The WIRELESS WORLD AND RADIO REVIEW

ABOUT OURSELVES.

By The Editor.

NOT often does it occur that we consider it necessary to burden our readers with what may be termed "domestic" affairs affecting the organisation and policy of this Journal, but there are occasions when such matters may be of sufficient importance to provide the excuse for taking our readers into our confidence and sharing with them the satisfaction which we feel ourselves at any event constituting a milestone on the road of progress and prosperity of the Journal.

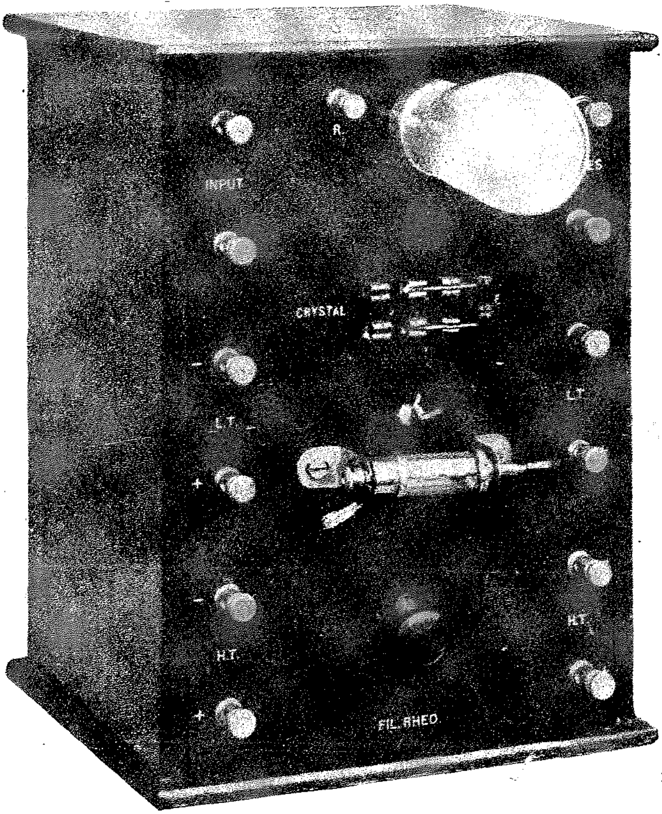
For the benefit of those of our readers who have not had a long association with us, it is not out of place to make reference to the fact that *The Wireless World* is now completing its fifteenth volume, having been in existence for well over ten years, or more than seven years before broadcasting was thought of in this country.

The first announcement which we wish to make to our readers is one concerning a change of proprietorship and control of the Journal. *The Wireless World* hitherto published by the Wireless Press, Ltd., has been taken over by Messrs. Iliffe & Sons, Ltd., the proprietors of a number of highly successful specialised publications, including *Experimental Wireless*, *The Autocar*, *The Motor Cycle* and *The Amateur Photographer*. This change carries with it the guarantee of an entirely independent policy unhampered by any association with commercial or other wireless interests. With the further object of ensuring that nothing shall interfere with this desirable freedom of action, the proprietors have obtained the consent of the Radio Society of Great Britain to transfer the obligations of Official Organ of the Society from *The Wireless World* to our sister journal, *Experimental Wireless*.

Our second announcement relates to the future style and character of *The Wireless World*. Commencing with the next issue, to be dated February 11th, the outward appearance will be entirely altered and modernised, the size of the page will be increased considerably, with a consequent addition to the space available for matter. This, together with additional pages, will enable us to introduce several new features and to extend the scope of the Journal to appeal to a wider circle of readers whilst sacrificing nothing of the character of the magazine in so far as it appeals to present readers.

In short, *The Wireless World* will in future be a bigger, a better, and we hope an indispensable journal to all wireless amateurs, with whom we trust we may include a very large number of professional wireless workers who are amateurs at heart.

Next week, therefore, you should look for *The Wireless World* in a new cover, but at the old price, and although there will be a minimum of 100,000 copies issued, make sure of your copy by placing an order with your newsagent at once. We mean to introduce *The Wireless World* to every wireless amateur, and we hope you, our present readers, will help us to do so.



CRYSTAL–VALVE DETECTOR UNIT.

This unit may be attached to any low frequency amplifier and to a high frequency amplifier if desired. It is a particularly simple unit, being easily made and operated.

