pass through the loud-speaker LS, which is included in the anode circuit of the first valve. The loud-speaker is usually shunted by a condenser C_4 of about ·002 μF capacity, although the use of this condenser, like other fixed condensers in these circuits, is a matter for experiment. A fixed condenser might be tried across the primary T_1 of the step-up transformer T_1T_2.

Suitable values for both the coils L_1 and L_2 are Nos. 50 or 75, although a No. 75 for L_2 will probably be found most effective. These values refer to the broadcast band of wavelengths. A 100,000 ohms resistance R_3 is connected across the grid and that filament of the first valve which is connected to the positive side of the filament accumulator B_1. The condenser C_3 might be ·001 μF capacity, though the best value should be determined by experiment. The variable condensers C_1 and C_2 may conveniently be ·0005 μF capacity.

The S.T. 150

Fig. 4 shows a useful two-valve circuit, in which the first valve acts as a high-frequency amplifier, reaction being introduced into the circuit L_1C_1 by coupling the reaction coil L_2 to L_1. The reaction coil L_2 is tuned by means of the variable condenser C_3, and a connection is taken from the anode side of the circuit L_2C_3 to the grid of the second valve which acts as a detector. Suitable values for L_1 are Nos. 35 or 50 coils, and for L_2, Nos. 50 or 75. In the anode circuit of the second valve we have the primary T_1 of the step-up inter-valve transformer T_1T_2, the secondary T_2 of which is connected both in the aerial circuit and in the grid circuit of the first valve. The result is that the low-frequency potentials are applied to the grid of the first valve, the amplified low-frequency currents passing through the loud-speaker LS and operating it. Instead of a loud-speaker, telephone receivers might be included, and it is a matter for experiment to see whether the fixed condenser C_4 of ·002 μF or more is necessary or not. If telephones are

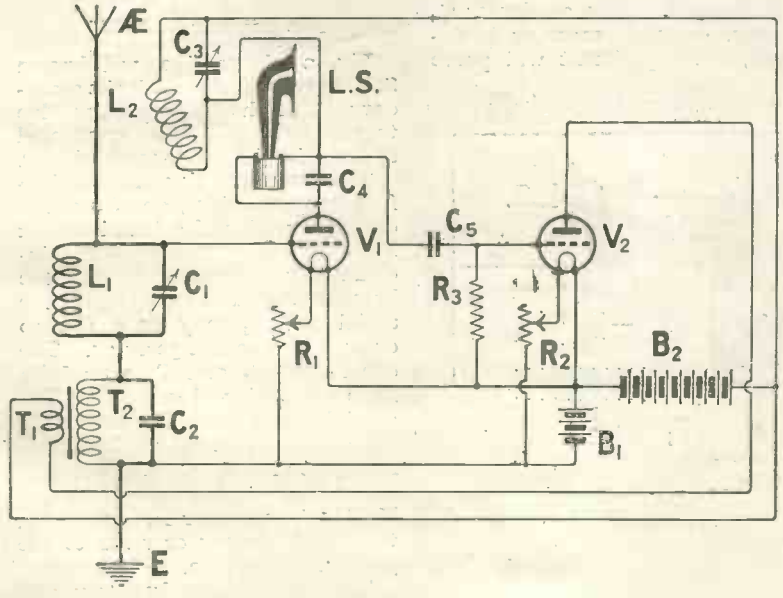


Fig. 4.—The theoretical circuit of the S.T. 150.

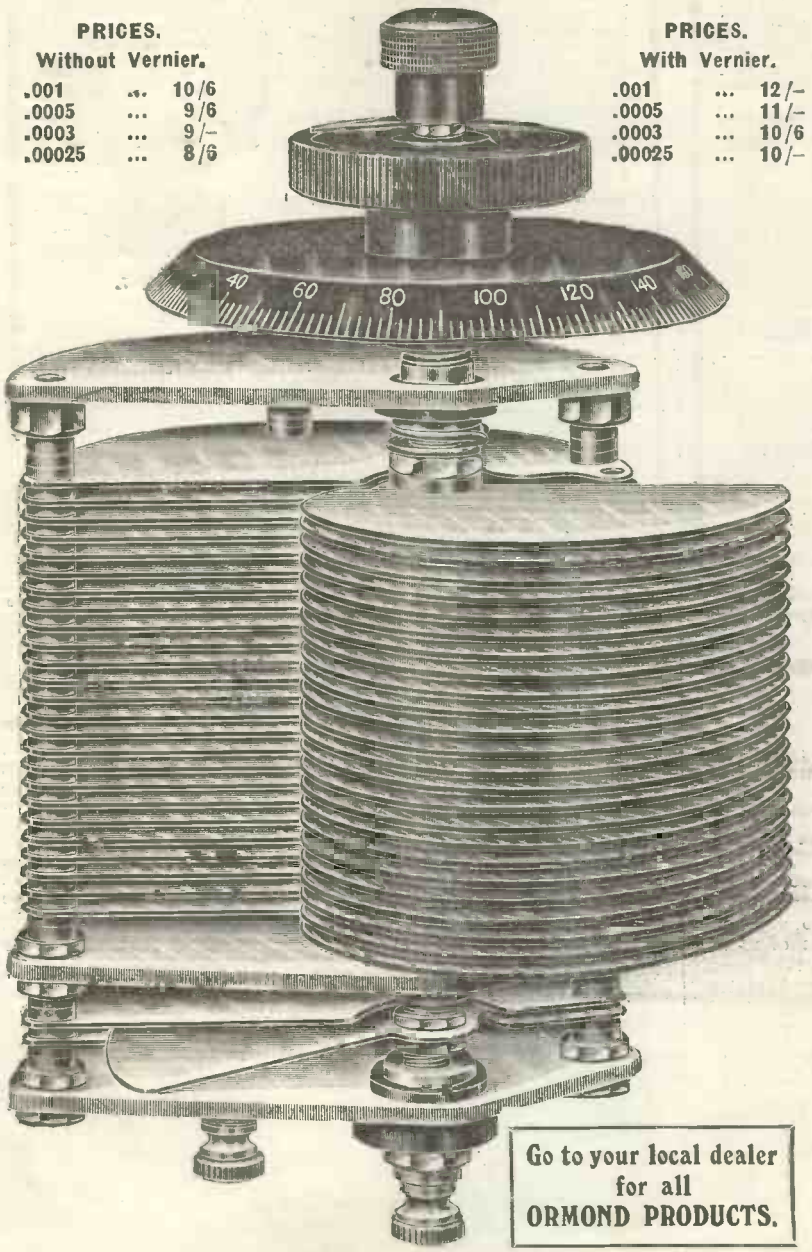
Find the true worth of your set!

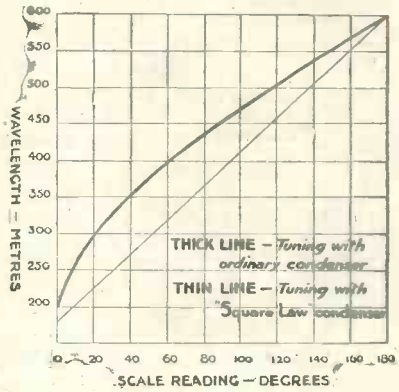
Find out how many stations you can really get! Don't be satisfied with simply picking up a distant station, but bring it in with all the beauty and strength of tone that you so easily get from your local Broadcast Station. Ask your Dealer for ORMOND SQUARE LAW CONDENSERS (ALL ORMOND PRODUCTS ARE BEST), and give your set a real opportunity to prove its merits.

"ORMOND" ENGINEERING COMPANY Reg. App. For

PRICES. Without Vernier.		
.001	...	10/6
.0005	...	9/6
.0003	...	9/–
.00025	...	8/6

PRICES. With Vernier.		
.001	...	12/–
.0005	...	11/–
.0003	...	10/6
.00025	...	10/–





The "Square Law" *Type Variable* CONDENSER

The use of a "Square Law" Condenser renders the tuning of a Receiver a very simple matter indeed. A calibration chart may be made up by the following simple means:—

Tune in a Station of known wavelength on the lower part of the condenser scale and plot it on the chart. Repeat this process with another station of known wavelength which is received on the upper part of the condenser scale. Draw a straight line through the two points and the chart is complete.

Owing to details of its design, this type of Variable Condenser possesses a negligible minimum capacity, and the specially shaped vanes give an ease of control which is entirely unknown to users of the ordinary type.

We specialise in turning Brass and Steel Screws and Machined Parts and Accessories of all descriptions.

All Cheques and Postal Orders should be crossed and made payable to "The Ormond Engineering Company."

Go to your local dealer for all ORMOND PRODUCTS.

Ormond Engineering Co.,

199-205, Pentonville Road, King's Cross, London, N.1.

'Grams—"ORMONDENGI, KINCROSS." *'Phone—Clerkenwell 6652 and 7833.*

25 YEARS' BRITISH MANUFACTURING EXPERIENCE.

used it is desirable that their insulation should be perfect. A loud-speaker is, in general, greatly to be preferred to telephone receivers with this circuit. Suitable values for other components are ·0005 μF capacity for the variable condensers C_1 and C_3, ·0003 μF for the grid condenser C_5, and 2 megohms for the gridleak R_3.

A Modified S.T. 75

Fig. 5 shows a modification of the Fig. 1 circuit whereby reaction is introduced into the aerial circuit and H.F. transformer coupling between the two valves is used. The incoming oscillations in the aerial circuit L_1C_1 cause varying potentials to be set up across the grid-filament circuit of the valve V_1. Corresponding amplified currents pass through the primary L_2 of an H.F. transformer L_2L_3 of suitable design for the wavelength range to be covered. The secondary L_3 is tuned by the condenser C_2 of ·0005 μF or ·0003 μF capacity. This secondary is connected across the grid and filament of the valve V_2, the usual grid condenser C_4 and gridleak R_3 being provided. Thus the amplified high-frequency oscillations in L_2 are passed on to the second valve, which rectifies them, the resultant low-frequency currents being fed into the grid circuit of the first valve via the step-up intervalve transformer T_1T_2.

A reaction coil L_4 of, say, 35 or 50 turns, coupled to L_1, is included in series with T_1 in the anode circuit of the valve V_2. Provision is also made for adding grid bias to the first valve by connecting a suitable grid battery GB, as shown, in the earth-filament lead. It will

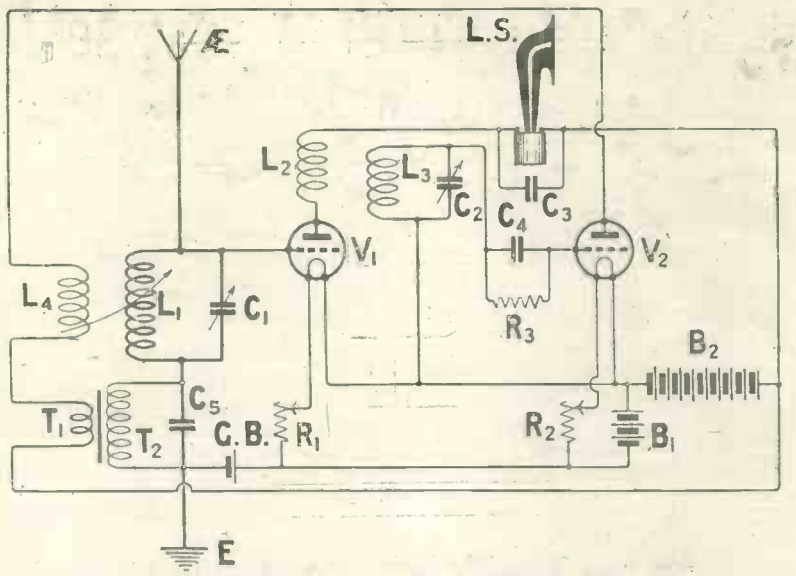


Fig. 5.—A modification of Fig. 1 circuit, using H.F. transformer coupling.

be observed that no condenser is shunted across T_1. With some apparatus, however, a small fixed condenser is necessary here, but usually the self-capacity of the primary windings is sufficient.

The S.T. 75 with aerial reaction

In Fig. 6 is shown a circuit similar to that of Fig. 5, except that tuned anode coupling is used instead of high-frequency transformer coupling between the two valves. The first valve acts in a dual capacity as a high-frequency and a low-frequency amplifier, while the second valve acts as the detector.

The incoming oscillations in the aerial circuit L_1C_1 cause varying potentials to be applied to the grid of the valve V_1. As a result amplified high-frequency oscillations are set up in the anode circuit L_2C_2, which is tuned to the incoming wavelength. A lead is taken from the anode end of L_2 to one side of the grid condenser C_3, the other side of which is connected to the grid of V_2, the usual leak R_3 being provided. The amplified high-frequency oscillations are thus applied to the grid of the valve V_2, which rectifies them. The resultant low-frequency currents are fed into the grid circuit of the first valve through the step-up intervalve transformer T_1T_2, and are further amplified by the valve V_1. The loud-speaker LS is in the anode circuit of the valve V_1, and is shunted by a by-pass condenser C_4 of ·002 μF. As before, provision may be made for grid bias on the first valve.

In series with T_1 in the anode circuit of V_2, is a reaction coil L_3 coupled to L_1. For broadcast reception L_1 may be a No. 25, 35 or 50 coil, and for L_2 and L_3 Nos. 50 or 75 will be found suitable. The values of the other components are the same as those mentioned in reference to the Fig. 5 circuit.

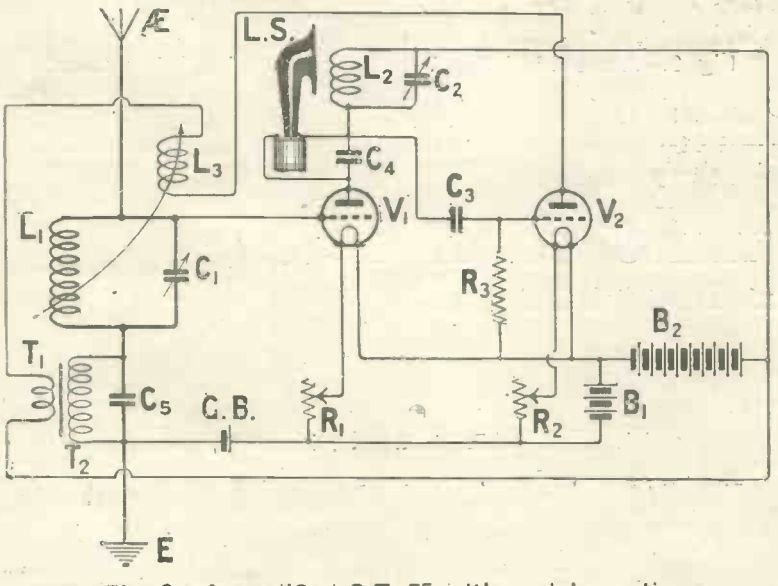


Fig. 6.—A modified S.T. 75 with aerial reaction.

Intervalve coupling using a choke

Fig. 7 shows a modification of the Fig. 6 circuit. The tuned anode is replaced by a choke coil L_2, the grid circuit L_3C_2 of the second valve being tuned by the variable condenser C_2. The loud-speaker LS is in the anode circuit of the first valve, as shown. By means of this arrangement any L.F. potentials established across the loud-speaker LS will not be

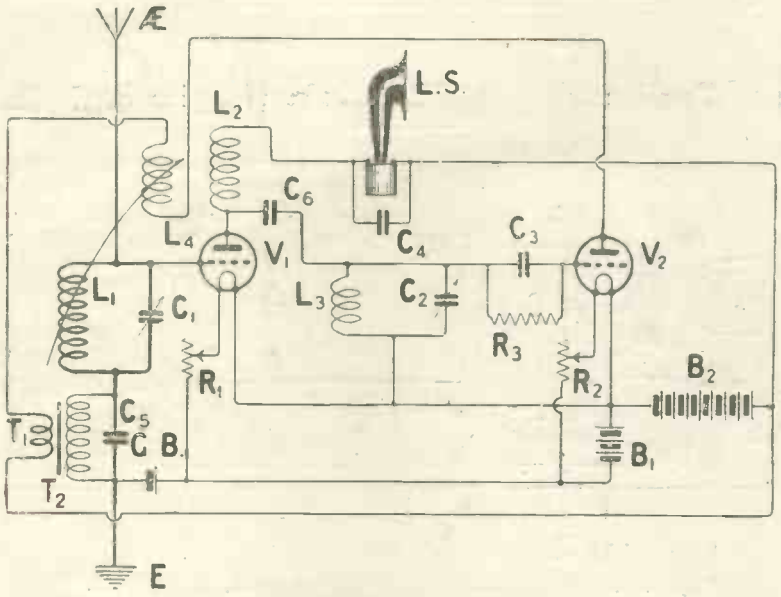


Fig. 7.—With this arrangement the loud-speaker is not at high-frequency potential.

applied to the grid of the valve V_2 because of the short-circuit provided for L.F. currents by the coil L_3. A chain of low-frequency amplification, with consequent buzzing, is thus prevented.

It will be observed that no condenser is shown shunted across the primary T_1 of the transformer T_1 T_2. A small fixed condenser may be necessary with some apparatus, but usually the self-capacity of the primary winding suffices. Reaction on to the aerial is provided by coupling a coil L_4, in the anode circuit of the second valve, to the coil L_1, and grid bias may be put on the first valve by including a grid battery GB, as shown. To cover the broadcast band of wavelengths, L_1 may be a No. 35 or 50 coil, L_3 being Nos. 50 or 75, while a No. 50 for L_4 will probably be found suitable. For L_2 a convenient coil is a No. 200.

A further modification

The Fig. 8 circuit shows a modification of that of Fig. 7. In this case reaction on to the aerial is omitted, and in its place is substituted reaction on to the grid circuit of the second valve, obtained by coupling a coil L_4, in the anode circuit of the valve V_2, to the coil L_3. This will, to a large extent, minimise re-radiation from the aerial. The same arrangement as is used in the Fig. 7 circuit in order that the loud-speaker should not be at high-frequency potential to earth is incorporated in this circuit. A fixed condenser across the primary T_1 of the transformer T_1T_2 is not shown, but experiments may be tried with condensers of different values, or with a variable condenser of, say, 0·001 μF capacity, to determine whether a condenser in this position is an advantage or not.

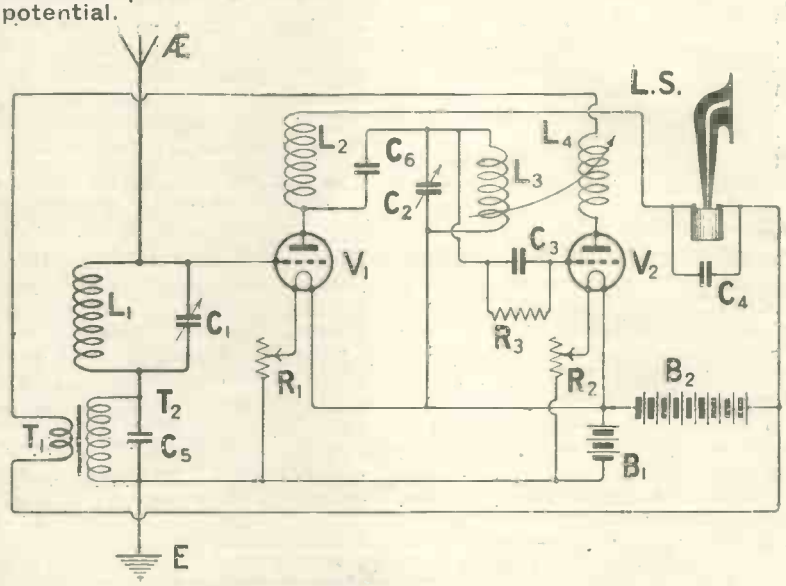


Fig. 8.—A modified Fig. 7 circuit employing inter-valve reaction.

The Japanese Operators' Difficulties

An Explanation of the Complex Japanese Telegraph Code.

MANY an exasperated operator in the Pacific, cooped up in his stifling wireless cabin on a hot and sultry tropical night, has torn the 'phones from his aching and perspiring head almost with feelings of murder in his heart at being hopelessly jammed by a near-by Japanese ship sending what appears to be an inextricably muddled series of signals quite incomprehensible to any of the Western nations. Little does he realise the difficult lot of the Japanese operator who is making his life unbearable.

The Japanese Alphabet

It is the object of this article to present in an interesting manner the tremendous obstacles which have had to be solved before telegraphic transmission of the language of Japan was possible, and to give some idea of the severe training undergone before the Japanese operator is posted to a ship and of his difficulties afterwards.

In order to do this, it is first necessary to tell something of the complex language of the country and of its writing systems. Although not strictly so, Japanese writing is almost letterless, and, unlike Chinese, from which modern Japanese has largely been derived, it has been developed into a phonetic system of syllables denoted by forty-seven symbols and twenty-six diacritical marks. Fortunately, of the latter only one is absolutely essential for telegraphing. Using these symbols and marks, all Japanese sounds, and hence words, can be reproduced.