By R. H. COOK.

SEVERAL requests have been received from readers for an article giving details of a crystal or valve detector panel to match the instruments described by the author in *The Wireless World and Radio Review* of April 13th, May 28th and August 13th, 1924. The following description of a suitable unit has therefore been prepared.

A study of the two-circuit amplifier (April 30th, 1924) and the two-valve high-frequency amplifier (August 13th, 1924) will show the reader that they were not designed as instruments for a unit system, as the order in which the battery and telephone terminals are placed is not the same. But this slight drawback does not prevent one from making up an efficient and useful receiver with the addition of the panel to be described.

A scale drawing of the panel is given in Fig. 2. It will be seen that the height of this is 9 ins., to match the other panels, and the width is 6 ins. These dimensions make the panel of a size that will give a compact instrument without overcrowding the components.

On the left-hand side is a row of terminals to match those on the right of the H.F.

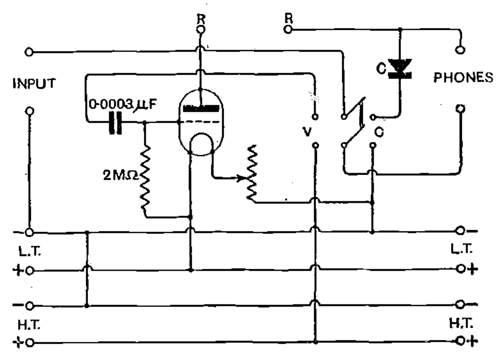
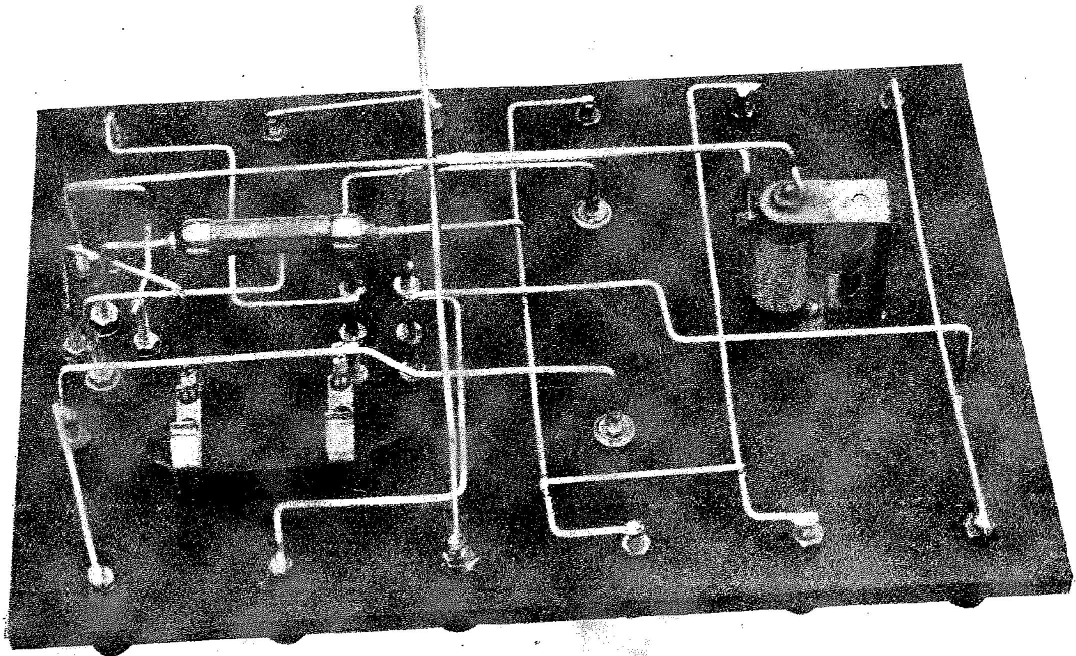


Fig. 1. The theoretical connections of the panel.



A view of the back of the panel.

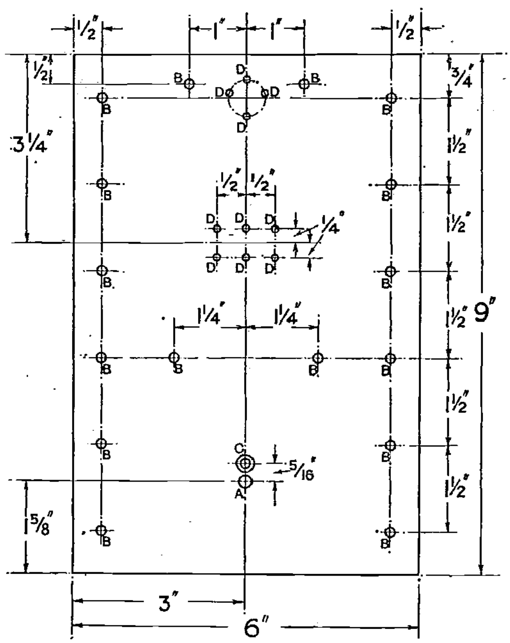


Fig. 2. Details of the panel. A, drill 3/16″ dia.; B, drill 5/32″ dia.; C, drill 5/32″ and countersink for No. 4 B.A. screws; D, drill ⅛″ dia.

panel; this allows short connecting wires to be used if desired. On the right of the instrument is another row of terminals to match those on the left, and one for the output (telephones) and battery terminals.

As may be seen from the photograph and figures, a valve holder, filament resistance, grid condenser and leak, a two pole change-over switch and a crystal detector are mounted on the panel. There are also two terminals for the wires to the reaction coil. When no reaction is required, these terminals must, of course, be short-circuited.

The theoretical diagram of Fig. 1 shows quite clearly the connections of the apparatus, and the circuit when a valve or crystal is employed as the detector.

The instrument is easily constructed. First true the panel to the dimensions given in the figure. This is a standard size, and so can be bought already trued. If the panel has not been rubbed down this should be done, using medium carborundum cloth.

Next mark out and drill the panel, using the drawing of Fig. 2. It is advisable to mark the position of holes with a scriber and not a lead pencil. When the lines and drilling centres are marked with a scriber very accurate work can be done.

Finally assemble and then wire the receiver. The layout is so simple that no difficulty should be experienced in assembling or wiring. The wiring diagram of Fig. 3 shows the connections. All the wires are carefully soldered after having first been bent to the required shape. The neat arrangement of the wires and the ample clearance between them is clearly shown by the photograph of the back of the panel. When the wires are arranged in this manner there is very little possibility of them accidentally making contact with one another, and the ample spacing tends to high efficiency. When soldering wires to the grid leak be careful not to have the iron too hot, or the leak may be spoiled.

The method of connecting the unit to the components mentioned above will be quite clear from the marking of the terminals