Complex Writing

This system is only one of the many methods of writing used in the country, and, although despised by academicians, is used in many publications, since by its means it is possible to express foreign terms and scientific meanings which cannot be made clear by any of the other writing systems. Hence it follows that this is the only form of writing which can possibly be telegraphed.

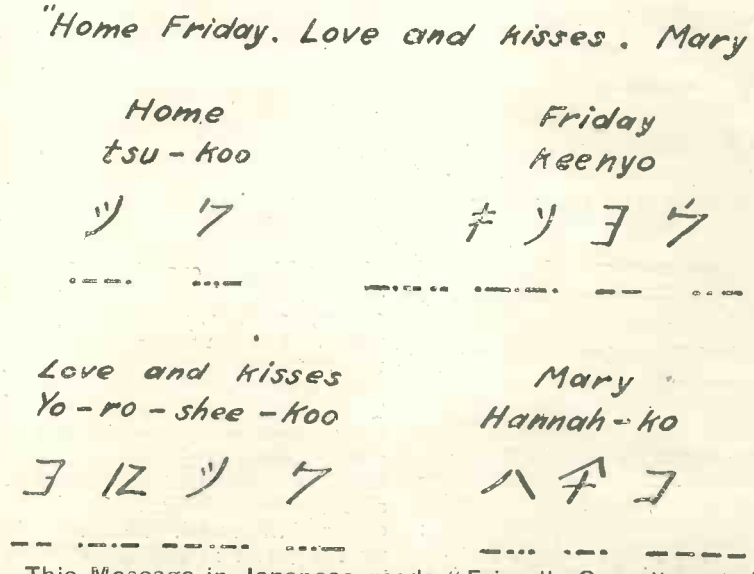
The Japanese operator has also to understand and be able to translate into the phonetic system another form, largely derived from the Chinese, which has from three to six thousand roots and can only be written, being unintelligible when spoken.

From the complex methods of writing previously mentioned it will at once be seen what a difficult problem had to be mastered before the introduction of telegraphy was an accomplished fact. Combinations of dots and dashes had to be found adequately to express the forty-seven symbols and the one vitally essential diacritical mark of the phonetic system. A code was worked out by European and Japanese experts before the year 1900, but this was modified somewhat after the war between Russia and Japan.

The resultant code is consequently a difficult one, since forty-eight letters or symbols have to be expressed, as compared with the twenty-six of our own alphabet. This, of course, necessitates the use of a number of long groups of dots and dashes, as there are not enough short ones to go round; no less than eighteen groups each contain five dots and dashes.

Morse Equivalents

The illustration shown is that of the forty-eight phonetic symbols, with their morse equivalents and, as far as is possible, their approximate pronunciation. Of these symbols two sound exactly alike when spoken, but are written and used differently. As an example, the translation of a simple telegram into Japanese is given. The "love and kisses" has been seriously altered, making the translation very tame, as even mention of kissing is thought highly improper in Japan.



This Message in Japanese reads "Friendly Compliments."

Japanese Operators' Hard Lot

From these remarks you will gather that the lot of the Japanese "Sparks" is not an easy one when compared to that of his British counterpart. Again, the Japanese language is absorbing new words and ideas from the Western nations, making for an increase in the

number of symbols and marks needed clearly to express these. Eventually this may compel an extension being made to the existing telegraphic code. The operator must, of course, be capable of translating and telegraphing the common, polite and Chinese-derived writing systems, of which the latter is in some cases capable of several interpretations determined merely by position.

Morse Symbols for Japanese Alphabet and their Approximate Pronunciation.

Good Education Necessary

An exceedingly good general as well as technical education is a necessity for an operator. There are many cases where the students, not being attached to military or naval schools, are forced to work long hours to pay for their tuition; and this, together with the strain of overstudy, is largely responsible for the high percentage of tragedies among the technical students in Japan. Faced with hunger and overwork, a number end their troubles in suicide.

The students who succeed in passing the strict examinations imposed are granted, in most cases, a second-class commercial licence by the Government. A first-class certificate is usually competed for after two years or so at sea, and to gain this the operator must be able to send and receive a hundred symbols a minute and at twenty words a minute in English in the Continental code. as well as have a sound knowledge of wireless law and theory.

Comparing conditions between Japanese and American operators as far as pay is concerned, there is not a great deal of difference, but in status the Jap is regarded much more favourably. He is one of the genuine officers in the ship, and dines with the captain and chief engineer in the first-class passengers' saloon, mixing with the latter freely. The American operator, on the other hand, even though he is a chief, is rated below the third mate. The position of the Japanese operator when on board is one of unusual authority. Under certain conditions his position is unassailable by even the captain or the owner of the vessel. He is a naval reservist, and responsible only to his Government with whom he keeps all his records and accounts.

Equipment

A few words regarding the usual equipment to be found on Japanese ships may be of interest here. In the majority of vessels this is of an obsolete type similar to the Telefunken sets of fifteen years ago. The transmitters are seven-kilowatt type, direct-coupled and using the quenched-spark system. Although so old, they are usually in magnificent condition, as the operators regard it as a labour of love to look after them; whilst anyone who has listened in the Pacific can vouch for the great strength of their signals.

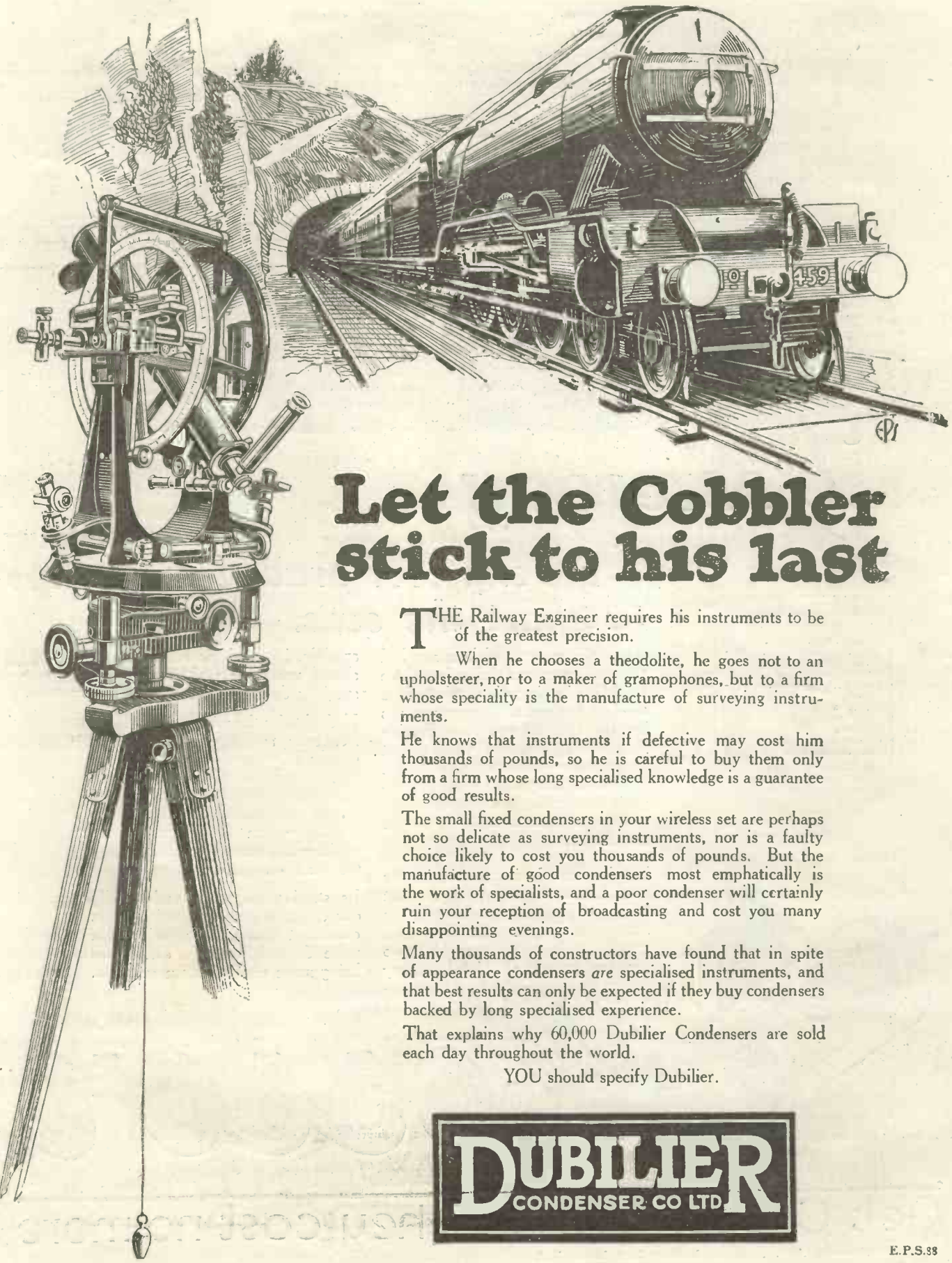
In Japan all wireless apparatus is built, installed and used under the strictest Government supervision, and transmitting by amateurs is not allowed except in the case of one or two powerful newspapers. Receiving is also illegal, but in the near future it is expected that receivers for broadcasting will be allowed to be used, subject to a number of restrictions.

We are indebted to the American journal "Radio" for much of the above information about the Japanese morse code.

British students learning the code should feel lucky that they were not born in the land of the Rising Sun!

The "Ultra" Loud Speaker.

In the advertisement of Messrs. Ed. Rosen & Co., in the November issue of "Modern Wireless" a slight error occurred. Width of base 10 *inches should read; Width of flare* 10 *inches.*



Let the Cobbler stick to his last

THE Railway Engineer requires his instruments to be of the greatest precision.

When he chooses a theodolite, he goes not to an upholsterer, nor to a maker of gramophones, but to a firm whose speciality is the manufacture of surveying instruments.

He knows that instruments if defective may cost him thousands of pounds, so he is careful to buy them only from a firm whose long specialised knowledge is a guarantee of good results.

The small fixed condensers in your wireless set are perhaps not so delicate as surveying instruments, nor is a faulty choice likely to cost you thousands of pounds. But the manufacture of good condensers most emphatically is the work of specialists, and a poor condenser will certainly ruin your reception of broadcasting and cost you many disappointing evenings.

Many thousands of constructors have found that in spite of appearance condensers *are* specialised instruments, and that best results can only be expected if they buy condensers backed by long specialised experience.

That explains why 60,000 Dubilier Condensers are sold each day throughout the world.

YOU should specify Dubilier.

DUBILIER
CONDENSER CO LTD

E.P.S.38

Yesterday

—the explorer braved hardships to chart the seas.

WUNCELL DULL EMITTERS

W.1. (For Detector and L.F. use). Operating at 1.8 volts .. 21/-
W.2. (With red top) for H.F. use. Operating at 1.8 volts .. 21/-
Types W.R.1 and W.R.2 as above but with resistance incorporated in base to operate off 2, 4 or 6-volt accumulator .. 23/6

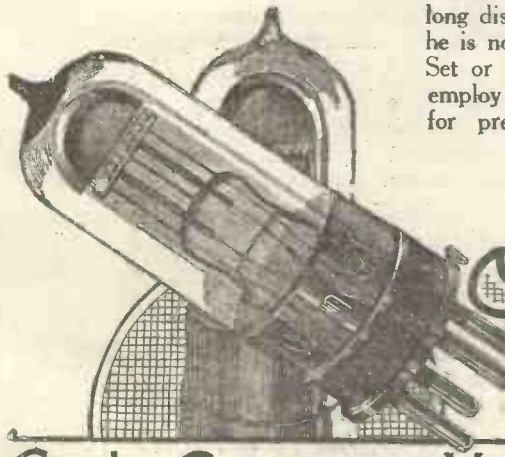
The Wuncell is fully described in a comprehensive Folder which will be sent post free to any experimenter on receipt of a postcard. Don't invest in a Dull Emitter Valve until you have read about the Wuncell.

While the explorer of long ago had to set sail and face almost incredible hardships in his praiseworthy efforts to chart the globe, his successor sits by the fireside and logs Foreign Broadcasting Stations with almost absurd ease. From America to the borders of Russia and from Scandinavia to the shores of the Mediterranean the ether is available for his exploration.

But the man who is enthusiastic over long distance reception will see that he is not handicapped either by his Set or his Valves. His Set should employ at least one stage (and two for preference) of high-frequency amplification, and for his Valves he should use those which have been specially developed for the work.

Undoubtedly the most popular high-frequency amplifier to-day is the Cossor P2—the valve with the red top. Hundreds of thousands of these valves are in use at this moment among all grades of wireless enthusiasts—from the expert to the novice—and everywhere it is giving the most complete satisfaction.

Its striking success is undoubtedly due to its design. As every wireless enthusiast knows, the working of a valve depends upon the correct use being made of its electron emission.



Cossor

Get Cossor Valves—they cost no more

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

To-day

—he charts the ether from the comfort of his fireside.

You must have noticed that when your accumulator begins to fail and the filaments of your valves grow dim that your Set falls off in sensitiveness and volume. A clear case that the emission from the filaments has decreased.

Obviously, therefore, the quantity of the electron emission is an important factor in valve efficiency.

Now compare the Cossor P2 with an ordinary Valve. Instead of a hood-shaped Anode and Grid totally enclosing an arched filament and almost completely entrapping its electron stream, we see that at each end of the tubular Anode the filament is exposed and that a large proportion of the electron stream is obviously leaking away. Remember that for high-frequency use you cannot afford to risk inefficiency—feeble oscillations from Stations thousands of miles away will strike your aerial and you'll be none the wiser if your Valves are not sensitive to them.

The remedy is in your hands—for high-frequency use select the Valve specially developed for the purpose and chosen by the vast majority of Valve users in this country—the wonderful Cossor P2.

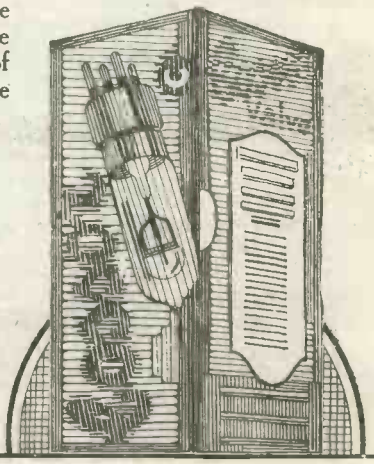
COSSOR BRIGHT EMITTERS.

P.1. For Detector and Low-Frequency use **12/6**

P.2. (With red top). For H.F. use only .. **12/6**

TO THE TRADE:

Have you received copies of the new Cossor Electrical Testing Showcard? If not, send in your application at once.



Valves

but what a difference in results!

Gilbert Ad. 1738

(*Continued from page 745.*)
obtained in the presence of Mr. Clarabut, a prominent member of the Bedford Radio Society.

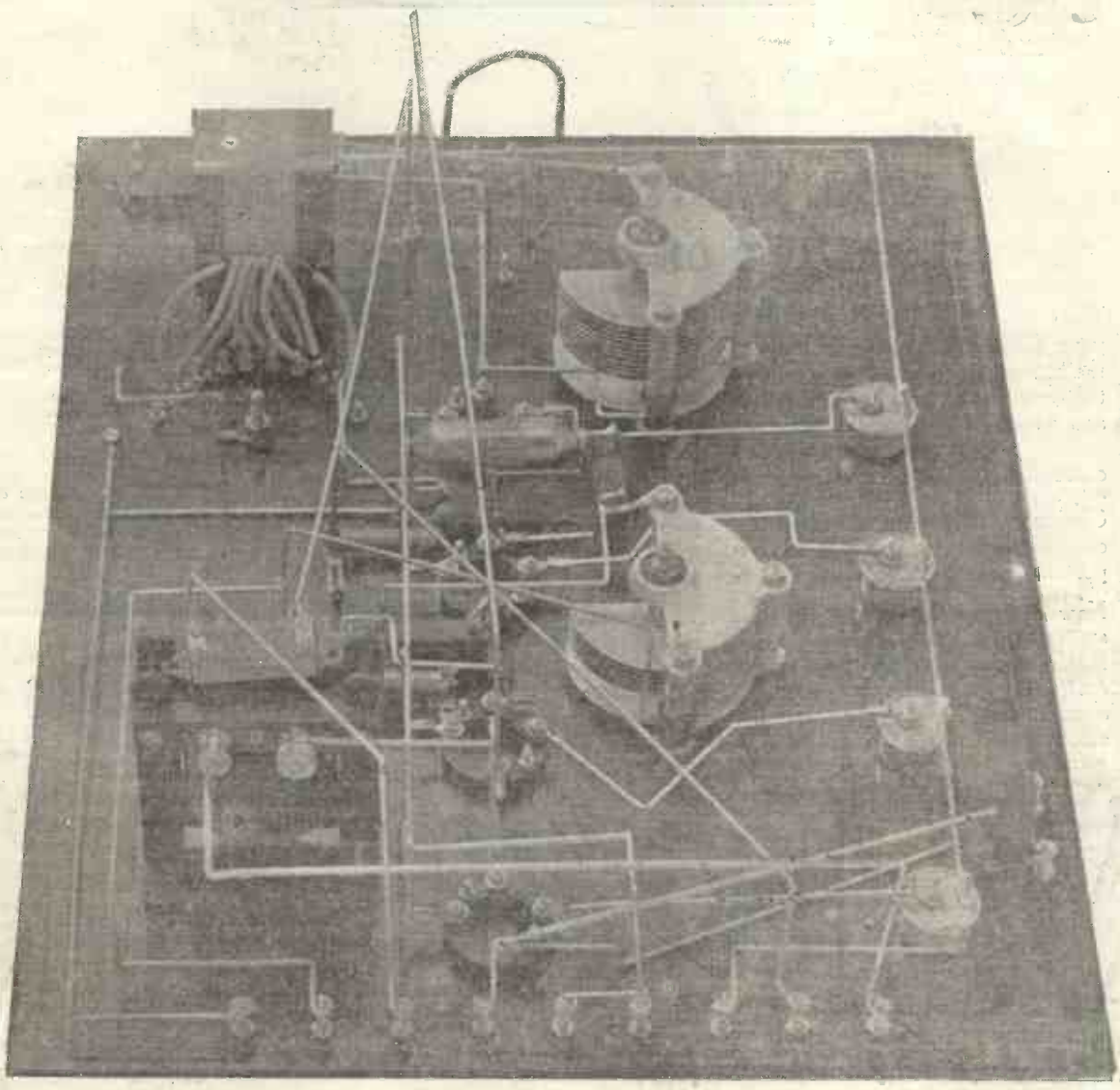
A separate table is shown giving the different values of condensers, etc., to obtain certain stations. I discarded the use of the constant aerial tuning condenser on this receiver, chiefly because I do not believe in a multi-stage H.F. circuit reducing the stabilising effect of an aerial. When first tuning in, the constant aerial tuning terminal, however, may be employed, although on a shorter wave length, including that on which 2LO works. I found that the reaction coil should be reversed, a No. 35 coil being employed. When the aerial was connected straight on to the aerial inductance, ordinary reaction, in all cases, improved signal strength. It must be remembered, of course, that the nearest station was about 50 miles away.

Comparative Tests

Two aerials were tried. One was a single wire aerial of standard Post Office dimensions suspended at an average height of about 35 ft., and the other was a considerably smaller aerial about 65 ft. long and about 15 ft. high. The tests given in the table were made on the 100 ft. aerial, but very similar results were also obtained on the smaller aerial, although rather more careful tuning was necessary and signal strength was a little weaker. As, however, a number of the stations were obtained very well on the loud-speaker there was ample reserve of signal strength.

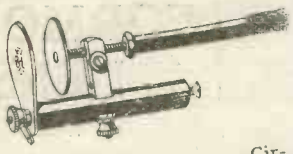
All the high-tension terminals were connected together, and 78 volts used. The valves used were of the general purpose type, one Cossor and three Ediswans being employed, although these were merely used because they were available and not for any technical reason. The last valve was occasionally replaced by a B_4 B.T.H. valve, or its dull emitter equivalent, the B_6. Both these valves are beautiful low-frequency amplifiers, and give improved strength, possible output and purity of reproduction. The Marconi Osram Company produce an equivalent valve, namely the D.E.5.

I can strongly recommend the dull emitter valve, the B_6, which gives as good results as the B_4 but consumes much less filament current and costs about the same. I would not advise this valve for H.F. or detector purposes because the extra price does not justify any difference



This photograph shows the connections to the choke coil L 3.