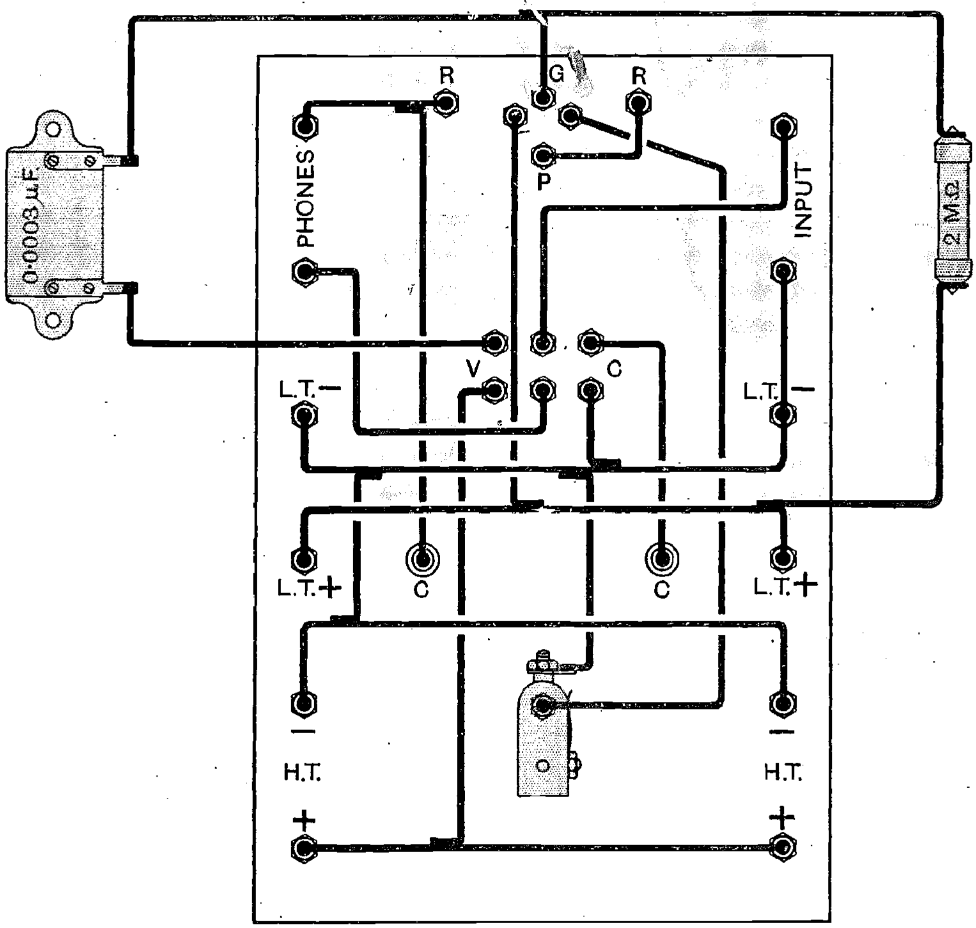
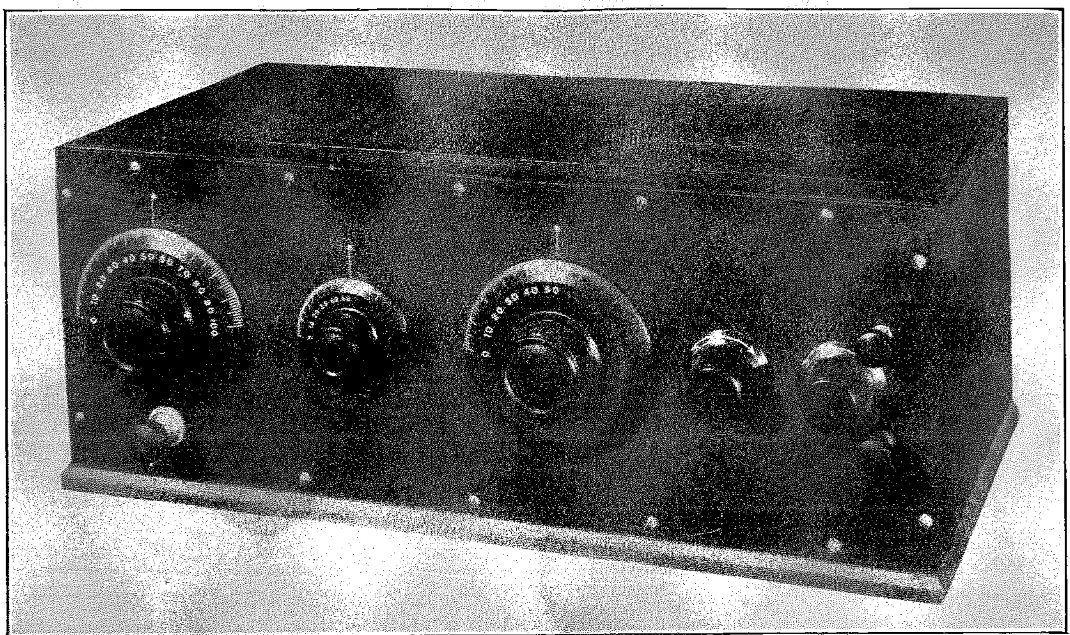


Fig. 3. The wiring diagram.



A view of the set. On the left is the variable condenser tuning the closed circuit coil. The next knob, which is smaller, controls the coupling of the aerial and secondary coils, while the third knob is for adjusting the reaction coupling. There are two filament resistances, and the telephones are connected to the terminals on the right of the set.

AN AMATEUR SHORT WAVE SET.

A description of the receiver employing a "Low-loss" Tuner used by Mr. Gerald Marcuse, G 2 NM, for the reception of American and Australian Amateurs.

ON the last day of my visit to the amateurs in Canada a short while ago, I happened to express a wish that I should like to take a set back on the boat and listen to the amateurs on my way home. That well-known amateur C 2 BN, Mr. Miller, of Montreal, said he would make me one. Someone produced the condensers, valve holders, a transformer, and the other accessories, and another found a cabinet, and very soon the set was completed and roughly calibrated on C 2 BN's aerial.

The set is shown in the accompanying photographs, and the connections are given in Fig. 1. From the diagram of connections it will be seen that the set has a valve detector and one stage of low frequency amplification. The aerial has a coil L_1 connected to it, consisting of a few turns of thick wire tied together, and to an ebonite spindle. A knob is attached to the spindle in order that the coupling with the closed circuit coil may be adjusted. The large coil, marked L_3, is wound basket-weave fashion with No. 16 D.C.C. wire, and has a tap which consists of a clip soldered to the wire. This coil is tuned with a variable condenser C_1, and is connected to the grid-filament of the detector through the usual grid condenser and leak. A V.24 valve is employed as the detector. The reaction coil is mounted in the same way as the aerial coil, and consists of a few turns of medium gauge wire tied together. It may be seen in the photograph between the V.24 valve and the secondary coil.

It should be noticed that the components are well spaced. The tuning condenser is well away from the coils, and there is a space of two or three inches between the secondary coil and the reaction and aerial coils. A remarkable feature of the set is the ease with which it oscillates over the whole range—50 to 275 metres—with only one tapping, and with no dead spots such as one frequently meets with.

There is nothing remarkable in the low frequency amplifier, which has the

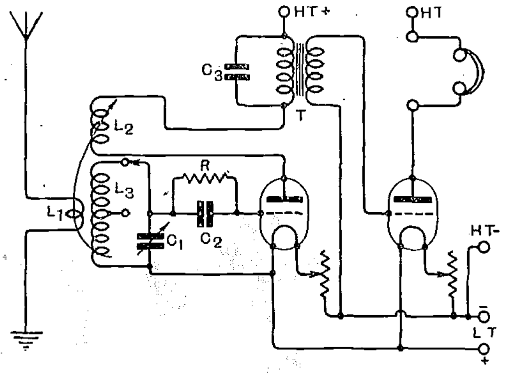
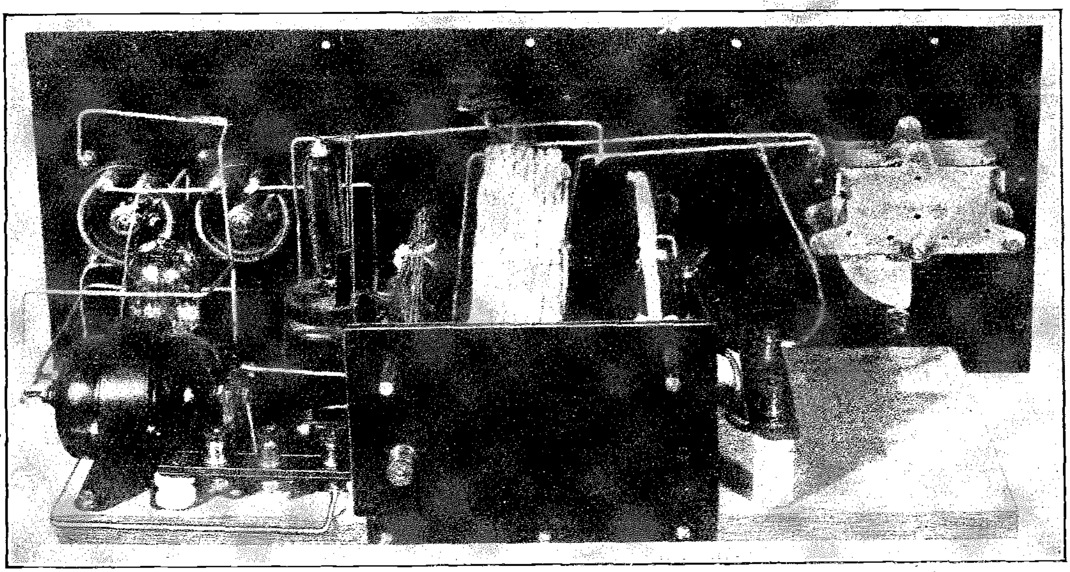


Fig. 1. Connections of the receiver. L_1 is the loosely coupled aerial coil; L_2, the reaction coil; L_3, the tapped secondary coil; C_1, the tuning condenser; RC_2 the grid leak and condenser; C_3, the by-pass condenser, and T the intervalve transformer.