A NEUTRODYNE CONDENSER



EVERY Neutrodyne Circuit needs a condenser whose minimum capacity is practically zero and whose maximum is less than the minimum of an ordinary condenser. The instrument illustrated fills these conditions. It has been carefully tested and yields admirable results in any Neutrodyne Circuit. The base rod and the operating spindle are of ebonite; the plates and standards are of heavy gauge brass. Fixing is by a single screw, with an additional ¼ in. hole in the panel for the operating spindle. Every detail of this production is up to the high standard demanded of Bowyer - Lowe Components. The price is exceptionally low.

PRICE **5/-** EACH.

Each instrument is individually packed in a container bearing our name and trade-mark. Insist on seeing this before buying. Drilling template supplied.

"A SURFACE LIKE FINE PORCELAIN"

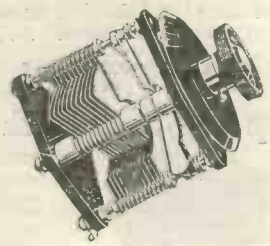
In these words a customer describes the first Bowyer-Lowe Panel he bought. Every Bowyer-Lowe Panel is finely finished, but what is more important, every one is guaranteed to be entirely free from metal and may be used without rubbing down.

BOWYER-LOWE TESTED RADIO PANELS

Sold in sealed packages. Semi Matt, ½d. per sq. inch. Polished one side and all edges 1d. per sq. inch. Drilled and engraved for Radio Press Set (except OMNI top panel) 1½d. per sq. inch. Thickness ¼ inch in all cases. Order direct if your dealer does not stock.

THE Set you make is just as good as the parts you put into it. Those who use Bowyer-Lowe parts obtain reception of unusually fine quality, because these components are all of the highest mechanical and electrical efficiency. Bowyer-Lowe parts make successful sets. Insist on having them. If your dealer cannot supply, order direct.

A STANDARD OF PERFORMANCE



Prov. Pat. 7213/24.

MONEY cannot buy condensers of higher efficiency than the Bowyer - Lowe type. They have the highest capacity ratios in wireless, and as a result yield signals of a purity and volume not otherwise to be obtained. Instal them in your sets and notice the difference they make. Tuning will be simplified, your wavelength range will be increased, and you will obtain reception free from distortion.

FOUR TYPES MADE.

Standard, .00003 to .0015m.f.
Vernier, .0002 to .001 m.f.
Double, .0001 to .0005 m.f.
Triple, .0002 to .0003 m.f.
Quadruple, made to order.

AT PRICES FROM **11/6**

Order direct or from your Dealer.

Bowyer-Lowe Tested Components

Bowyer-Lowe Co. Ltd. **Sold by all Reliable Dealers** Letchworth

A BETTER VALVE WINDOW

Of heavily nickel-plated Brass, Bezel rounded on outer and inner circumferences. Nuts, bolts, backing plate and gauge supplied. Outer diameter 1¼ in., inner diameter 1 in. Each window individually packed in carton bearing our trade-mark.

Price 9d. each.

H.F. TRANSFORMERS.

You may buy at random any two Bowyer-Lowe Plug-in H.F. Transformers of the same range and they will match perfectly. There is no necessity to ask for special matching for H.F. Stages if you buy these standard transformers of guaranteed quality. All terminals clearly marked. All ranges at a uniform price. Particulars on request.

Price 7/- each.

STUD SWITCH PARTS.

Complete sets of parts for Stud Switches, 2 to 10-way, with 1 in. radius arms. Set comprises Switch Arm with Ebonite Knob, Bush, Contact Plate, 10 Studs with 2 Nuts each, and 2 Stops. Lacquered finish. Drilling template supplied. Sold in boxes bearing our name.

Price 2/3 complete.

ANTI-CAPACITY VALVE HOLDER.

Made at the suggestion of Mr. P. W. Harris in a form to give high efficiency, especially on short wavelengths. Can be fitted to Panel without nuts, as the ebonite base plate is tapped. Lacquered finish.

Price 1/2 complete.

in results, and the high capacity of the valve for H.F. work makes it unable to compete with the ordinary general purpose valve. For low-frequency amplification, however, it is very hard to beat.

From the table it will be seen that London (50 miles); Manchester (120 miles), Bournemouth (110 miles), Newcastle (200 miles), Glasgow (300 miles), Birmingham (65 miles), Aberdeen (350 miles), were all received perfectly well on a loud-speaker. I would like to say that telephone receivers were not employed during the whole test, which occupied about an hour.

Tuning on Loud Speaker

All the stations mentioned in the table were properly identified by their wavelength and the programme, and they were all tuned in by the aid of a loud-speaker only.

Manchester and Cardiff were subject to interference from 2LO, and the signals, while tunable on a loud-speaker, could not be said to be of loud-speaker strength. They have therefore been classified as good phone strength. It is a curious thing that these two stations are never heard very well in the south-east of this country, but readers in these two districts must not make the beginner's mistake of imagining that because the report on the signal strength was not glowing the set was in any way to blame. In a different part of the country the results would probably be entirely different.

It will be seen that Lissen and Tangent coils were employed, but there is no particular reason for using these coils; both types of coils, of course, are of excellent make, but it must not be assumed because they were used on this occasion that there was any technical reason for so employing them.

Chelmsford

Chelmsford, of course, came in very well on almost any kind of an aerial, but there was no very large difference in signal strength between choke coupling (a 300 turn choke was found best) and the 100,000 ohm resistance, which may also be connected in circuit as an alternative when working on wavelengths above about 1,000 metres.

In addition to the stations mentioned, two German stations working on about 440 metres and 380 metres were heard on the loud-speaker. These were not identifiable in view of the short time available. Two relay stations of the B.B.C. were also heard, but they were not identified.

In all cases reaction helped greatly, and except when receiving Chelmsford a No. 35 turn coil was used throughout.

In this table the condenser readings are only approximate. Most of the stations were so loud that the same signal strength was obtained over several degrees of the condensers, although with the exception of Cardiff and Manchester each station was received without interference from any of the others.

Where there may be an apparent discrepancy in the condenser readings, as, for example, where two readings appear too close together when considering the wavelength difference between the stations, it must be remembered that the different readings were obtained at different times, and that the reaction was adjusted in each case to obtain the best results, the reaction adjustment, of course, altering the tuning of the circuit.

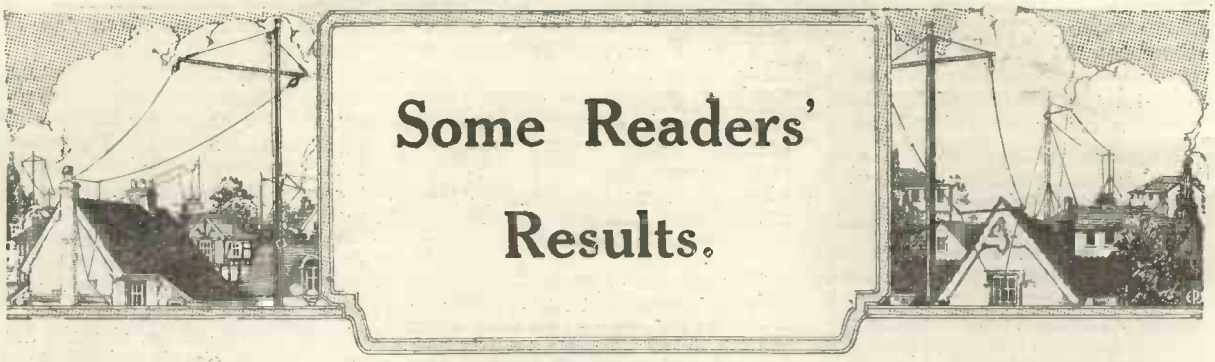
No grid bias at all was used, although, no doubt, it would have been preferable to have given about 1½ volts negative to the grids of the amplifying valves.

Parallel Tuning

In all cases a parallel condenser was employed, the C.A.T. condenser not being used. The table shows the number of the stud employed on the specially wound choke coil, and also the number of the plug-in coil connected in series when such a coil was used. In some cases no additional coil was used, and consequently the coil holder was shorted by a dummy shorting plug. The number of the stud used was not critical, and consequently no special deduction should be made regarding the relationship between the stud used and the wavelength of the station received on that stud.

TABULATED TEST RESULTS.

Call Sign and Wavelength.	Name. Distance. Miles.	Aerial Coil.	Aerial Condenser	1st Anode Coil.	2nd Anode Coil.	2nd Anode Condenser.	Reaction Coil.	Results.
5 WA 351 m.	Cardiff 120	35 Lissen	30°	Stud 6, Plug shorted	50 Lissen	83°	35 Lissen	Good phone strength.
2 LO 365 m.	London 50	35 Tangent	35°	Stud 7, Plug shorted	50 ,,	64°	35 ,,	Very good loud-speaker.
2 ZY 375 m.	Manchester 120	35 ,,	45°	Stud 7, Plug shorted	75 ,,	27°	35 ,,	Good phone strength.
6 BM 385 m.	Bournemouth 110	35 ,,	55°	Stud 10, Plug shorted	75 ,,	30°	35 ,,	Good loud-speaker.
5 NO 400 m.	Newcastle 200	50 ,,	nearly 0°	Stud 7, Lissen 75	75 ,,	4°	35 ,,	Medium loud-speaker.
5 SC 420 m.	Glasgow 300	50 ,,	3°	Stud 8, 75 Lissen	75 ,,	39°	35 ,,	Medium loud-speaker.
5 IT 475 m.	Birmingham 65	50 ,,	8°	Stud 7, 50 Lissen	75 ,,	55°	35 ,,	Very good loud-speaker.
2 BD 495 m.	Aberdeen 350	50 ,,	13°	Stud 10, 50 or 75 Lissen	75 ,,	63°	35 ,,	Good loud-speaker.
440 m.	German Station	50 Lissen	10°	Stud 10, 75 Lissen	75 ,,	47°	35 ,,	Medium loud-speaker.
380 m.	,, ,,	35 ,,	53°	Stud 7, 75 Lissen	75 ,,	28°	35 ,,	Medium loud-speaker.
5 XX 1,600 m.	Chelmsford 45	150 ,,	32°	Resistance or 300 Lissen (any stud).	200 ,,	70°	150 ,,	Very good loud-speaker.



Some Readers' Results.

The No: 3 Envelope

To the Editor of MODERN WIRELESS.

SIR,—I recently purchased your Envelope No. 3 (How to Construct the "Simplicity" Three-valve Set). I followed the instructions contained, and have completed a set which is giving satisfaction beyond expectations. I get all B.B.C. stations, also several stations in France and Germany, with very good results. The earphones, when placed on the table, give the effect of a loud-speaker, which can be heard all through the house. I cannot speak too highly of the results obtained.

Hoping your R.P. envelopes will have a wide circulation.—Yours truly, W. BAKER.

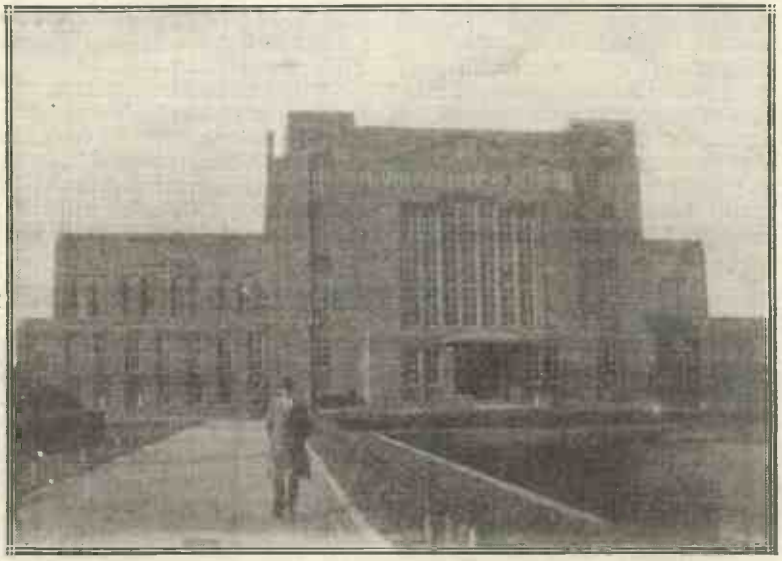
Horden, Co. Durham.

The 3-Valve Dual

To the Editor of MODERN WIRELESS.

SIR,—*Re* your three-valve dual as described in MODERN WIRELESS, April, 1924, you will be glad to hear some of the results obtained. Having built several of your sets for myself and friends (my first being a three-valve set out of MODERN WIRELESS, March, 1923), I was so struck with the three-valve dual that I decided to convert my own and also to assist a friend to convert his. Result—all the B.B.C. stations on loud-speaker, practically all the Continental stations on the loud speaker—Manchester, Birmingham 5XX, Radio-Paris and Berlin—with great volume; in fact, they could be heard quite clearly 300 yards from the speaker. On Monday evening at 11.10 p.m. I was fishing around for anything, when I tuned-in a station on a wavelength between 400 and 500 metres. It was probably a Spanish station, as it did not sound like French. It was transmitting till 12.30 a.m. Tuesday morning, and appeared to come from some opera house or concert hall.

The station then closed down, and I could not get the call sign, as it was so distorted, and I could not get it clear, as the least touch on condensers or filament and the carrier wave was gone; it was practically as loud as Birmingham. I got on with another station, but could not tune-in, as it was very critical and set was going into violent oscillation over or under the wave. At 1.25 a.m. I was fishing around and, to my surprise, I heard the announcer say "WGY, General Electric Co., Schenectady; stand by one moment," then "WGY Orchestra will now play a piece of the opera called ——." It sounded like "Mal Gall" to me; anyway, the music was very clear; at 1.30, song, piano and soprano; 1.35 a.m., piano and soprano again; 1.42, 'cello or violin; 1.45, 'cello or violin; 1.50, WGY Orchestra; 1.55 piano and soprano again; 2 a.m., announcer said: "This concludes our programme for studio. We are now going to relay Mr. Charles Davies' Democrat candidate speech from the Albany, New York"; 2.9 a.m., chairman announcing speaker, band or orchestra struck up with "The Star Spangled Banner"; 2.12 a.m., Mr. Davies' speech, which concluded at 2.35 a.m., when the announcer said that WGY was closing down. The above was very clear, and I could have got it through the loud-speaker, as it came through in great volume in the headphones. A cup of tea after the excitement, and then another fish round. At 9 minutes to 3 a.m. a fox-trot suddenly came in, and then the announcer said "WHAZ," pianoforte solo, announcer; 3.10, man singing "Old Kentucky Home," announcer, another song called "Just a Song at Twilight"; 3.18, comic song with what I should call step time at the end of the song, announcer; 3.30, fox-trot, announcer, fox-trot called "Somebody Stole My Girl," and then I switched off as I had had enough excitement for one night.

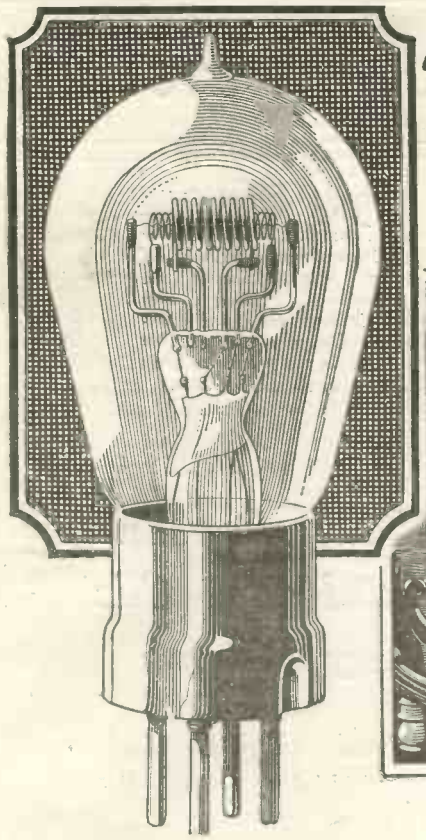


An exterior view of the Nauen Station which now transmits on short-waves.

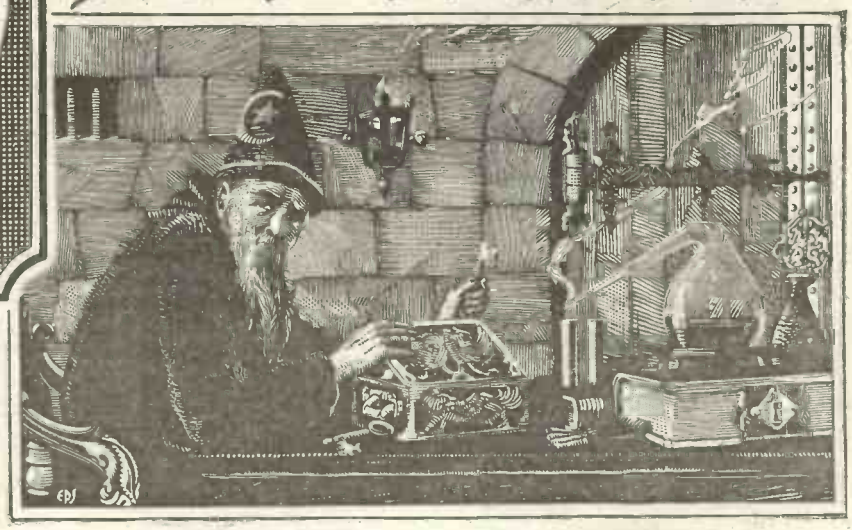
I think it is the best three-valve set that has been before the public for all-round work; in fact, nothing to beat it with three valves.

Wishing yourself and MODERN WIRELESS the success that you deserve.—Yours truly, F. JONES.

Penketh.



Louden



The Secret

10/-

Magicians and Sorcerers had their "Secrets of Healing" and "Secrets of Success," which they would dispense for a consideration, but in these less romantic times success is more apt to be won on sheer merit.

Take the case of the Louden Valve. Four months ago it was unheard of—to-day there are thousands of enthusiastic "slaves of the lamp" who will never go back to the old type of valve.

Why? Well, because however you consider the Louden Valve it is a sound investment.

It costs only ten shillings. It takes so little current that your accumulators will last twice as long as they do with ordinary bright filament valves, and in spite of the fact that the anode is "full of holes" volume is, if anything, above the normal, showing that a full use is made of the electron stream.

It is the *unwanted* charges that escape through the turns of the anode, and strangely enough this is precisely what we intend to happen.

It gives a silver clear reproduction which is the delight of all who have heard it, and the life of the filament is exceptionally long.

So naturally the Louden is outstripping all other valves in popularity.

There is no secret—only merit.

Louden VALVES

The Plain Louden for Detecting and Low Frequency Amplifying.
The Blue Louden for H.F. Amplification.

Filament Volts ..	4.8-5
Filament Amps. ..	0.4
Anode Volts ..	40-80

FELLOWS WIRELESS

Manufactured throughout in Great Britain.

All Loudens are silver clear and free from mush.

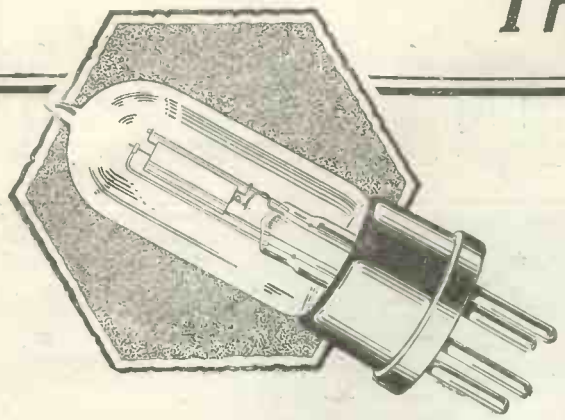
The current consumption is very low and the life long.

Louden Valves - Silver Clear

ADVT. OF THE FELLOWS MAGNETO CO., LTD., PARK ROYAL, LONDON, N.W.10.

E.P.S.6.

The New Valve



The "Cosmos" Type D.E.11 Dull-Emitter Valve is the result of prolonged experiment and research. Thoroughly tested and tried out and manufactured commercially at their Cosmos Lamp Works at Brimsdown, the Metropolitan-Vickers Electrical Company Limited now confidently offer it to the public as being characteristically reliable and efficient.

COSMOS
D.E 11 VALVE

Here are Six Reasons why you should use this new "Dry Battery" valve:

1—The Filament "lights" off a single Dry Cell
2—It has a robust filament which is practically unbreakable ... ...
3—It has a remarkably long life, due to its platinum filament, heavily coated with active material ... ...
4—It is a highly sensitive valve for all reception purposes... ... ...
5—It is an exceptionally good Amplifier, being capable of handling considerable output without distortion ... ...
6—It is the best "Dry Battery" Valve for Loud Speaker work ... ...

CHARACTERISTICS :
Low Capacity Cap
Standard 4-pin contacts
Filament Voltage 1·3 V.
Filament Current 0·25A
Anode Volts (Detector) 20-45 V.
Anode Volts (Amplifier) 40-100 V.
Amplification 6·5

PRICE
25/-
from all Wireless dealers.