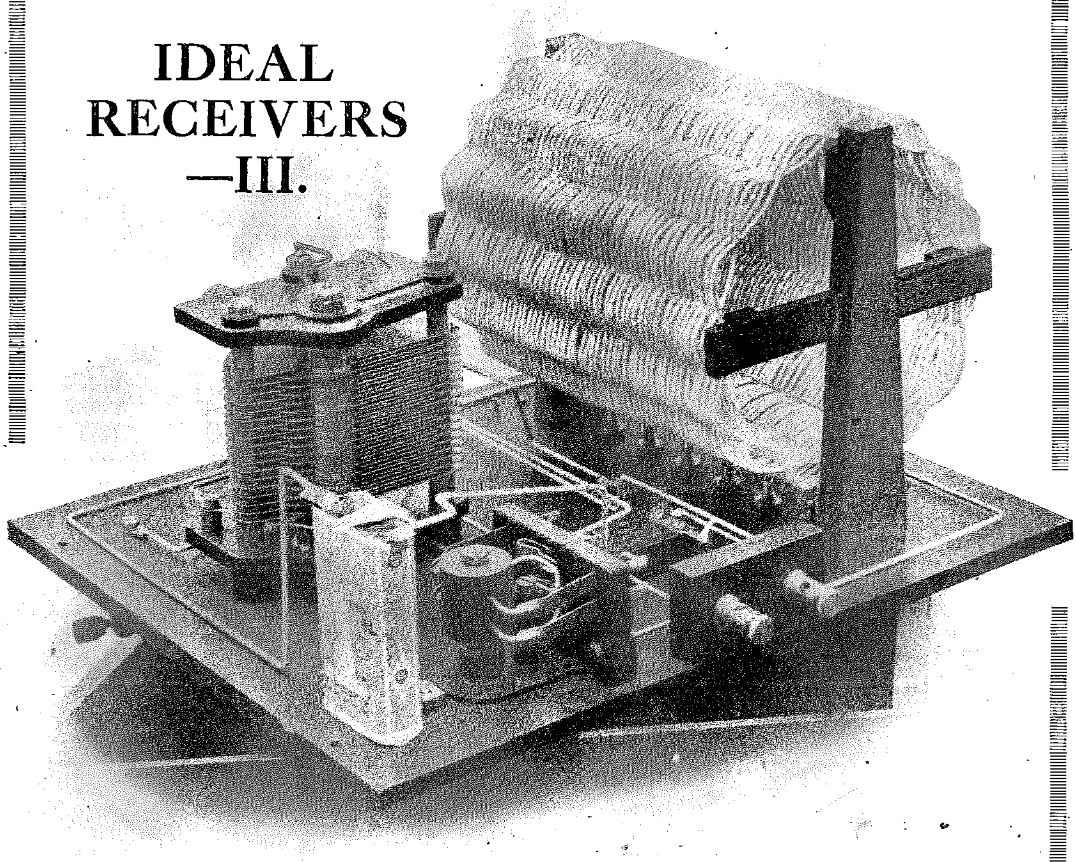


A view showing the arrangement of the set. Looking from right to left we have the tuning condenser, aerial coil, closed circuit coil and reaction coil. Then the detector valve and the transformer and valve for the L.F. stage.

usual intervalve transformer, shunted by a small fixed condenser.

Unfortunately the ship coming home was very full, and I did not have an opportunity of using the set on the ship's aerial. A temporary aerial was rigged up, but I was very much bothered by interference from the ship's motors. The set has been in almost constant use since my return from Canada and receives signals from all countries.

IDEAL RECEIVERS —III.



CONSTRUCTING THE COMBINED

CRYSTAL RECEIVER AND WAVEMETER

In the last number the author discussed the design of the instrument and described the construction of the coil. The remaining constructional details are given below, together with instructions for operating. The particularly neat arrangement of the instrument is shown by the photograph.

(*Continued from page* 568, *January 28th issue.*)

By W. James

The Panel.

THE ebonite panel should be filed to 10 ins. by 8 ins. by $\frac{1}{4}$ in., and have the components mounted on it as indicated in Figs. 4 and 6. Mount the Clix sockets and plugs first, then the fixed condenser, and then the remainder of the components, putting the coil on last. Details of the connection strips are given in Fig. 5. The buzzer shunt consists of a number of turns of Eureka wire wound on a piece of ebonite rod about 1 in. long by $\frac{1}{2}$ in. diameter. The correct number of turns are found by experiment, as explained below.