Ask your dealer for a copy of the leaflet D.S. 4117/3.

COSMOS
DULL EMITTER TYPE D.E 11 VALVE

The Valve that is "M" *"Crystal Clear."*

Advertisement of Metro - Vick Supplies Ltd., London. R Vo2

Some New Radio Press Activities

This article makes clear to new readers some of the facilities which Radio Press affords to its adherents.

Two New Envelopes

READERS who have already bought one or more of the Radio Press envelopes will welcome the two new envelopes that have just appeared; while for those who have not yet tried them they present an excellent opportunity of discovering their great utility. These two envelopes are Nos. 8 and 9.

Envelope No. 8

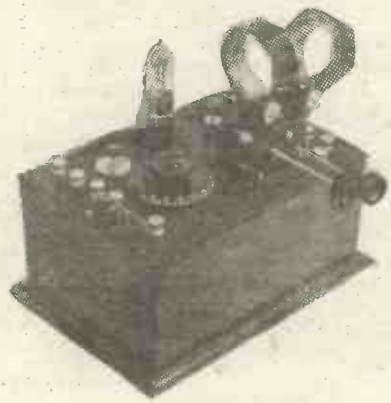
Envelope No. 8 contains complete instructions for the construction of a single-valve reflex set, by Herbert K. Simpson. This circuit is one that has proved itself extraordinarily popular with our readers, probably for two reasons. First, it gives not far short of "three-valve" results with the consumption and ease of control of one valve only; and, secondly, as it employs a crystal detector, the quality of reproduction is very good. The single-valve reflex stands in a class by itself, for it is a set that is very stable in action and yet extremely sensitive. Here in London it has been possible not only once but several times to receive Birmingham on a reflex set with a frame aerial only two feet square, and other stations have also been received at times, while 2I.O. is just clearly audible in the loud-speaker. The set described employs two condensers for tuning; one, the aerial tuning condenser, tunes the aerial circuit, and a plug-in coil of any size suitable to the particular station you wish to receive can be employed; the high-frequency amplification is obtained by means of a plug-in high-frequency transformer the secondary of which is tuned by the other variable condenser. The filament current is controlled by a rheostat that can be used either for bright or dull emitters. This is a set that will prove of great interest to any experimenter who has not yet made up a receiver on these lines, while the beginner who wishes to try out this circuit will find the detailed instructions given will enable him to complete a set from which he can obtain valuable experience with the certainty of making a success of it.

Envelope No. 9

Envelope No. 9, by the same author, gives all the necessary directions for making an efficient single-valve receiver. Although many hundreds of circuits have appeared from time to time, the

A Single Valve Reflex Set

single-valve set, or "one-valver" still retains a large measure of popularity because of the reliable and efficient results that can be obtained with it. It is one of the easiest sets to handle after the humble crystal set, and owing to the employment of reaction is extremely sensitive. In this set reaction is magnetic, and the usual two-coil holder serves to couple the reaction coil to the aerial coil. Terminals are provided for constant aerial tuning, the advantages of which are too well known now to require further comment or explanation. A further refinement is provided in the form of a variable grid-leak; this will be found of help in making final adjustments when receiving distant or weak transmissions. The filament resistance is designed to control either dull or bright emitters. With this set, favourable conditions obtaining, all the B.B.C. stations can be received on an average P.M.G. aerial, and many Continental stations as well. While if the constructor goes to the trouble of making himself special short-wave coils, he can always find many transmissions of interest down on the short waves, and it is even possible to receive KDKA on a single valve under favourable conditions.



An Efficient Single Valve Set

Both the above receivers have already been built by our readers, and many extremely favourable reports have been received. They are simple to construct, and the exact and detailed directions given enable even the veriest novice to build either of these sets and be sure of success.

Radio Press Transfers

How many an experimenter has looked at a finished set with pride and thought: "If only I could get this engraved cheaply and without trouble." This is now possible. Results equal in every way to engraving can be obtained by a means which he can employ himself. The Radio Press Transfers, costing but a humble sixpence, provide him with an adequate solution to this problem. Each set of transfers is placed in a sealed envelope for protection, and contains 80 different transfers. Full instructions are given how to apply them, and they can be put on to a set in a few minutes, and so give the completed instrument an

appearance of professional finish. Make sure when ordering transfers to get "Radio Press"; they have been specially produced for the amateur by men who know the experimenters' and constructors' every need.

The Wireless Constructor

No. 2 has now appeared, and will be found full of special articles, not only of interest to the beginner, but also containing helpful and useful tips for the more advanced amateur. By the way, get your copy at once, or you may be disappointed and find they are all sold out. Under the editorship of Percy W. Harris, this publication has been specially designed to meet the needs of the newcomer to the ranks of wireless enthusiasts, and any experimenter who knows of anyone just starting to learn about this fascinating subject should place a copy of the *Wireless Constructor* in his hands. The beginner will find articles giving full and detailed particulars with regard to the construction of a large variety of receiving sets. Not only are full dimensions, wiring diagrams and drilling diagrams provided, but tricky points in the constructional work are carefully explained and all possible difficulties dealt with. For the constructor with limited practical workshop knowledge there are articles which will tell him how to use the various tools that he is not familiar with and so enable him to put his best work into a set, not only improving its appearance but also its performance. If you have any constructional difficulties you should read the *Wireless Constructor*, and to make sure of obtaining your copy every month and not miss a single valuable issue, it would be advisable if you were to place a standing order with your stationer or direct with us. Why not fill in the order form enclosed with this issue of MODERN WIRELESS and post it to-day?

Our Blue Print Service

If you are contemplating building any valve set from a "single-valve" to a "five" it is now possible for you to obtain blue prints which have been made from the actual sets and original drawings of the author. The veriest beginner in wireless work is enabled to profit by the experience of technical wireless experts. The actual lay-out of the set is shown on one blue print which is full size, and can therefore be used as a drilling template, while the other gives a complete wiring diagram, which is copied direct from the original set itself, and is a full-size reproduction of the back of the panel with all the connections appearing. These blue prints are 1s. 6d. each, post free, and will be found well worth this. We have started this service specially for the benefit of those readers who like to be able to obtain exact information of sets as made up by members of our technical staff. If you will write to the Sales Manager he will be pleased to send you a complete list of all these blue prints which cover every set from a five-valve receiver to a single-valve set, including many dual and reflex sets. From this list of over 70 sets you can choose just the set that is going to meet your particular requirements. Write to-day and the list will come to you without delay.

Mr. Kellaway, who has succeeded Mr. Godfrey Isaacs as managing director of Marconi's Wireless Telegraph Co., is here seen at his desk.

The Special Test Department

So confident are we in the design of our sets and so sure that the public will find them satisfactory, that we have opened a special test department. This department is completely equipped with up-to-date precision instruments of various kinds.

Would it not be worth time and money to you to be able to benefit by the use of such apparatus in testing out a set that, for some reason or another, has proved faulty?

If, then, you make up a set from our design which you feel is not up to what you expected, you may send it to us and for the nominal sum of 2s. 6d. per valve we will test the set out thoroughly and send you a complete report. This small charge we make is actually only a fraction of the cost to us for this highly-skilled work, and this offer is an earnest of the confidence we place in sets built and designed by our technical staff.

What Coil Shall I Use?

A good deal of doubt frequently arises as to the right size coils to use so as to receive a certain transmission. The Radio Press have published the MODERN WIRELESS Coil Table, by means of which this difficulty can be solved at a glance.

The various wavelengths employed in broadcasting have been classified, and different makes of coils are given, together with their designating numbers or letters, covering different wavelengths. It is therefore only the work of a second to determine which coil is wanted for the reception of a desired transmission. In order that this table may be kept as a permanent record, it has been printed on stout card, and may be obtained at 6d. each. Other data and useful information can be obtained as to our series of books, and a card to the Sales Manager will bring you a list of these.

Readers will find a note elsewhere in this issue drawing their attention to the importance of using our special order form when purchasing articles advertised in our columns. Unless this is done, we cannot help the purchaser if any question should arise at any later date.

Tested by Ourselves

"Sparta" Crystal Receiver.

A neat little crystal receiver, enclosed in an imitation leather case only 6½ in. by 4½ in. in size, has been submitted by Messrs. Fuller's United Electric Works, Ltd. The tuning is by a flat basket-coil type of variometer with limited angular movement; two alternative earth connections are provided which correspond to different tapping-points in the tuning inductances, and thus provide two ranges of tuning for aerials of different characteristics. Provision is made for a loading coil for the 1,600 metre station, a short-circuiting loop being normally inserted in its place. Two phone terminals only are supplied. We would like especially to commend the crystal detector incorporated in this set; the crystal—quite a small fragment suffices—is held by a spring plunger which allows of immediate adjustment or replacement, a hinged cover protecting the crystal when not in use; a cat's whisker mounting is adopted which is at the same time firm and extremely versatile in its setting. The aerial and earth connections are of the plug-in type, and adapted for shorting the aerial when not in use by simply inserting the one plug in the end of the other, after removing them from the set. We think, though, that the majority of broadcast listeners would prefer to be able to close down the box-lid without altering any connections.

The wave-length range, on test, proved to be from about 310 to 485 metres on the "Short" terminal range, and from 425 to 700 metres on the "Long" with a standard P.M.G. aerial of ·0003 μF capacity; or from below 300 to 420 metres on an aerial-capacity of ·0001 μF, corresponding to a small aerial, e.g., a short and well-isolated indoor one. With the loading-coil, and on a P.M.G. aerial, the tuning-range was (on the "Long" arrangement) from about 1,470 to just above 1,600 metres.

In practical tests in actual reception, on a moderate indoor aerial 6 miles from 2LO, the signals were quite comfortably strong on more than one pair of phones: 5XX was just audible here. At 35 miles out in the country, on a low 70 ft. test aerial, London came in at quite good strength in the evening, the signal-strength measuring up to a good proportion of the standard as determined on the same aerial, i.e., about 1¼ microamperes in this case, for the whole rectified wave. At the same point, 5XX (which is at practically the same distance) gave excellent phone strength, and a value of about 6 microamperes. The tuning in the latter case was not sharp, the variometer adjustment making but little difference when the small enclosed loading-coil provided with the instrument had been inserted. The general appearance and the finish of the instrument are excellent.

The "Sparta" crystal receiver.

"Uralium" Crystal.

Specimens of "Uralium" crystal, marketed together with a special cat's whisker in small boxes with a transparent cover, which is at the same time a seal, have been submitted to us for test by Messrs. G. Street and Co., Ltd. This crystal is a bright, rather coarse-granular type of synthetic galena. On test, it gave really excellent results, the sensitive spots being very plentiful, and the crystal gave on cutting a fresh surface equally good results. It was not unduly brittle. We would like especially to commend the cat's whisker, described as "silver," supplied with each crystal. This is of just the right degree of springiness and fineness of point. Actual measurement shows but little difference between cat's whiskers of varying materials; but the physical conditions are of great importance, and this whisker appears to have been adjusted accurately in this respect. Some little care is necessary in mounting it in some types of holders, as the wire was found to be rather brittle. We can strongly recommend this combination of crystal and cat's whisker for distant crystal reception.

"Britezite" Crystal.

Some specimens of their "Britezite" synthetic galena type of crystal have been sent us for test by Messrs. British Central Electrical Co., Ltd. These were of medium coarseness of texture, and rather duller than usual in appearance. On trial, the behaviour was somewhat erratic, some pieces having an excellent proportion of good spots which (in actual reception with measurement of resulting signal-strength) were up to the standard of good galena; whilst other pieces were not of the same order. The crystal was rather brittle to cut.

Variable Grid-Leak

The general experience of variable grid-leaks is that their most conspicuous property is variability, certainly, but usually not a conveniently and permanently controllable variation over a desirable range of resistance. A type of variable grid-leak which seems to bid fair to overcome some of the weaknesses of many of the existing varieties is the "Panleak," samples of which have been submitted for test by Messrs. A. H. Hunt, Ltd. This is of the step-by-step variety, giving by a 7-point switch a convenient choice of leak values, the ranges quoted by the makers being from ½ to 5 megohms, from 0 to 3, and from 0 to 8 megohms, with a special model rated at 10,000 to 100,000 ohms.

Those submitted were in the form of a small square of insulating composition a little over 2 in. square, adapted for fastening behind the panel by four small bolts and with a centre spindle which is taken through the panel and carries the controlling knob. The latter is knotched deeply to engage with a special anti-capacity extension handle 5 in. long, supplied with the instrument. The 7-point switch is in the rear. Small terminal nuts are provided, which might with advantage be made rather larger for experimental work. The contact finger is kept up to its work by a strong spiral spring, and is apparently intended to be secured on a D-shaped spindle-end, to prevent working loose in use. In one of the samples submitted, on removing the small screw at this end (as is necessary in order to pass the spindle through the panel in mounting it thereon) it was found that this had not been properly fitted, and the small screw stripped its thread when efforts were made to secure the finger again. This was easily remedied, and the screw replaced by a somewhat longer one. The instrument then operated correctly and gave a range from about ½ to 7 megohms on test; another sample tested from ·8 minimum to about 10 megohms maximum, in each case by six convenient steps. The resistance-values appeared to be reproduceable with reasonable accuracy, and a continuous current of 10 microamperes through the whole resistance made a difference of the order of 10 per cent. only in some hours. As far as it is possible to tell by a strenuous laboratory test of necessarily somewhat short duration, and by trial in critical circuits (such as "grid-leak-howl" types of "super" circuits), it would appear as if these variable grid-leaks possess the elements of success.

A photograph of the variable grid-leak with its extension handle.

Substitute Filament Resistance

In cases where low consumption valves (*e.g.*, of the ·06 D.E. type) have replaced the more greedy bright emitters it is generally necessary to replace the old filament resistances with new ones of considerably higher value, or else to introduce a high external resistance, thereby abandoning any appreciable power of control over filament temperature by means of the original filament resistances. Messrs. Ward and Goldstone, Ltd., have just brought out a substitute resistance fitting, intended to replace the old low-resistance spiral of the usual type in circular filament rheostats, and with a suitable

value for controlling dull-emitter valves, which promises to get over this difficulty in a very simple way.

Samples submitted to us consisted of a spiral of fine resistance wire, with a maximum value of around 20 ohms. wound on a pliable cylindrical asbestos core of about ¼ in. diameter. This is bent round the usual circular grooved former in place of the old spiral; the core is soft enough to permit of good contact with the resistance brush, whilst at the same time providing a heat-proof mechanical support for the fine wire.

With reasonably careful fitting this substitute resistance should give a satisfactory solution of the problem provided by a change over to dull emitter valves.

"Amplifytone" Aerials.

Another pattern of copper-ribbon aerial material, to replace the customary 7.22's cable, is included in the "Amplifytone" aerial outfit submitted by Messrs. United Manufacturers and Agency, Ltd. The outfit consists of a cardboard box containing a 100-foot roll of thin ¼ in. copper tape, a 10 in. lead-in insulated with rubber tubing, insulators, and copper sleeves for securing loose ends in a simple manner. The aerial was tested in a similar manner to that in which other ribbon aerials have been investigated, by direct comparison of signal strength on crystal and a two-valve reaction set, measuring resulting signal strength directly and comparing reaction requirements and aerial capacity with this aerial and an exactly similar one of a standard material hoisted rapidly in its place. In this case, stranded thinly-insulated aerial wire was used for comparison. With the phones in series with the micro-ammeter the crystal signal strength (from 2LO, 35 miles away, with an aerial about 70 feet long and 25 feet high, in a good geographical position but locally screened), with the standard low-resistance crystal-tuner and an excellent galena crystal, was 2·5 microamperes with the stranded wire, and 3 micro-amperes with the ribbon. With low-resistance microammeter alone, the figures were 3·5 and 4 micro-amperes respectively. The difference in audio signal strength, as judged by casual aural observation, was naturally inappreciable. With the two-valve reaction set there was no measurable difference in audio signal strength (as measured in mean (R.M.S.) volts across the phones, on a fairly uniform transmission) between the two aerials, though a slightly higher capacity and lower reaction demand was noticed with the copper ribbon.

That there was nothing to be gained by a further increase in the cross-section or area of a single element (without spacing by cage or cross-bar) was shown by the fact that the two aerials when hoisted together practically in contact, after adjusting for the increased capacity, gave exactly the same crystal strength as the ¼ in. ribbon alone. The effective resistance of the aerial is already so low with the standard type of wire that there is little margin for improvement in *reception*; resistance-damping and other losses elsewhere are predominant.

With this reservation, it is evident that the "aerial outfit" provides a convenient equipment for the erection of an aerial of low resistance. The greater wind-resistance of the ribbon should be taken into account in putting up the aerial outdoors.

"Lydden" Crystal Detector

A practical point in crystal-reception which is very often overlooked by the makers of component parts is that of rapidity and ease in changing the all-important crystal. The result is that crystals are very seldom changed as often as they should be, and a low general standard of reception is perforce tolerated.

In the "Lydden" crystal detector, a sample of which has been sent us by John T. Nichols, a special point is made of ease in changing the crystal. The instrument is of the vertical type, glass-enclosed; but the whole top, carrying whisker-holder and cover, is held down on the panel, over, but not mechanically connected to, the crystal-cup, by a single terminal milled-head nut. The cup base is a fixture in the panel, a single screw in its base ensuring this; and the stud on which the terminal-head screws is also a fixture, and provides the second electrical connection necessary. The crystal is held simply in a cage which screws easily over the fixed cup-base. As a result of this ingenious mechanism, the crystal can be got at and removed in five seconds by actual trial, although it is thoroughly protected and securely held. The broad ebonite base of the top portion imparts adequate steadiness to the whisker-holder with the fixing nut only lightly screwed up.

The whisker holder has the usual ball and socket universal joint, but with adjustable spring pressure on

the joint, and has a small chuck for the actual whisker. On trial, it was found to operate smoothly and firmly. The base of the instrument provides a drilling-template for the second hole needed for fixing it on the panel. The glass tube has an opaque back, for better vision in the operation of setting the whisker. On test, the ebonite passed a severe insulation test.

We can strongly recommend this ingenious and extremely practical detector, which should do a good deal towards raising the standard of crystal reception in many cases.

Crystal Detector

A type of vertical enclosed crystal-detector which is provided with a micrometer adjustment for the cat's whisker is the No. 922 pattern supplied by Messrs. A. H. Hunt, samples of which have been submitted for test. This instrument is mounted on a composition base 1¾ in. square, which carries two miniature terminals and the crystal-cup, the latter of small size and provided with the usual three small fixing-screws for the crystal. The glass tube which encloses the crystal is fixed down by means of a metal frame screwed to the base: this has to be unscrewed when a crystal is inserted or changed, an operation which proved somewhat troublesome on trial, and which would present difficulty to many users with the present design of the detector. The usual ball and socket joint on the top is adjustable by a screwed cap, and the cat's-whisker holder has a longitudinal adjustment by means of a fine-thread screw working against a spring. A second crystal cup can replace the cat's-whisker for certain crystal combinations. We found the whisker supplied unduly stiff and thick, without the fine point which is generally called for. The screw-adjustment feature, and the operation of the cat's whisker in general, in searching for and holding sensitive settings, proved on trial to be quite satisfactory.

NOTE ON A "DOUBLE-CIRCUIT NEUTRODYNE."

With reference to the grid-leak connection at the point X in the wiring diagram of the above set, it is essential that the clip should be severed when in position as stated in the article. On no account should the clip be removed to do so, as this will break the internal connections and render the condenser useless.

A Single Valve Set.

To the Editor of MODERN WIRELESS.

SIR,—I constructed the one-valve set described by Mr. Herbert K. Simpson in the June number of MODERN WIRELESS and I am writing to tell you of the success I have achieved with it. It was my first valve set, but I experienced no difficulty in making it. The first time I tried it out it worked very well and received J.B. (*i.e.*, the Johannesburg Broadcasting Station) which works on a 450 metre wavelength, with a number 50 coil in aerial socket and a 75 in reaction socket and using parallel tuning. This form of tuning gave the loudest and clearest signals.

J.B. is 40 miles away and only uses 500 watts. power for transmission. I use an Ediswan A.R. .06 valve, which works very well.

Congratulations on producing two such fine papers as *Wireless Weekly* and MODERN WIRELESS.—Yours truly, R. L. SIMPSON.

Pretoria, S. Africa.

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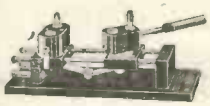
REVERSINE COIL HOLDER



A beautifully made, perfect action coil-holder. It is made of polished ebonite with lacquered brass mountings. The contacts with the moving coil are by rubbing spring brushes, terminals at one end provide for the circuit connections of both the fixed and movable coils. Standard plugs and sockets take the ordinary type duolateral coils.