Construction.

The components are mounted on a panel of ebonite measuring 10 ins. by 8 ins. by $\frac{1}{4}$ in.

Good quality ebonite should be employed as leakage between the sockets connected to the coil may materially lower the efficiency. The arrangement of the parts may be seen from the photograph, the lay-out of the panel given in Fig. 4 and the wiring diagram of Fig. 6. It will be seen that on the left of capacity 0·002 microfarads and the shunt for the buzzer are also mounted on the under side of the panel. A connection strip with three terminals (A_1, A_2 and E) is secured to the back edge of the panel, and another strip with two terminals for the telephones is secured to the front edge of the panel.

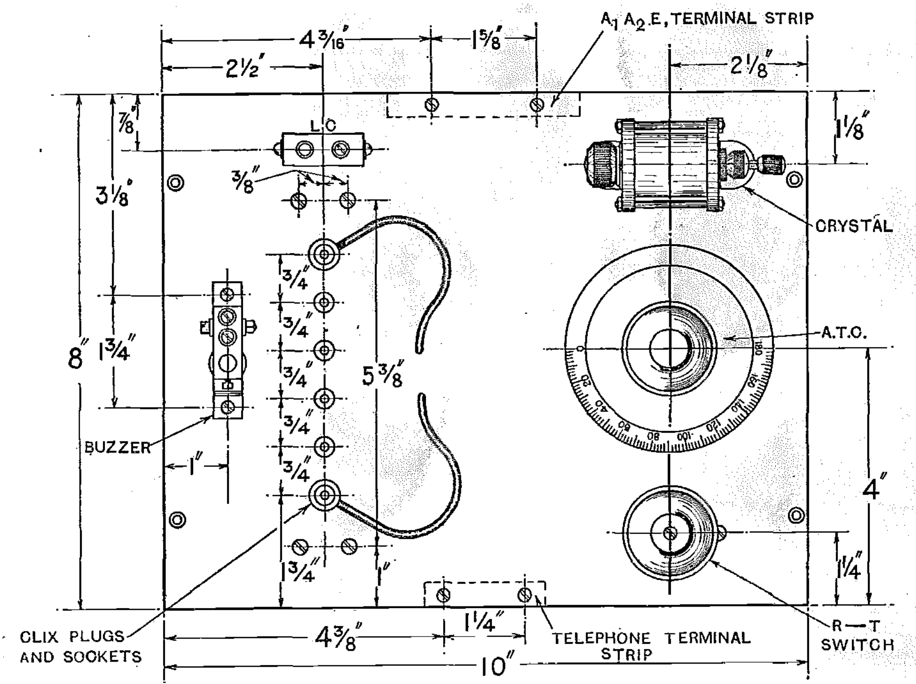


Fig. 4. Scale drawing of the top of the instrument showing the position of the parts. On the left we have the buzzer, the Clix sockets and plugs connected to the basket-weave coil, and the socket for a loading coil; on the right the crystal detector, the variable condenser, and the "receive-transmit" switch.

the panel is the tapped coil, the coil socket and the buzzer. On the right of the panel is the detector, tuning condenser, switch and buzzer battery. A telephone condenser of

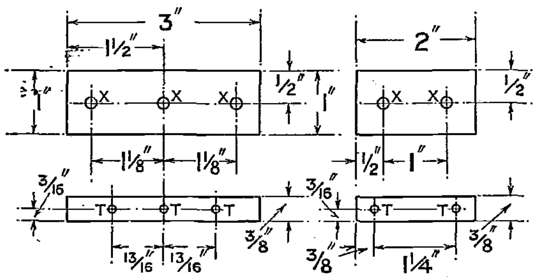


Fig. 5. Details of the pieces of ebonite which carry the terminals for the aerial and earth connections, and for the telephones. X=Drill 5/32-in. dia. T Tapped No. 6 B.A. × 5/16-in. and let into edge as shown.