This M.H. coil holder enables the moving coil to be completely reversed in both its physical and electrical relationship with the fixed coil. It is a perfect variometer as well as a loose coupler and means of applying re-action. If you need to reverse re-action there is no need to reverse the movement of the moving coil.

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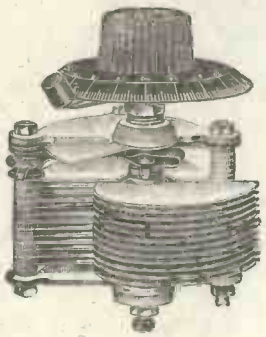

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4. 3 in.,	,,	450 to 650	,,	8½d. ,,	4.	7d. ,,
5. 3½ in.,	,,	600 to 750	,,	10d. ,,	5.	8d. ,,
6. 4 in.,	,,	700 to 1,000	,,	1/2 ,,	6.	9d. ,,
7. 4½ in.,	,,	950 to 1,350	,,	1/4½ ,,	7.	10d. ,,
8. 5 in.,	,,	1,300 to 1,750	,,	1/– ,,	8.	1/– ,,
9. 5½ in.,	,,	1,700 to 2,660	,,	2/– ,,	9.	1/2 ,,
					10.	1/4 ,,
					11.	1/6 ,,
					12.	1/8 ,,

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Interference from Trains

By E. H. CHAPMAN, M.A., D.Sc.
Staff Editor.

An article of interest to those living near Railway Lines

ONE of the most peculiar forms of interference which can be experienced in the use of a wireless receiver is that arising from trains travelling along a railway line. Fortunately, the majority of wireless experimenters live too far away from our railways to be within range of this kind of interference. When, however, an aerial is erected near to a railway line, it is possible for interference from trains to be a decided nuisance, especially if the aerial wires run parallel to the railway lines.

A case of interference from railway trains has recently come under the writer's notice, and a number of careful observations made at different times are worthy of consideration and comparison with similar observations. The receiver used was one of a well-known type of two-valve set. The aerial was of the twin-wire variety, the wires being suspended at the open end from a mast and at the down-lead end from a chimney on a house. The aerial wires were placed parallel to the railway lines, the possibility of interference from trains having been overlooked. An earth connection to a mass of buried metal was made. Fig. 1 is a sketch showing the position of the aerial with respect to the railway lines.

Noises due to interference from trains may be of at least two kinds. There may be a series of distinct "knocks" occurring at regular or irregular intervals or there may be a very pronounced and continuous scratching noise. From the observations made in the case under consideration, it would appear that atmospheric conditions must have something to do with the intensity of the noises heard, since on some evenings the noises were most pronounced, whereas on other evenings the noises were hardly audible.

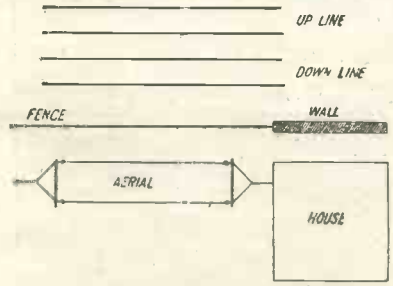


Fig. 1.—Severe interference was experienced with this aerial arrangement.

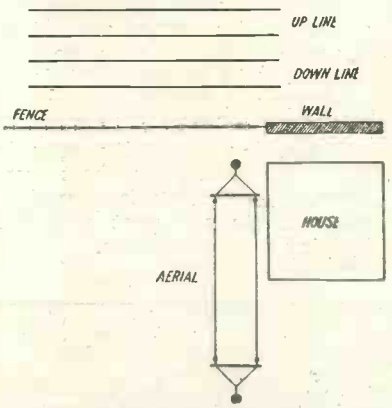


Fig. 2.—In this position interference was reduced.

The following table is a specimen of the observations recorded on an evening when the interference was at its worst.

On the two following evenings the noises were nothing like so noticeable. On the third evening following that for which the table is given, a passenger train travelling on the up line caused slight knocking noises as the train approached, and as it passed the aerial there was a loud click in the telephones, and this loud click was followed by a most peculiar scratching noise, which persisted for some seconds as the train receded in the distance.

It is, of course, highly probable that a train made up of carriages fitted with dynamos which revolve when the train is travelling may cause interference in a wireless receiver, but it is a little difficult to explain how a goods train can cause such interference.

The interference from trains in the case under consideration was noticeably reduced by moving the aerial so that the wires were at right angles to the railway lines. (See Fig. 2.)

INTERFERENCE FROM TRAINS.

Time p.m.	Train.	Line.	Observations.
4.30	Passenger.	Up.	Knocking noises at regular intervals as train approached. Slight scratching noises as train receded.
4.45	,,	Down.	Loud knocking noises.
4.50	,,	,,	Knocking noises.
4.57	,,	Up.	,, ,,
7.7	Goods.	,,	Indistinct noises.
8.20	Passenger, going slowly	Down.	No effect.
9.4	Passenger, going quickly.	,,	Slight knocking.
9.11	Passenger.	,,	Knocking noises.
9.16	,,	Up.	Slight knocking noises.
9.42	Passenger, going quickly.	,,	Distinct hard knocking.
9.48	Passenger.	Down.	Slow and distinct knocking noises.
10.0	,,	,,	Rapid ,, ,, ,,
10.5	,,	,,	Slow ,, ,, ,,
10.8	,,	Up.	Irregular knocking noises.
10.50	Goods.	,,	Noises only just audible.

The Advantages and Disadvantages of Plug-In Coils

An article of particular interest to the amateur which may prove helpful to those undecided as to what coil to use.

PLUG-IN coils have come into extensive use, probably because, as far as a certain class of wireless amateur is concerned, their advantages greatly outnumber their disadvantages. The latter are, of course, less obvious, but will be indicated briefly here, together with the former.

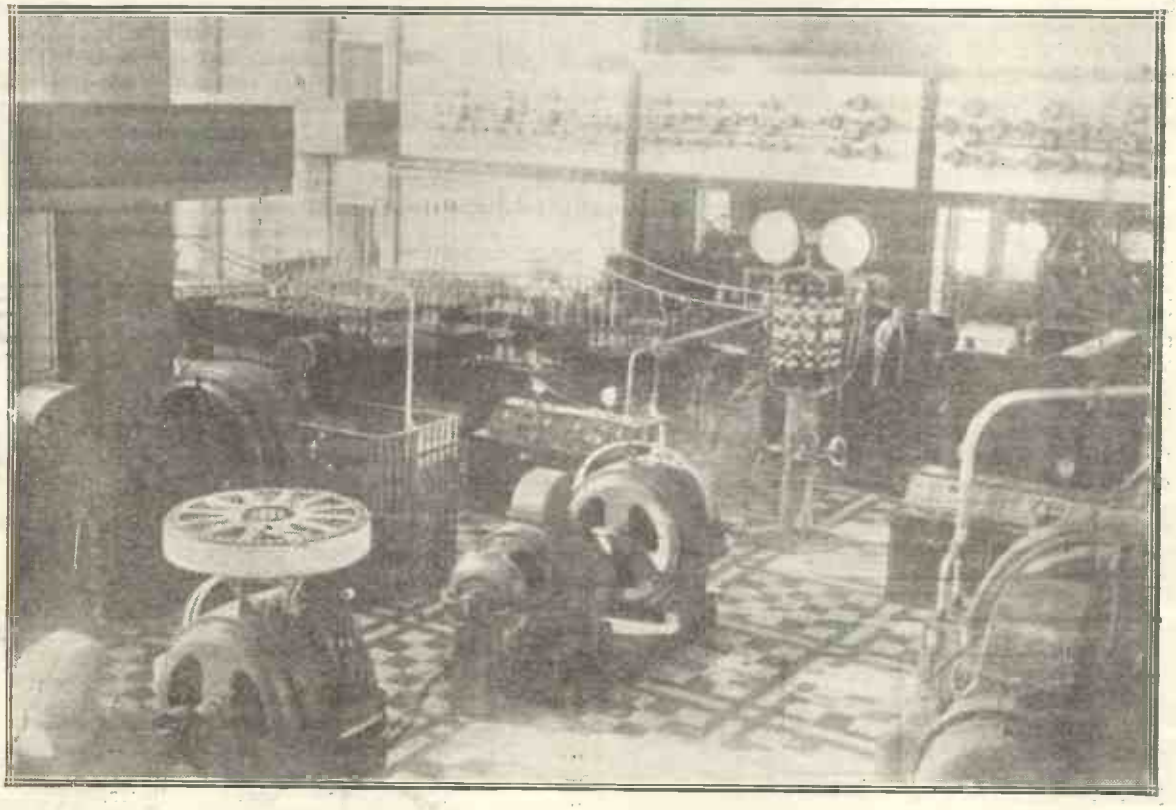
The main advantages of such coils lie in their compactness, their general all-round efficiency, the fact that they are (with one or two exceptions) a standardised commercial product of fairly reasonable price, thus allowing easy interchange, and also that a wide range of wavelengths may readily be covered with the same receiver, provided a sufficient number of coils is available. A very important consideration is that harmful dead-end effects are completely obviated.

Against these undoubted advantages must be weighed the following disadvantages :—

It is not easy in every case to provide, by any combination or arrangement of plug-in coils, for such tuning arrangements as those due to Reinartz, with their many modifications ; also for short wave work, bringing out two leads so close together is a disadvantage.

On such short waves a much thicker gauge of wire is in many cases advisable, the turns being well spaced to minimise dielectric losses and reduce self-capacity, and a smaller area of support for the wire is desirable for the same reasons. The usual type of plug-in coil does not always comply with this specification, for the dielectric losses and self-capacity may be relatively high. For short wave work, therefore, it is sometimes advisable to construct coils embodying the above points.

It has been observed that receiving sets incorporating coils of special design, which must necessarily be made by the constructor himself, do not find great favour among our readers. Here it must be pointed out that the object of incorporating a coil of special design is simply to obtain greater efficiency. It is not known whether the apathetic attitude is due to lack of confidence on the part of the constructor in his ability to obtain good results with such coils constructed by himself, or not; but it is hoped that this attitude will not continue, for it is detrimental to the progress of the science of wireless. The writer has constructed many such sets of special design, and has, in fact, practically abandoned the use of the ordinary type of plug-in coil in favour of the former for nearly all purposes.



The capacious engine hall at the Nauen Station, showing the generators.

Electrostatic Reaction

An Explanation

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

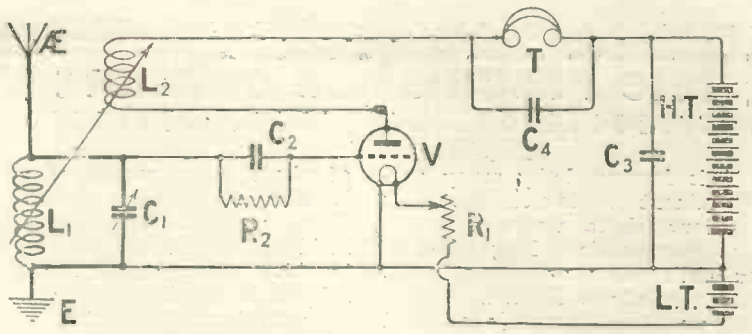


Fig. 1.—Reaction is obtained by coupling L_2 to L_1.

ELECTROSTATIC reaction is less frequently used by wireless amateurs than the more usual type of reaction achieved by the use of ordinary inductive coupling, the reason probably being that the former is very little understood. It is hoped, therefore, that this short article will assist in clearing up any doubts that may exist.

Magnetic reaction

Let us take the simple case of a single valve receiver with reaction on to the aerial, and show the two methods.

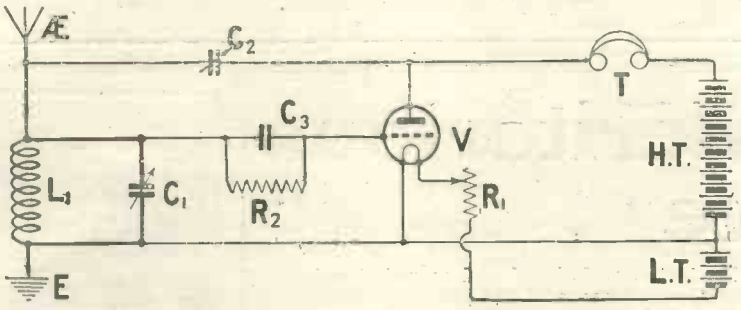


Fig. 2.—The reaction condenser C_2 gives smooth control.

Fig. 1 shows the usual arrangement, whereby magnetic reaction is introduced by coupling a coil in the anode circuit to the aerial or grid coil. Fig. 2 shows how electrostatic reaction may be provided, the coupling between anode and aerial or grid circuits being obtained by connecting a small variable condenser directly between the aerial and the plate of the valve.

A Comparison

In the former case the incoming radio-frequency oscillations set up varying potential differences across the grid-filament circuit of the valve which, by the action of the valve, cause corresponding audio-frequency currents in the anode circuit. These pass through the anode coil L_2, and since a magnetic coupling exists between L_2 and the aerial coil L_1, a transfer of energy from the plate circuit into the aerial circuit takes place. Thus when L_2 is correctly connected it increases the potential variations across the grid-filament circuit. This results in a corresponding increase in anode current, which, passing through the telephones T, gives greater signal strength.

Electrostatic reaction

Comparing this with the second case of electrostatic reaction, we find a similar state of affairs. The radio-frequency oscillations in the aerial circuit L_1C_1 cause varying potential differences to be applied across the grid-filament circuit of the valve V. Due to valve-action, corresponding audio-frequency currents appear in the anode circuit, the energy transference from anode to aerial or grid circuits taking place via the condenser C_2. An important point, however, arises here. It will be observed that in Fig. 1 the telephones are shown shunted by a fixed condenser, C_2, while in Fig. 2, this condenser is omitted, the reason being that in the second case (electrostatic reaction) a radio-frequency choke must be provided in the anode circuit, otherwise the H.F. oscillations in the aerial will have a direct path through the telephones T and the H.T. battery circuit to earth. Normally, on broadcast and higher wavelengths, high resistance telephones will function as an efficient radio-frequency choke, but on the shorter waves it is necessary to include a choke consisting, say, of a 200-300 turn, low self-capacity coil, L_2, between the telephones and the anode of the valve V, as shown in Fig. 3.

Double reaction

This will provide an effective block to H.F. oscillations while not preventing the passage of audio-frequency currents through the telephones.

On practical trial it will be found that the electrostatic method provides a smooth and easy control of reaction with an even build-up of signal strength by simply varying the capacity of C_2. It is usual in receivers employing more than one valve to arrange the anode-aerial capacitative coupling between the anode of the detector valve and the aerial; some experimenters, however, have introduced double reaction by effecting a similar coupling between the aerial circuit and the anode of a low-frequency amplifying valve.

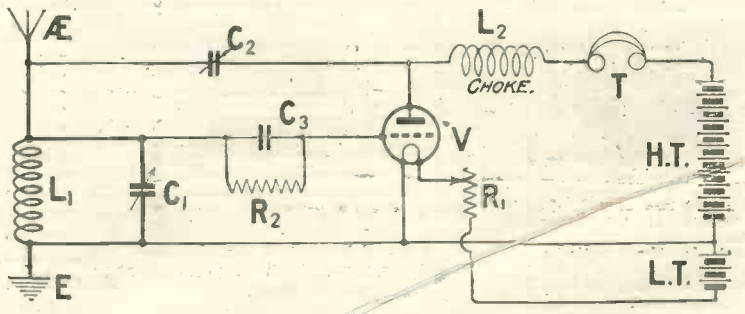


Fig. 3.—How to connect a choke when using capacity reaction on short waves.

The Fascination of Short Wave Reception

IT is forecasted by many prominent radio experts that very short waves may in time supersede long waves for both short and long range work. Only a little while ago long wavelengths were considered essential to transmit over great distances, but recent developments have shown that ultra-short waves have remarkable penetrative powers. But, as many readers well know, reception is much more difficult on these low wavelengths, and much attention is now being given to the efficient reception of waves below 100 metres, necessitating a certain amount of modification of existing apparatus.

In the issue of *Wireless Weekly* dated October 22 there commenced an extremely interesting series of articles on "Supersonic Heterodyne Reception" by John Scott-Taggart, F.Inst.P., A.M.I.E.E. No one who is anxious to learn the principles of this fascinating method of short wave reception, which is now so popular across the Atlantic, can afford to miss these lucid articles, which are the first in this country which tackle the subject in detail.

Apart from this series, several articles of outstanding interest have appeared in recent numbers of *Wireless Weekly*. In the issue for October 29 Mr. A. D. Cowper contributes an article on "Neutral Grid Coupling," an interesting method of obtaining stability in high-frequency amplifiers, of which original method he is the author. A wavemeter for amateur transmitters was described by Mr. Percy W. Harris, and under the title of "Some Record-breaking Achievements" the wonderful two-way wireless communication accomplished between this country and New Zealand is detailed.

The issue for November 5 was the second of our special numbers, containing twelve pages of superb photogravure reproduction, the first having been published on October 22. Mr. A. D. Cowper writes on "Long-Distance Reception with the 'Neutral Grid' Method of H.F. Coupling"; while Mr. R. W. Hallows contributes an article of universal interest entitled "Your Accumulator—How It Works." A two-valve and crystal receiver employing the S.T. 152 circuit is described, a special feature of this set being its immunity from A.C. hum.

In the November 12 issue is an article on the "Super-Autodyne," which describes a new method of obtaining extreme selectivity with minimum equipment. The popular combination of valves employed as H.F. amplifier, detector, and L.F. amplifier has been adopted by Stanley G. Rattee in his description of "A Transformer Coupled Three-Valve Receiver." Flat-dwellers and experimenters are well catered for by Mr. R. W. Hallows in an article describing a "Novel Frame Aerial."

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Radion is manufactured by American Hard Rubber Co., (Britain), Ltd., 13a, Fore Street, E.C.2.

Radion Panels

EVERY Wireless Magazine of note is emphasising the necessity of using only the very finest grades of ebonite guaranteed free from surface leakage. Writing in *Wireless Weekly* (dated November 12th), Mr. Percy Harris stresses the point that the average man cannot tell the difference between good ebonite and inferior ebonite by merely looking at it. The acid test is to use it—but no one wants to spend time and money on building a Set only to find that it won't work.

The safe way, therefore, is to be sure to choose an ebonite that is fully guaranteed in every respect and backed by a manufacturer whose name is well known. Radion, for example, is made in the largest factory in the world devoted to the manufacture of ebonite. Radion is more than ebonite, for its manufacturers found that ordinary ebonite was not sufficiently free from leakage for wireless use. Its beautiful polished surface — either in black or mahoganite— need not be removed before use. Not only will it convey a most distinctive appearance to any Receiver, but it is absolutely dust and moisture proof.

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Bright Emitter

12/6 each.

B.T.H. .. R. Type
Ediswan .. A.R. „
Marconi-Osram R or R 5 V „
Mullard-Ora „
Cossor .. P.1 „
Cossor .. P.2 „
Myers-Universal
Mullard H.F. (Red Ring)
Mullard L.F. (Green Ring)

Dull Emitter

21/- each Type
B.T.H. B.3
Ediswan A.R.D.E.
Marconi-Osram D.E.R.

25/- each Type
B.T.H. B.5
Ediswan .. A.R.O.G
Marconi-Osram D.E.3
Mullard .. D.F.Ora

DULL EMITTER POWER VALVES
For use with A.R.D.E. and D.E.R. Valves.
Marconi-Osram, Type D.E.6, 2—2·5 volt, ·25 amps. 25/-

DULL EMITTER POWER VALVES
For use with ·06 Valves.
B.T.H. Type B.6 35/-
Marconi-Osram „ D.E.4 30/-
Mullard „ D.F.A.2 30/-

DULL EMITTER POWER VALVES
For use with Bright Emitters.
B.T.H. .. B.4 35/-
Marconi-Osram .. D.E.5 35/-
Mullard .. D.F.A.1 35/-

·06 French Metal 17/6
·06 Dutch .. 12/6
Phillips ·04 Type 17/6

HEADPHONES

We can recommend these as being excellent Headphones, with a great reputation for telephone designs behind them. British Thomson-Houston, Sterling, Brown's Featherweight, Gecophone, 4000 ohms resistance, each £1 5 0
British Ericsson, 4000 ohms resistance, each £1 6 6
G.R.C., 4000 ohms resistance, each £1 0 0
B.T.H., 4000 ohms resistance, each £1 5 0
Brandes Matched Tone, 4000 ohms resistance, each £1 5 0.
Brown Type A, 4000 ohms resistance, each £3 2 0
Sterling, 4000 ohms resistance, each £1 5 0
Gecophone, 4000 ohms resistance, each £1 5 0

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L.F. TRANSFORMERS

Eureka Concert Grand

This is a really high grade transformer for Inter-valve use. We can thoroughly recommend its use where first class results are required. It increases power and the purity of signals. Made in two sizes but only one quality.

"Concert Grand" Model .. £1 10/-
No. 2 (Second Stage) .. £1 2/6
R.I. 5-1 Ratio .. 25/-
Igranic, 5-1 Ratio 21/-
The Ferranti, 4-1 Ratio 17/6
The Silvertown, 5-1 Ratio .. 21/-
The G.R.C. 5-1 Ratio 15/-
The G.R.C. 10-1 Ratio 20/-
Marconi Ideal Power 35/-
Burndept L.F. 5-1 Ratio 25/-
Lissen T. 1 L.F. .. 30/-
„ T. 2 L.F. .. 25/-
„ T. 3 L.F. .. 16/6
Success, 5-1 Ratio 16/-
Ditto, Super .. 21/-
Ormond 14/11

LOUD SPEAKERS

BABY MODELS

Sterling, 4000 ohms .. £2 15/-
Sterling Dinkie 1 10/-
Brown's 2000 ohms 2 8/-
Amplion Junior 1 7/6
Dragon Fly.. 25/-

PARTS FOR 2-VALVE "UNIDYNE" RECEIVING SETS.

The 4-Electrode Valve Thorpe K4 each 17/6
6 Terminals for 10d.
2 Microstat Filament Resistances each 2/9
1 Variable Grid Leak 2/6
1 Single-Pole Double-Throw Switch 1/9 or 2/-
1 ·0005 Variable Condenser, with Vernier 7/3
1 Cam Vernier 2-way Coil Holder .. 9/-
Panel, 5½ in. by 12 in. by ¼ in., drilled to hold 2 5-Pin Valve Holders .. .. for 2/-
2 5-Pin Valve Holders each 1/6
1 Fixed Condenser, ·001 .. 1/2, 2/2, 3/-
1 Fixed Condenser, ·0002 .. 1/2, 2/2, 3/-
1 Shrouded L.F. Transformer G.R.C. 10-1 .. .. 20/-
8 yds. No. 18 Gauge Tinned Copper Wire 1/2
Necessary Screws, Nuts, and Washers, Free if above lot purchased.
Post Extra.

BRUNET (genuine)

4000 ohm Double 16/6
4000 ohm Single 8/11
2000 ohm Single 7/6
Post Free.

ENERGO

H.F. Plug-in Transformers.

No. 1. 150-450 .. 3/6
No. 2. 250-700 .. 3/11
No. 3. 450-1200 4/3
No. 4. 900-2000 4/6
No. 5. 1600-3000 4/9
No. 6. 2200-5000 4/11

FILAMENT RHEOSTATS

Wire Wound Type. Rotary Action.

IGRANIC

The "different" filament resistance with stationary contact arm, extremely silent in operation, the plain type is recommended for amplifying valves. For the rectifier use the Vernier adjustment.

IGRANIC ohms each

Plain Type .. 4 & 7 4/6
With Vernier Adjustment .. 4 7/-
Plain Type .. 30 7/-
The Raymond 6 1/6
The Ormond .. 2/-
The T.C.B. Type, B 13 4/-
The T.C.B. Type, D 30 4/-
The Burndept, Dual, 222 5 & 30 7/6
Microstat 2/9
Lissenstat, Minor 3/6
Lissenstat 7/6
Lissenstat, Universal 10/6
Lissen Auxiliary Resistance .. 1/3

SHIPTON'S

30 ohms 3/-
60 ohms 3/-
600 ohms Potentiometer 4/6
Highly recommended.

T.C.B.

6, 13, 30 ohms .. 4/-
300 ohms Potentiometer 5/-
Highly recommended

IGRANIC COILS

Coils: 25, 5/-; 35, 5/-; 50, 5/2; 75, 5/6; 100, 7/-; 150, 7/10; 200, 8/8; 250, 9/-; 300, 9/5; 400, 10/3; 500, 10/6

DUBILIER. Post 2d.

.001, .002, .003, .004, .005, .006, Fixed .. 3/-
.0001, .0002, .0003, .0004, .0005.... 2/6
Type 577, .01 .. 7/6
Grid Leaks each.. 2/6
Anode Resistance 50,000, 70,000, 80,000, 100,000, on stand complete 5/6

EBONITE

COIL HOLDERS

Polar 2-way, with Vernier 11/-
Polar 3-way, with Vernier 17/-
Polar-Junior, 2-way Cam-Vernier 6/-
Polar Junior, 3-way Cam Vernier 9/6
Polar Universal 2-way 10/6
Goswell 2-way coil holder 5/6
Goswell 2-way Vernier Coil Holder 9/-
Goswell 3-way Coil Holder 7/6
Goswell 2-way Panel Mounting .. 3/-
Goswell 3-way Panel Mounting .. 5/-
Franco Cam Vernier 2-way .. 12/6
Goswell 3-way Cam Vernier 12/6

BASKET COIL HOLDERS

No. 1 .. ..2 for 2/-
No. 2 .. ..2 for 2/6
(both with plug)
Coil Stand 2-way for Basket Coils 5/6
Universal 2-way for Basket Coils 5/11

'BABY' COIL STANDS

2-way on base .. 3/-
3-way on base .. 4/9
(brass fittings)
2-way ex handles 4/6
3-way do. 5/6
(nickel fittings)
2-way Cam Vernier high class .. 5/9
Several high-grade patterns.
2-way .. .. at 5/- 5/6
3-way .. at 6/11 7/6

POLAR CONDENSERS

(Variable.) For Panel Mounting only.

A new form of Variable Condenser, constructed with a di-electric of air and high-grade mica, reducing losses to a minimum. Tested for Insulation on 1000 volts potential. Adaptable to any type of Panel.

Each
·001 mfd. .. 10/6
·0005 „ .. 10/6
·0003 „ .. 10/6
·00025 „ .. 10/6

'Sterling' Square Law Variable Condensers

A new type of superior quality, distinctive design of moving plates, with Vernier Adjustment. The auxiliary knob controls the Vernier.

Each
·001 mfd. .. £1 10/6
·0005 „ .. £1 5/6
·00025 „ .. £1 3/-

ACCUMULATORS MADE BY WELL-KNOWN FIRM FOR ME.

POST PRICES.

2 v. 40 amps. .. 10/6
4 v. 40 amps. .. 17/6
4 v. 60 amps. .. 20/6
4 v. 80 amps. .. 24/6
6 v. 60 amps. .. 29/-
6 v. 80 amps. .. 34/6
6 v. 105 amps. .. 40/6

EDISON BELL.

·0001 to ·0005 Fixed 1/3
·002 to ·006 .. 2/-
·001 .. .. .. 1/3
·0003 with Grid Leak 2/6
Variometer .. 10/-
Twin Detector .. 5/6

BRETWOOD (New Model)

Var. Grid Leak.. 3/-
Anode Resistance 3/-

Genuine DR. NESPER HEADPHONES

Adjustable diaphragm, detachable receivers, double leather-covered head-springs, long flexible cords, nickel plated parts. Very comfortable fitting to the head. LOOK FOR THE TRADE MARK.
4,000 ohms .. 12/11
Post 6d. pair.

McMICHAEL'S H.F. TRANSFORMERS

150–300 **10/-**
300–600 EACH
1,100–2,000 (Manufacturer's advance.)
100,000 ohms Fixed 2/6
2 meg. Leak .. 2/6
Both with clips.

WATMEL

Var. Grid Leak.. 2/6
Anode Resistance 3/6

NOTE!
OUR WONDERFUL MICROMETER ADJUSTMENT GLASS-ENCLOSED DETECTOR. WHY PAY MORE? **1/9**
POST 6d. each

WATES MICROSTAT
For D.E. or R. Valves **2/9**
Post Free.

FRENCH THOMSON HOUSTON
JUST TRY THEM.
4,000 ohms Per pair **15/11**

HAWK COILS HONEYCOMB

25..2/4 150.. 4/6
35..2/6 200 .. 5/4
50..3/- 250 .. 5/6
75..3/4 300 .. 6/-
100..3/10 400 .. 6/6

"MURRAY" (Prov. Pat.)
Valve Holders .. 1/3
High Finish. Absolutely Safe. Low Capacity.

Formo, open 12/6

47 Bucks "Powquip" 12/6

Manchester "Powquip," 15/6

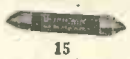
Ormond, 14/6

'Shrouded 'Powquip,' 18/-

Standard 'Powquip, 14/6

14 Voltmeter, 4/6

21 C and S, one-hole fixing, 1/6

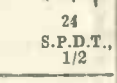


15 Grid Leak, 1/-, 1/3, 2/6

16 Rheostat, with Dial, extra value, 2/6

4 Bretwood Valve-holder, 1/9

23 D.P.D.T., 1/5



24 S.P.D.T., 1/2

17/6 N & K No. 3 **17/6**
LATEST MODEL.

RIGHT OPPOSITE DALY'S GALLERY DOOR

K. RAYMOND

27, LISLE STREET, LEICESTER SQUARE, W.C.2

No responsibility accepted on post orders unless cheques and postal orders are crossed and made payable to the firm. Moneys sent must be registered

HOURS OF BUSINESS:
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SUNDAY: 10 to 1

'Phone: GERRARD 4637.

CALLERS' PAGE OVERLEAF

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Please Note. Large stocks kept, but orders accepted on distinct understanding that same will be despatched in strict rotation at the earliest possible date. Not answerable for delays in manufacturers' supplies. Right reserved to return cash.

RAYMOND'S VARIABLE CONDENSERS

ALL OUR CONDENSERS HAVE BEEN TESTED AND RECOMMENDED BY LEADING JOURNALS—UNSOLICITED.

—Exclusive Design.
—Stout Vanes.
—Extra Insulation, Very Compact.
—Narrowest Spaces (Pressed Aluminium).
—Centre Rod cannot bend.
—Terminal Connections, Capacity Guaranteed.
—Perfect Efficiency.
—Handsome Design.
—Takes up very little space in panel.
—Nickelled Fittings.
—Beautifully Made.
—New one-hole fixing method.
—Wonderful for Portables.

UNSURPASSED FOR FINE TUNING.

Costs a trifle more, a few pence only, and is just what you want. Nice dial and knob included.

'DE LUXE' MODEL

AS SHOWN, WITH DIAL, KNOB AND BUSH.

·001 - 7/3
·0005 - 5/11
·0003 - 5/4
·0002 - 4/11

POST 6d. SET.

John Blair, Esq., Rexall Pharmacy, Millom. says:— Your Condensers are a REVELATION to me as a Dealer. Sept., 1924.

C. Walton, Esq., Andover. Tested your Condensers on Megger and got "INFINITY"

NEW MODEL SQUARE LAW

·0005 .. 7/9
·0003 .. 6/6
With Vernier.
·0005 .. 10/6
·0003 .. 9/6
Post 6d.
Knob & Dial included.

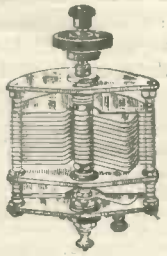
WITHOUT VERNIER

·001 - - 6/6
·0005 - - 5/3
·0003 - - 4/11
·0002 - - 4/6
Vernier, ·00005 3/9
With knob and dial
Post 6d. Set.

TWIN CONDENSER

Composed of two equal units of ·00025 or ·0003 mfd., operated by one Knob and Dial, thereby enabling you to tune two circuits by one turn of the dial. Can be used in series or parallel. Complete as shown, with Knob and Dial.

9/- POST FREE.



WITH VERNIER

·001 - - 9/3
·0005 - - 7/3
·0003 - - 6/9
With EBONITE DIAL and Two Knobs.
Post 6d. Set.

SQUARE LAW TWIN VARIABLE CONDENSERS

EBONITE ENDS. KNOB AND DIAL

·00025 - - - 12/6
·0003 - - - 12/6
·0005 - - - 18/11

VALVE DETECTOR & REACTION from Anode Circuit to A.T.C. 1 L.F. Valve.

PARTS FOR P.W. Standard 2-valve Set (Nov. 8th, 1924) For Telephone reception UP TO 40 MILES.

The following is a list of materials and cost of the chief parts for the 2-valve Set.

EBONITE, 12 x 9 x ¼
·001 Var. Condenser.
L.F. Transformer.
2 Rheostats.
Grid Leak & Condenser.
Two valves (Bright).
Two coils (Igranic).
2-way coil holder.
Valve Sockets.
Terminals and Wire.

All above are BEST QUALITY. 75/- Panel Drilled. the lot

SPECIAL ! !
CRYSTAL SET AND 1-VALVE AMPLIFIER.
Fittings for Chelmsford. Enclosed box.
Splendid quality.
Post 1/6 39/11

"HART" Accumulators stocked.

MYERS VALVES.
UNIVERSAL 12/6 D.E. 21/-

BROWNIE "IMPROVED" WIRELESS SET, 7/6
Post 1/-.

"POLAR" MICROMETER CONDENSER 5/6

DIAMOND WEAVE BASKET COILS (5) EXTRA AIR SPACE (DUPLEX WAXLESS) Equal to Honeycomb. 25, 35, 50, 75, 100 (wave-lengths marked).
Post Free 3/9

JACKSON BROS. "J.B." VARIABLE CONDENSERS ORDINARY MODELS

	Standard	Super.	Microdenser
.001 ..	8/6 ..	9/6 ..	11/6
.00075 ..	8/- ..	9/- ..	11/-
.0005 ..	7/- ..	8/- ..	10/-
.0003 ..	5/9 ..	6/9 ..	8/9
.00025 ..	5/9 ..	6/9 ..	8/9
.0002 ..	5/- ..	5/6 ..	8/-
.0001 ..	4/9 ..	5/3 ..	7/9
Vernier	4/- ..	4/6	Post 3d. set.

SQUARE LAW

.001	9/6	.00025	6/9
.00075	9/-	.0002	5/6
.0005	8/-	.0001	5/3
.0003	6/9	Vernier	4/6

EBONITE

Post Prices.

	3/16 in.	¼ in.
6 x 6 ..	1/6	2/-
7 x 5 ..	1/8	2/-
8 x 6 ..	2/-	3/-
9 x 6 ..	2/2	3/3
10 x 8 ..	3/-	4/2
12 x 6 ..	3/3	4/2
12 x 9 ..	4/3	5/8
12 x 12 ..	5/6	7/6
14 x 10 ..	5/6	7/6

Cut to Size, 3/16 in. at ½d square inch.

"N & K"

No. 3

17/6 LATEST MODEL 17/6

New 3-pole Laminated Magnets, which ensure an even magnetic pull and still greater volume. Windings well insulated. Large size carpieces and leather headbands of standard "N&K" comfortable design. Technically, "N & K" Headphones represent the last word in Wireless Reception.

IMPOSSIBLE TO EQUAL FOR CRYSTAL SETS.

35 Tumbler Switch, 1/6

30 Connecticut, 1/6

Callers' prices elsewhere

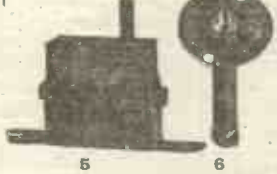
53 2 for 1/6

29 2 for 2/-

49 Formo Shrouded, 18/-

3 EDISON Bell Wedge, 2 for 2/-

25 S.P.D.T. .. 1/9 D.P.D.T. .. 2/6 China Base.



5 With Clips, 2 for 1/6

6 ALLEN Variable Grid Leak, 1/6

46 Cut from Solid Rod 1/3 Legless 1/3

48 5—1 11/9 12/6 13/11

34 Wates Micro-stat 2/9

43 BASKET 2-way, 4/11.

2 BASKET HOLDER Without Terminals, 1/-, 1/3 each With Terminals, 2 for 2/9

54 EBONITE Variometer with dial, 4/11, 5/11

33 ENERGO (see list) Raymond 2/9 to 3/6

?? M'Mich'l H.F. Barrel 10/-

FERRANTI INTER-VALVE TRANSFORMER 17/6

36 EBONITE 1/-

37 Dubilier Fixed

41 Dragon Fly, 25/-

"R.I." NEW MODEL IN SEALED BOX *Don't Buy Otherwise.* Post 25/- Free

51 Enclosed Detector Micrometer Adjustment 2/3

One-Hole Fixing, 1/6

55

42 CAM VERNIER 2-way (see lists).

RIGHT OPPOSITE DALY'S GALLERY DOOR

Phone: GERRARD 4637.

K. RAYMOND

27, LISLE STREET, LEICESTER SQUARE, W.C.2

No responsibility accepted on post orders unless cheques and postal orders are crossed and made payable to the firm. Moneys sent must be registered

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POST PAGES OVERLEAF.

THIS PAGE IS FOR CALLERS ONLY

ALL POST ORDERS FROM THE OTHER TWO PAGES

OPEN WEEKDAYS 9 to 7.45 SUNDAYS 10 to 1

Prices subject to alteration without notice. Every endeavour made to keep large stocks; but am not responsible for manufacturers' non-deliveries.

NO POST ORDERS FROM THIS PAGE.

SUNDRIES.

Legless Valve Holder Solid Ebonite .. 10d.
'Phone Cords (6 feet).. 1/5
Nugraving .. .. 7½d.
Similar Sets (Titles or Scales) .. .. 3d.
Good Knobs .. .. 2d.
Studs, Nuts and Washers doz. 4½d.
Switch Arms .. 3d. to 1/-
Copper Foil .. ft. 2½d.
18g. Sq. Tin Copper 15 ft. 5d.
16g. Sq. Tin Copper 16 ft. 5d.
Round Tin Copper, various Sizes.
Insulated Staples 5 a 1d.
Insulated Hooks 4 for 3d.
Rubber Lead-in 30 ft. 1/-
7/22 Copper Aerial, 100 ft. 1/10½
Extra Heavy Aerial, 100 ft. 2/- and 2/3
Good Valve Holders .. 3d.
H.F. Transformers, 300/600 .. .. 2/9
Empire Tape, ½ in., 2 yds. 1d.
6 in. Ebonite Anticap Handles .. .. 3d.
Connecticut Switches .. 1/4
Sorbo Rubber Ear Caps pr. 1/4
Adhesive Tape Roll .. 2½d.
Allen var. Gd. Lk. .. 1/3
Allen Anode Res. .. 1/3
Scales, 0-180, 2d., 3d., 4d.
Dial and Knob (Ed. Bell) 1/3
Dial (Ebonite) .. .. 10d.
Brunet Headphones .. 14/6
Twin Flex .. 4 yds. 6d.
D.C.C. Bell Wire, 10 yds. 5d.
(Indiarubber covered).
Sleeving .. yd. 4d.
Wander Plugs .. pr. 3d.
Coloured Plugs each 1½d.
(All screw pattern).
Electron Aerial .. 1/3½
Polished Boxes, 8 by 6 3/6
Strong Valve Template 4d.
Egg Insulators.. .. 1d.
Reel ditto .. .. 1d.
Thick Rubber Lead-in per yd. 2d., 3d.
Ribbon Aerial, 100 ft. 1/10
Panels Drilled.
Radio Press Envelopes.
Raymond Fixed Condensers, .001, .0001 to .0005.. 10d.
.002, .003, .004 .. 1/-
.006, 1/3; .01, 1/9; .02, 1/9
Polar Micrometer Condenser 5/6
2 Meg. Grid Leak .. 10d.
Rubber Lead-in, 10 yds. 1/-
Valve Windows, 6d., 7d., 9d.
R.I. Choke Coil .. 10/-
Lissen Ditto 10/-
Bretwood Valve Holder 1/9

SWITCHES ON.

Porcelain D.P.D.T. .. 1/7½
Porcelain S.P.D.T. .. 1/1
Ebonite D.P.D.T. .. 1/8
Ebonite S.P.D.T. .. 1/3
Min. Panel D.P.D.T. 1/-
Min. Panel S.P.D.T. .. 10½d.
Tungstalite 1/-
Microstat 2/6
Tumbler Switches (Ebonite) 1/4
Fibre Strip (for Coils) 3 ft. 2½d.
D.C.C. Wire, per ½ lb.—
18g. .. 9d. 20g. 9d.
22g. ..10d. 24g. 1/-
26g. ..1/1 28g. .. 1/3
30g. ..1/6 Etc., etc.
Solder .. per stick 2d.
2 Colour Flex .. yard 3d.
Shellac .. .. .. 5d.
Battery Box 4/6
(with clips for 36 v.)
Nickel Pillar Terminals 2d.
Nickel Contact Studs 2 for 1½d.
Nickel Switch Arm .. 1/-
(one-hole fixing).
Loading Coil and plug 8d.
Condenser Brushes .. 6d.

BRASS PARTS.

W.O. Terminals .. 1d.
Small Pillar .. .. 1d.
'Phone 4 B.A. .. 1d.
'Phone 2 B.A., 2 for 2½d.
Valve Sockets .. 4 for 3d.
(Above with Nut Washer)
Valve Pins and Nuts, 2 a 1d.
Stop Pins and Nuts, 2 a 1d.
Plug and Socket pr. 1d.
Spring Washers 4 a 1d.
Spade Screws .. .. 1d.
Pin Screws .. 2 for 1½d.
Spade Tags .. 5 a 1d.
Spring Pillar Terminals 2½d.
Nuts, 2, 4, 5, 6 B.A. doz. 2d.
Washers (Brass) 12 a 1d.

DETECTORS, &c.

Enclosed Brass, large.. 1/3
Ditto, Nickel or Brass, large 1/6
Small Brass .. .. 9½d.
Ebonite, enclosed .. 1/-
Burndept 5/-
Easi-Fix Cups 1d. and 1½d.
Gold Spearpoint .. 3d.
Neutron Crystal .. 1/6
Hertzite (Shaw's) .. 1/-
Midite .. .. .. 6d.

VALVES.

Dutch Detector .. 4/9
Dutch "R" 5/-
Phillips "R" .. 7/6
French "Metal" .. 6/11

TOOLS.

Set of Spanners .. 1/4
Taps, 0, 2, 4, 6 B.A., set 2/-
Small Soldering Irons.. 6½d.
7-Twist Drills 1/4

SHAW'S HERTZITE

BEATS ALL OTHER "ITES." 1/-

Impossible to Advertise All the Goods Stocked.

MYERS VALVES.

UNIVERSAL 12/6 D.E. 21/-

EXIDE.

D.T. 9 Type. 2 Volts. (Glass). (For .06) 5/-

EBONITE PARTS.

Good Coil Plugs from 4½d.
Edison Bell Shaped .. 1/-
Raymond Ditto .. 10½d.
Basket Adapters .. 3½d.
Also at 1/- and 1/3
2-way Coil Stands .. 2/6
With Extens. Handle .. 2/11
Also at 3/6, 4/-, 4/6
3-way 4/8, 4/6, 5/-
Goswell Cam Vernier .. 9/-
Franco Cam Vernier .. 12/6
Polar Cam Vernier .. 11/-
Etc., etc.
Coil Plug on Stand .. 1/-
Ditto, Swivel Movement 1/3
Coil Plug and Clips .. 6½d.

H.T. BATTERIES.

Best Made 30 v. .. 4/6
Best Made 60 v. .. 7/6
Best Made 66 v. .. 8/6
B.B.C. 9 volts .. 3/-
B.B.C. 60 volts .. 9/6
B.B.C. 36 volts .. 5/6
B.B.C. 16 volts .. 2/6

EBONITE STOCK SIZES 3/16 in.

6 × 6	1/4
7 × 5	1/4
8 × 6	1/10
9 × 6	2/-
10 × 8	3/-
12 × 6	3/-
12 × 9	4/3
12 × 12	5/6
14 × 10	5/6

Cut to size ½d. sq. inch.
WE STOCK ¼ in. EBONITE.

CRYSTAL DETECTOR.

Glass enclosed. Micrometer adjustment. 1/9

MURRAY VALVE HOLDER (Patent) 1/3

Blue and Red TUNGSTALITE

MIDITE. GECOSITE. NEUTRON Stocked.

SIMPLEX LEAD-IN 1/3

"POPULAR WIRELESS"

FREE TO CALLERS. (Limited number, of course.)

BRASS FORMER.

(DOUBLE) 23 spokes each side 2/11
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Readers' Results with T.A.T. Circuits.

T.A.T. SUCCESSES. In N. Wales.

To the Editor of MODERN WIRELESS.

SIR,—As requested in your article on the T.A.T. system of H.F., I herewith send results obtained from the three-valve with the stage of L.F. :—

All B.B.C. Main Stations.—Moderate L.S. strength.
Munich—Moderate L.S. strength.
Voxhaus—Fair L.S. strength.
Petit Parisien—Moderate L.S. strength.
Radiola—Moderate L.S. strength (300 choke, 200 anode, 150 aerial).
Madrid—Moderate L.S. strength.

Choke coil 110 (home-made), lattice coil 200 I find weakens signals considerably. H.T. voltage 55 actual, 6-volt. L.T., Manchester and Chelmsford can be heard at good 'phone strength without any *aerial coil*.

Manchester 70 miles and Chelmsford at good L.S. strength, with no reaction.

Yours truly,
BERTRAM BELL.

Rhyl, N. Wales.

[This circuit is similar to that of set described in this issue.]

In Ireland.

To the Editor of MODERN WIRELESS.

SIR,—I am writing to you to tell you how much I appreciate your articles on high-frequency amplification which appear in MODERN WIRELESS.

None of your articles, however, interested me so much as those appearing in the last issue, which were on the Tuned-Aperiodic-Tuned system. The article was most interesting all through.

I am seventeen years old and have been at wireless just over a year. I bought the components for a four-valve (1 H.F. Det. and 2 L.F.) set, but as I had never seen a set wired a wireless operator friend of mine wired it up for me.

The set worked well for about two months, when trouble developed, which, after I had taken the set to pieces for all the parts to be tested, was located in a faulty .0003 variable condenser and a .0003 fixed condenser.

To facilitate trying several circuits I soldered no connections when rewiring the set again. Since that I have tried nearly a dozen four-valve circuits, but none with 2 H.F. valves.

No. 12 Circuit.

When I read your article in MODERN WIRELESS I decided to try circuit No. 12 (2 H.F. and Det. with reaction on aerial), to which I added my fourth valve as L.F. and provided a switch to cut it out at will, but the L.F. is unnecessary. I may add that all connections are now by locknuts and terminals, but as I have now found an excellent circuit I think after a few additions have been made I will solder all joints.

As I was confined to bed last week until Saturday I did not get it tested on my good aerial but tested it on a very poor aerial and earth arrangement erected by my little nephew, aged seven.

A Bad Aerial.

The aerial is 25 ft. of electric light wire (3/20's) running from a plum tree 5 ft. high in the garden to my bedroom window. The earth is one strand of No. 24 S.W.G., D.C.C. wire, joined to a tin plate 3 in. by 2 in., buried 6 in. in sandy soil. The aerial, I may add, runs between two walls, 4 ft. apart, so it is badly screened.

With this very inefficient arrangement I can, when using the No. 12 circuit with 1 L.F. valve, tune in every B.B.C. station, relays included, and ten Continental stations. I also received six amateurs, One of these was 8 AQ, and the language used was, I think, French.

Yesterday (Sunday) I tested it on my full size aerial with good earthing system. The results were truly amazing and were as follows :

All B.B.C. Stations.

Every B.B.C. station at excellent L.S. strength and eight Continental stations at same strength. Fourteen other Continental stations on three valves, and about thirty amateurs were received. I got 2 LK with such strength that I added a second L.F. valve and could hear him all over the house on the full size Claritone loud-speaker.

I have not yet sat up for any American stations, but hope to do so after I have recovered sufficiently from my illness. I will write later and let you know the results of my future experiments with the circuit.

The set is much more stable than any set I have tried, using reaction. The layout of my existing panel makes it possible to use extremely short wiring although all parts are well spaced, as there is plenty of room on the panel, which is 24 in. by 10 in.

Great Stability.

As the set is so stable I would like to be able to cut out one or both H.F. valves at will when listening to the local station (Belfast). Here again is a point worthy of note. Belfast is only about eight or ten miles away and I can, without wave-traps or any other fine tuning arrangements, cut him out and get any other station but Glasgow, without the slightest interference. Glasgow can be tuned in well enough to be free from serious interruption from the local station.

As I shall be at home some time, probably all winter, if there is any way I can help you in your experiments or otherwise I shall be pleased to do so, as it would help me to pass the time at home. I am studying wireless from some books and I have read almost every Radio Press book yet published.

Yours sincerely,
B. GRAY.

Dunadry,
Co. Antrim.

At Sheffield.

To the Editor of MODERN WIRELESS.

Sir,—I had given H.F. amplification up in disgust and come to the conclusion that a D. and L.F. system with a good tuner was all that one could desire from the standpoint of "D.X." reception. Last night I read your article on T.A.T., and decided to change my two-tuned anode set, which was the last word in instability, to your system. Using a 150 Basket coil as choke and No. 50 as reaction —stations to profusion. Yes! real amplification on such stations as Leeds, Manchester and Birming-

ham. I am going to change to 3 H.F., D., 1 L.F., for the next two weeks and will let you know results on America and other "D.X." stations. I am sure it is the last word in H.F., and will prove a system which has come to stay.—Yours truly,

ALAN G. STEWARD.

Sheffield.

[I advise you to try four stages of T.A.T. amplification instead of three.—ED.]

In Spain.

To the Editor of MODERN WIRELESS.

SIR,—Just a short line of appreciation. A friend of mine here has been using a high-frequency receiver consisting of three H.F. valves and detector with excellent results on the long waves, using tuned anode coupling, the first two valves being tuned by a Bowyer-Lowe square-law double condenser and the third tuned by a separate condenser, reaction being applied to this valve from the detector; however, he has always experienced great difficulty in receiving the shorter wave stations until I told him about your T.A.T. system, and last night he connected up for the short waves using your figure 8 system, MODERN WIRELESS, Vol. III., No. 6, and was able to receive all B.B.C. stations, including Manchester, which is one of the most difficult stations to get here in Gibraltar. The set is very stable with this system, and for long-distance reception I do not think it can be beaten.

I, myself, am using a single-valve reflex neutrodyne, on which I have been receiving 5XX regularly here very clearly.

Wishing your periodicals every success in the future.—Yours truly,

C. W. BIDDULPH.

Gibraltar.

America on "The 4-Valve T.A.T. Receiver."

On the night of the 19th instant, under unfavourable conditions; KDKA and WGY were received by the Author at Bush House, at moderate loud-speaker strength.

Under Sir Wm. Mitchell-Thomson, the new Postmaster General, amateurs hope to gain an improved status.

Special Note on the Transatlantic Four.

In the "Transatlantic Four" receiver, described by Mr. Percy Harris in the November issue, a Lissen Five Point Switch is used. In order to make the connections quite clear a special switch diagram was also inserted. This is perfectly correct for the switch used, but for some reason best known to themselves Messrs. Lissens have since altered the order of contacts, completely upsetting the accuracy of our diagram. The switch now supplied has the contacts arranged as if our diagram (Fig. 2) were viewed from the *front* of the panel. Those readers who find difficulty in making the correction are advised to return their five-point switch direct to Messrs. Lissens, who will supply in return a switch of the original pattern.

We take this opportunity of emphasising the importance of manufacturers adhering to their original designs in such matters, or, if they intend to change them, of advising Radio Press, Ltd., of their intentions.

Obviously, in the present case, we could do no more than indicate the exact arrangement of the switch points, and the manufacturers' alteration was quite unknown to us.

Readers who are wiring up the set from Fig. 4, and not from the blueprint (which is quite clear), should note that in some copies there appears to be a connection dotted between I.S. of the first H.F. transformer and the long dotted line (positive L.T. lead). This is superfluous and should be deleted. In V_1, V_2, the second transformer, V_3 and V_4, the connection is necessary.

A great deal of doubt frequently arises as to the question of what coil is the correct one to use for reception on a certain wavelength. The MODERN WIRELESS Coil Table, which has just been published, enables you to solve this difficulty at a glance.

The various wavelengths used for broadcasting have been classified, and different makes of coils are given with their appropriate numbers or letters to cover these wavelengths. It is therefore only the work of a second to determine what coil to use in order to receive a certain transmission. So that this table may form a permanent record, it has been printed on stout card, and can be obtained for 6d. a copy, post free.

P.W.H.

Readers' Experiences.

"THE ALL BRITAIN."

To the Editor, MODERN WIRELESS.

SIR,—In your September MODERN WIRELESS you ask for results from constructors who have made sets from the instructions given in your paper.

I have made up the "All-Britain" (three-coil) set according to your plans with the following exceptions.

I was unable to obtain "Clix" locally, and so used ordinary terminals.

Having by me a "Raymond" .0003 (with integral vernier) condenser, I did not use a separate vernier on the second valve circuit. I also used an old (and good) transformer. Otherwise I followed your instructions exactly.

After one hitch, the nature of which I will explain later, I was able to receive on the first night of trying all the British stations (except Manchester) and the relays, Radiola, Brussels, P. and T., and three German stations.

London, Chelmsford, Brussels and Radiola good on a loud-speaker. Newcastle fairly good, and Bournemouth, Glasgow and Aberdeen audible on the L.S.

When first trying the machine out I was able to hear nothing except Chelmsford very faintly.

The only new parts in use were a three-coil holder and a Utility switch.

The coil holder was bought by me from one of the large shops in London, and for which I gave a fair price. It was a beautiful looking affair and had the finest polish I have ever seen on ebonite. When I had taken it to pieces and thoroughly removed every bit of polish, the set functioned perfectly.—Yours truly,

R. C. B.

East Malling, Kent.

To the Editor of MODERN WIRELESS.

"A CRYSTAL SET."

SIR,—I have made the crystal set described by Mr. Harris in September MODERN WIRELESS, and tested same, and it is everything he states. It is the loudest and clearest set I have heard. I got Newcastle testing on Friday night, the 12-9-24, between 7-30 and 7-45 as clear as a bell. I can get Leeds on all studs. I have a good aerial 100 ft. long and 22 ft. high, 5½ miles from Leeds. But the loudest place on the studs is with the aerial switch arm on stud 3 and the earth arm on stud 2.

I shall recommend anyone making a crystal set to make your model, as it is worth the cost.—Yours truly,

SAM LONGBOTTOM.

Morley, nr. Leeds.

To the Editor of MODERN WIRELESS.

SIR,—May I congratulate Mr. P. W. Harris for having designed still another first-class circuit. I refer to the crystal set described by him in MODERN WIRELESS, Vol. III. No. 4.

I have just completed this little set, and am truly delighted with it, as it is certainly infinitely better than any other crystal set I have ever listened to. I followed his instructions for erecting this set, but used components I could obtain locally. A list of these are: Woodhall variable condenser, Burndept micrometer adjustment detector (I find this a wonderful little component) and Bowyer Lowe switch-arms and studs, also that firm's coil-holder and short circuiting plug.

All these tests were made on an outside aerial about 90 ft. long, mounted on masts 8 ft. high on the top of a tenement building on the north side of this city.

Even with this height from the ground (approx. 150 ft.) we are still heavily screened from 2 EH, which is about two miles distant. This afternoon our local station was broadcasting an orchestral selection for one hour, which came through (very loud) on two pairs of phones (Brandes being used), the switch settings being as in Fig. 4 with 50 degrees on condenser.

After our station closed down at 4 p.m., I hunted round and got Glasgow, which is about 40 miles as "wireless" flies.

The best reception up till the time of writing is the Savoy Bands, which are coming in just now even louder than this afternoon's programme, with switch settings as in Fig. 4, but with only 35 degrees on condenser.

Taking into consideration that our station is not a strong one, and the distance and locality we are in, I think this speaks volumes for this little crystal set.

I can only conclude by wishing MODERN WIRELESS and *Wireless Weekly* every success which they most assuredly deserve.—Yours truly,

J. M.

Edinburgh.

"A THREE-VALVE RECEIVER."

To the Editor of MODERN WIRELESS.

SIR,—I recently constructed "A Three-Valve Set with Resistance Note Magnifier," by Mr. H. K. Simpson, in October MODERN WIRELESS.

I thought it may be of interest to know I received WBZ, Boston, Mass., on November 11–12, about 1 a.m. our time. The band came through at splendid 'phone strength, while speech occasionally faded. The programme I heard included a band selection, Armistice oration, address on "Eternal Youth." Band: "Keep the Home Fires Burning," "A Long Way to Tipperary."

The above songs were then sung (by a Mrs. Williams), accompanied on the piano. Coils used were 50 anode, 50 aerial, 75 reaction. Aerial, 50 ft. long (single), 30 ft. high. Aerial lead on terminal C. With constant aerial tuning the set works my Baby Sterling from Liverpool at about 5 miles, and Manchester about 40 miles (using 120 volts H.T.). My thanks to Mr. Simpson and success to M.W. —Yours truly, F. HAYNES.

Wallasey, Cheshire.

Trouble Corner

By "ADSUM."

An interesting chat on short-wave reception.

SHORT wave reception is becoming increasingly popular nowadays amongst amateurs, and it has a peculiar fascination of its own. In the first place, it is rather difficult even to get down to 100 metres and under, unless special care has been given to the design and construction of the set. Then the tuning is so sharp that signals may be missed altogether unless one is accustomed to doing very fine work. The problem of hand and body capacity also plays a very important part, and, in addition, we find that there are quite a number of troubles to be met with on the lower wavelengths which are practically unknown on the broadcast band and

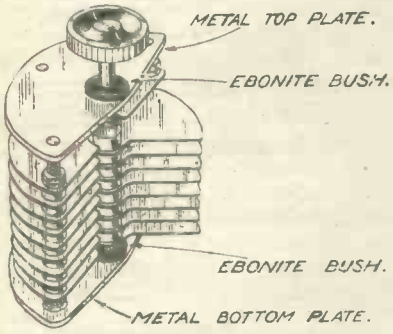

Fig. 1.—A condenser which may be unsuitable for short-wave work.

above it. Fortunately short wave signals come in at considerable strength, so that it is usually unnecessary to employ high-frequency amplification. This makes matters very much easier, for there is probably no "straightforward" method of high-frequency amplification which is at all stable when dealing with oscillations with frequencies ranging from three million to five million per second. These figures will help us to appreciate some of the difficulties involved. The highest frequency used in broadcasting in this country is slightly less than one million per second. The short-wave set must be capable of dealing effectively with frequencies up to five or even six times this amount. Some idea of the sharpness of the tuning required is obtained by remembering that if we increase the wavelength from 60 to 75 metres, we vary the frequency from five million to four million per second—this is only for 15 metres. Lower down in the scale there is a frequency difference of a million in the 10 metres between 50 and 60 metres. On the broadcast band, if we turn from the Sheffield relay station (301 metres) to Newcastle (400 metres), an increase in wavelength of 100 metres, the frequency change is approximately from one million per second to 750,000 per second. That is to say a frequency difference of only a quarter of a million represents a wavelength change of 100 metres.

Wiring and Design

When we get down to the very short wavelengths the effects of stray capacities become very much more marked than they are higher up the scale. This is only to be expected when we remember that the higher the frequency the smaller is the capacity needed to offer a perfectly free path to oscillating currents. This means that a set which will work quite well on the broadcast wavelengths may be "all over the place" on 100 metres or below. In designing a short wave set it is best to be on the generous side in the amount of space allowed for components. Besides preventing capacity couplings between them, it is also a very great help to tuning. If, for example, rheostats and condensers are crowded together, one cannot bring one's hand to the knob of a filament control without upsetting tuning owing to the effects of hand capacity on the condensers. Allow plenty of space and you will then have room to use the extension handles, which are practically essential to success. Now as regards wiring, there is no question here that careless wiring of any kind is quite unsuitable. All wiring must be short, and every joint must be securely soldered. The wire used should be of heavy gauge—not less than 18 or 16—so that it may offer the smallest high-frequency resistance. In this connection it should be noted that plain copper wire has a smaller high-frequency resistance than that coated with tin. Personally I prefer wire to square rod for wiring. Whether wire or rod is used, the constructor must be careful to avoid any kind of parallelism at short range between leads at different potentials, and it is a good rule to keep leads at least one inch apart where they must cross each other. So far as is

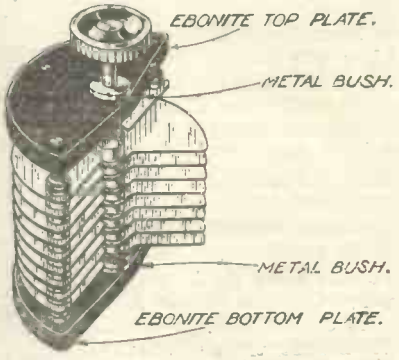

Fig. 2.—A good type of condenser for short-wave work.

possible all crossings should be at right angles. Before you make up a short wave set make quite sure that the ebonite which you intend to use for the panel is above suspicion as regards its insulating properties. The simple test described recently with a high-tension battery and the headphones is the best to employ for making certain that the ebonite is all that it should be.

Variable Condensers

For short wave work variable condensers must be of really good make and of a design that is beyond reproach. It goes almost without

saying that for ease in tuning they can be of the square law type. Fig. 1 shows a kind of condenser that may not be suitable for short wave work if really good results are to be expected. The top plate is of metal, either brass or aluminium, in direct electrical contact with the fixed vanes. The spindle to which the moving vanes are connected is insulated from the top plate by an ebonite bush through which it passes. The arrangements at the bottom plate are of the same kind.

Capacity due to Metal-End Plates

It will be seen at once that there must be capacity between the spindle and both top and bottom plates through the ebonite bushes. Ebonite has a dielectric constant which is rather more than that of air. In other words, if two plates have an ebonite dielectric between them the condenser thus formed will have a capacity more than double that of one with plates of the same size and spaced at the same distance, but with an air dielectric. The thinner the ebonite bush, the greater will be the field concentration between the end plates and the spindle, and therefore the greater will be the losses in the condenser at high frequencies.

Another point to be noted is that the insulating bushes are not always ebonite but may be substitutes, of which there are, unfortunately, many, with very inferior insulating properties, and in which losses may be very high.

For these reasons condensers with metal end-plates and thin ebonite washers in which the fixed plates are in direct contact with the end plates, should not be fitted in sets intended for short-wave reception. A good type of variable condenser

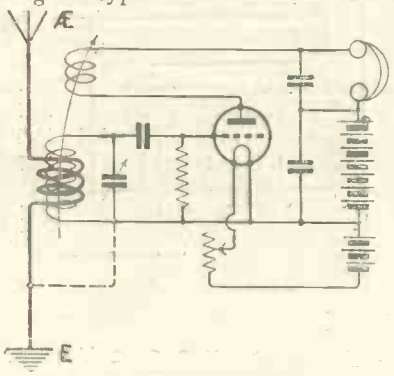

Fig. 3.—The secondary circuit should be earthed.

is that shown in Fig. 2. This is provided with end pieces made of good quality ebonite. The spindle passes at both ends through small metal bushes. An examination of either plate will show that the bush is so well separated from the points in contact with the fixed vanes that capacity is reduced to the smallest possible amount. With the metal end-plate variable condenser the minimum capacity will usually be on the high side, whilst where ebonite end pieces are fitted it can be reduced to something very small indeed. It is of the utmost importance that the high potential end of any tuned circuit should be wired to the fixed plates of a variable condenser in order to reduce hand capacity effects as far as possible. This means that if you use a tuned primary the aerial must be connected to the fixed plates and the earth to the moving. In the secondary circuit the grid will go to the fixed plates, and the L.T. to the moving. The reason for this is quite obvious when it is remembered that the knob with which the hand comes into contact is fixed to the spindle to which are attached the moving plates. By connecting in this way we keep the moving plates at earth potential, which is practically that of the body.

Fixed Condensers

For work on very high frequencies fixed condensers must be of the very best quality obtainable. The grid condenser is the one which chiefly needs attention, for it is directly through it that oscil-

lations reach the rectifying valve. If one of really good make is purchased no fears need be entertained as regards its efficiency, but it is the height of folly to fit to a short-wave set a cheap condenser of questionable origin. It may be found that better results are obtained by using a grid condenser of smaller value than 0.0003 or 0.00025μF or rather less used in conjunction with a gridleak whose value may be from .5 megohm to 1 megohm. The gridleak again must be of good quality if noisiness and instability are to be avoided.

Inductances

If we are to obtain a good voltage built up across the inductances of a short-wave set all losses by capacity must be avoided. For this reason it is undesirable to use coils made of too thinly insulated wire wound so that the turns lie side by side in contact with one another, or touching each other at various points in criss-cross winding. If turns touch there is between them the dielectric of the insulating material which may have a higher specific inductive capacity than air and be very inefficient. Heavy losses are therefore likely to occur both by capacity and by conduction through the poor enamel covering. There are several excellent types of short-wave coil on the market in which the turns are provided with ample air space and no touching takes place between them. The experimenter will find that good results are to be obtained with these. Inductances should be wound with wire of fairly heavy gauge in order to reduce high frequency resistance,

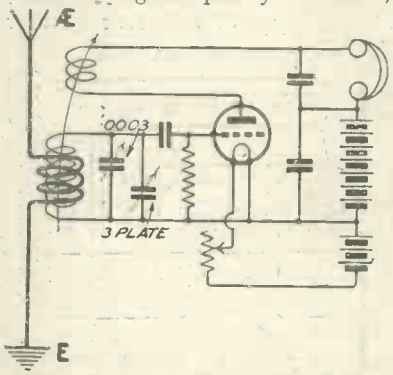

Fig. 4.—The use of a Vernier Condenser.

for any undue resistance will probably lessen the efficiency of the receiving set.

Valves

Experiments have shown that though it is best to use valves of the low capacity type such as the V24, Q, QX, DEV, DEQ or Myers, quite good results can be obtained with those of the standard 4-pin type. It is, however, necessary to exercise a little care in mounting them. It is best to use separate valve legs of a short thin kind with 6.B.A. shanks and to screw them into tapped holes in the panel, using no securing nuts below. The tip which I gave a month or two ago for reducing capacity in valve holders is also most useful. At the centre of each group of legs drill a 5/16 inch hole right through the ebonite and from it make file cuts between each pair. In this way capacity is reduced whilst insulation is improved. The constructor need not be afraid that he will weaken his panels by doing this. I have treated all my valve-holders in this way for many months now without having a single casualty.

Some Special Troubles

Where any kind of double circuit tuner is used, whether the aerial is "aperiodic" or not, it will be found that the set is liable to become very unstable unless the secondary is earthed as shown by the dotted line in Fig. 3. By doing this we are able to keep large components such as the telephones and the low frequency transformer if one is used at

approximately high-frequency earth potential; but if the secondary is not earthed there may be a large capacity from each of these big parts to earth. For ease in tuning, the condenser in the grid circuit should have a very small maximum capacity. From 0.00025 to 0.0003μF is the largest size that should be used, and it will be found a distinct advantage to have a two or three plate "vernier" condenser in parallel with it. Without the vernier it is sometimes not at all easy to resolve carrier waves, and nothing is more tantalising than to pick them up one after another without being able to tune in the transmissions which they convey.

Use Vernier

Further, if it is annoying to the operator it is much more so to all dwellers in his neighbourhood who are trying at the same time for these transmissions. With the aid of a vernier condenser tuning is made both easier and quicker. The knobs of both main and vernier condenser should be fitted with extension handles 8 or 10 inches in length so that the hand need not come near them. These handles should be arranged in such a way that when moving them the hand does not travel over the inductances. An extension handle will also be required for adjusting the coupling of the reaction coil.

The Use of Reaction

Until one gets the hang of it, the adjustment of the reaction coil may be found rather a difficult business. As oscillation occurs very easily on these very short wavelengths, the reaction coil should not be large. One of the same size as the secondary answers very well. This coil should be coupled to the secondary and the degree of coupling required will depend very much on the design and make up of the set. As a general rule it will be found to be fairly loose. If the aerial is "aperiodic," as it should be for the best results, the turns of wire forming the A.T.I. should not be close coupled to the secondary. Provision should be made for allowing the A.T.I. to be moved in relation to the secondary. As a general rule the coupling between the A.T.I. and the secondary will be on the loose side and here again adjustment is rather critical. It will be found too that the filament of the rectifying valve is critical in its current requirements. It is therefore desirable to use a rheostat which enables fine settings to be made. A carrier wave which has previously defied all efforts at resolving may often be dealt with effectively by means of the filament rheostat.

Worth Trying

It cannot be denied that there are difficulties in getting down to the very short wavelengths, but it is very well worth while to do so, for quite apart from the thrill brought by the achievement, short wave work teaches one a very great deal not only about the design of sets but also about the best methods of operating them. Anyone with the smallest knowledge of wireless, or even with no real acquaintance at all of the working of a set, can tune in a nearby station on the broadcast waveband with success. But to deal satisfactorily with very high frequencies you must know exactly what you are doing and why. A single valve set, efficiently designed, is in most cases quite sufficient to bring in KDKA's 65 metre transmission at good telephone strength. With one or two stages of note amplification his signals can be brought up on a favourable night to such magnitude that they will operate a loud-speaker, so that it can be heard at a considerable distance.

5XX on the 4-valve Family Set in S.W. Africa.

To the Editor of MODERN WIRELESS.

SIR,—I suppose you will be surprised at hearing from someone in the outskirts of the Empire, but I am only writing you a few words of appreciation of the Family Four-Valve Set as outlined in Radio Press Envelope No. 2. This compact little set is by far the best operating set I have yet handled. Having had nearly 15 years' wireless experimenting, I have naturally handled many sets. The general principles of the set are excellent and leave nothing to be desired, but in the set I have made up I have made some slight alteration to the original design in so far as the components are concerned, and also the top.

The wiring is carried out with bare 18 gauge wire with no systoflex covering, but special attention has been paid to this part of the construction—no wire runs parallel with another and if crossing is necessary it is at 90 degrees. The coils are Igranic.

As to results obtained, these exceeded anything like expectations. Cape Town (750 miles) comes in at good strength on H.F. and detector. With note magnifier added signals are too loud for 'phones. The power of Cape Town is the same as 2LO, so these results are far better than could be hoped for. JB (Johannesburg), with ½ kw. in the aerial, comes in quite loud on two valves, his distance being 740 miles. Shipping comes in with a roar. 5XX comes in with fair 'phone strength on three valves. 2LO faint, and also 5IT with four valves. Three a.m. one morning I managed to pick up KDKA on three valves at good 'phone strength. All high-power morse stations come in well, and I can get them any time of day or night on two valves.

Hoping you will find this interesting, and congratulating you most heartily on your design of a thoroughly reliable and efficient set.—Yours truly,

PERCY F. SYMONS.

Windhoek,
S.W. Africa.

John Henry is here seen broadcasting his impressions of the Lord Mayor's Show.

USE THE ORDER FORM.

In this copy of MODERN WIRELESS will be found a special order form for use when ordering goods or making enquiries from wireless firms. Radio Press, Limited, guarantee to see that all readers obtain complete satisfaction from advertisers when the order is written on this form. This is a great boon to all who order by post, and if you wish to safeguard yourself and prevent any possibility of disappointment, do *not* forget to use the order form. By using the form you will have the support of the largest wireless publishers in the world in the event of any query arising.

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By HUGH S. POCOCK.

This receiver can be used on any situation with a temporary aerial or with the frame aerial incorporated in the receiver itself.

No. 2 **A Three-Valve Receiver.**
By F. H. HAYNES.

The tuning arrangements of this receiver are self-contained and cover a band of wavelengths between 200 and 2,000 metres. All the B.B.C. Stations are therefore within the range of this receiver when used in conjunction with an average outdoor aerial. A straight-forward three-valve set, consisting of a high-frequency amplifier, detector and note magnifier, with re-action on the aerial inductance.

No. 3 **A Two-Valve and Crystal Reflex Receiver.**
By W. JAMES.

Reflex receivers are capable of giving a very high degree of amplification per valve. This two-valve and crystal receiver, unlike many reflex receivers, will be found perfectly stable in operation and will be capable of giving loud-speaker strength within a radius of thirty miles of a main B.B.C. Station.

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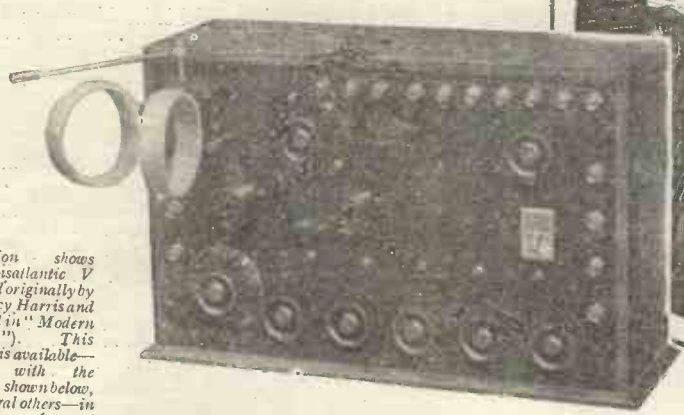

Illustration shows the Transatlantic V (designed originally by Mr. Percy Harris and described in "Modern Wireless"). This Receiver is available—together with the Puriflex, shown below, and several others—in a semi-manufactured state at the cost only of the actual components.

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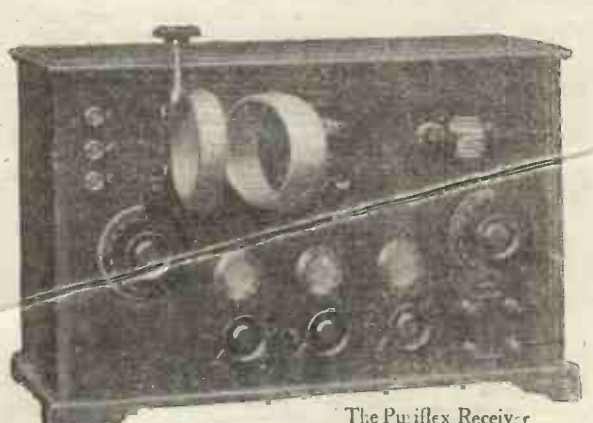

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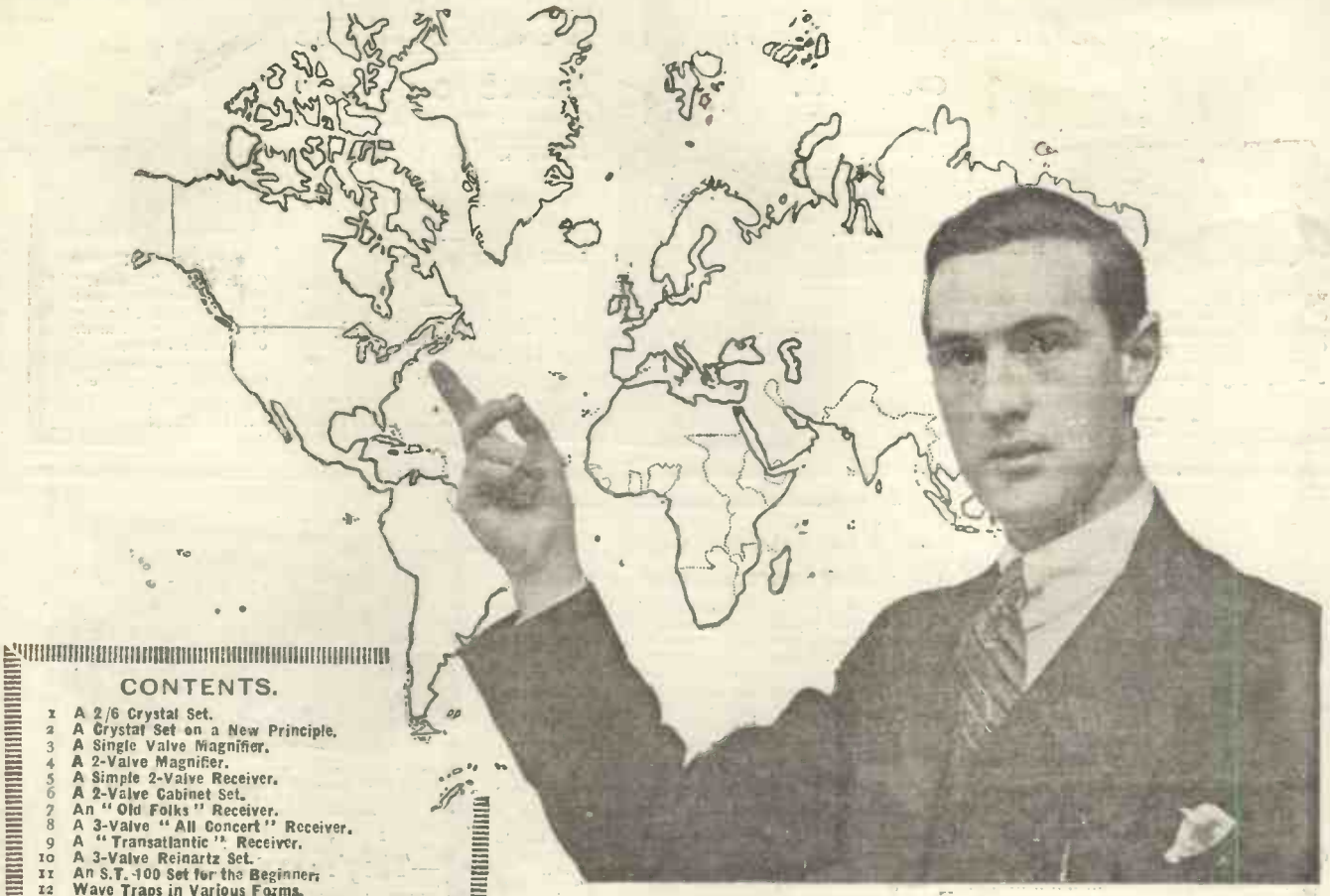

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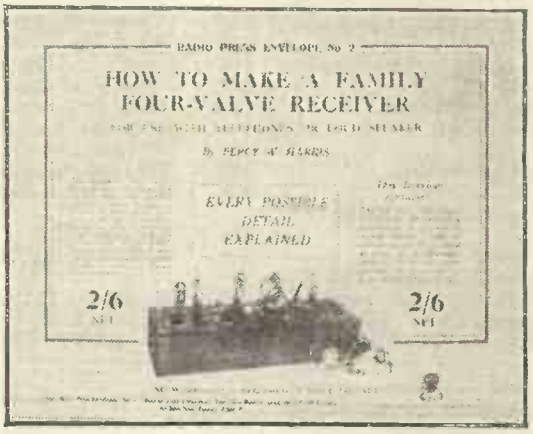

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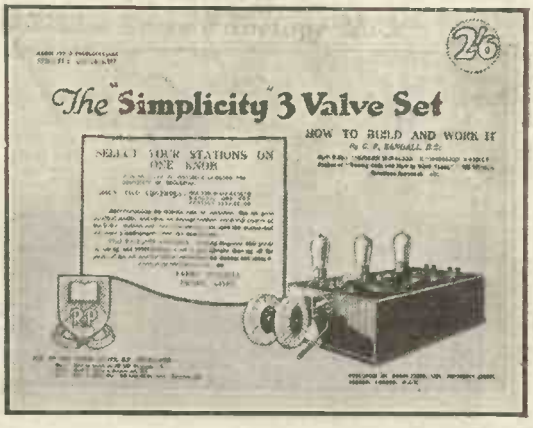

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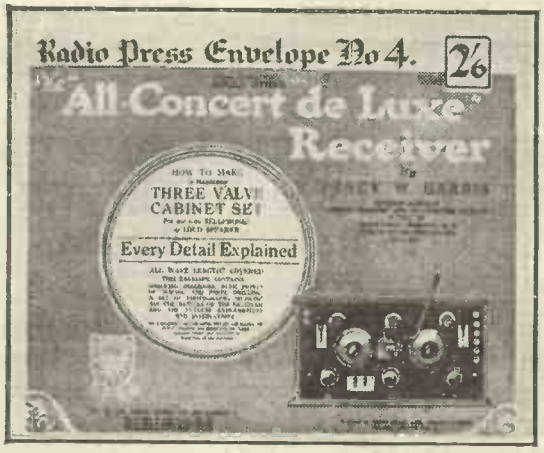

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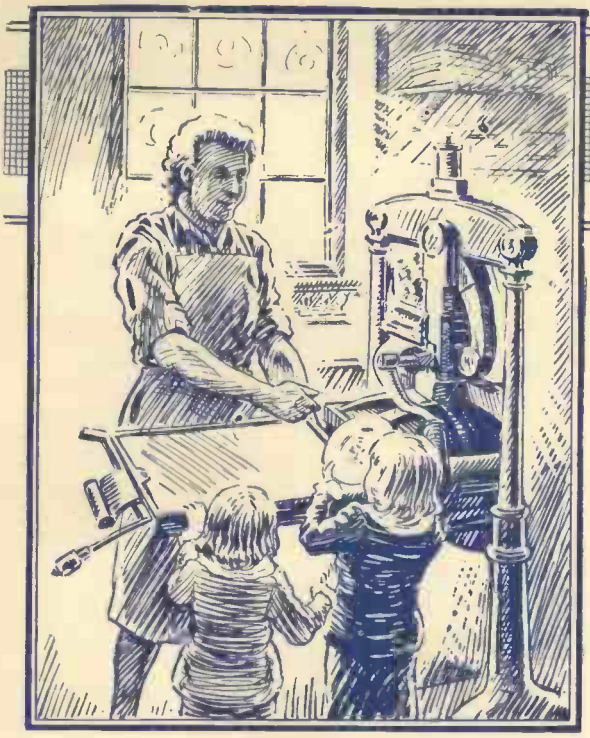

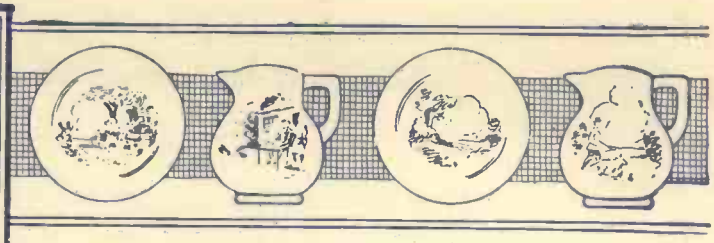

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