The materials required are as follows:

- 1 Ebonite panel, 10 ins. by 8 ins. by ¼ in.
- 1 Ebonite strip, 3 ins. by 1 in. by ⅜ in.
- 1 Ebonite strip, 2 ins. by 1 in. by ⅜ in.
- 1 Variable condenser, capacity 0·0005 microfarad (Sterling square law type).
- 1 Fixed condenser, capacity 0·002 microfarad.
- 1 Coil socket.
- 1 High note buzzer (such as the Ericsson).
- 6 Clix sockets.
- 2 Clix plugs.
- 1 Crystal detector.
- 1 Switch, two-pole, two-position.
- 1 Battery (two dry cells).
- 5 Terminals.
- 1 Reel of No. 18 D.C.C. copper wire.

Small quantity of resistance wire (No. 26 or 28 Eureka wire).

Connecting wire (bare tinned No. 18 copper).
1 Containing case to suit.

this particular case of three-ply wood and ordinary deal, finished off with a coat of stain.

WIRING.

The wiring connections are given in Fig. 6, where the coil, connection strips, buzzer and switch, are shown to the side of the panel for clearness. The wiring is particularly easy and straightforward. Connecting tags are used when possible, and No. 18 tinned copper wire is employed. It will be found easier to solder the taps from the coil to the Clix sockets if the coil is unmounted and held a short distance from the panel. The tappings can be straightened when the coil is put back in position.

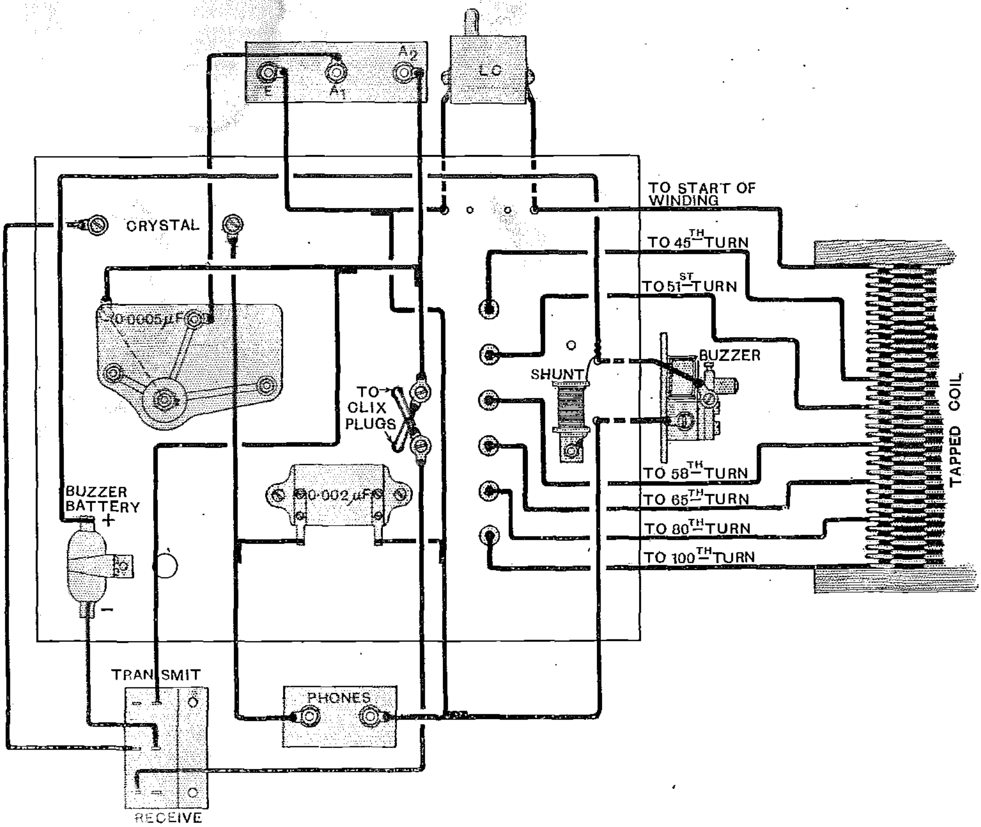


Fig. 6. The wiring diagram. The connection strips, loading coil socket, buzzer and tapped coil, are shown removed from the panel for clearness.

THE INSTRUMENT CASE.

A drawing of the box employed is given in Fig. 7. It is of simple construction, and in this particular case of three-ply wood and ordinary deal, finished off with a coat of stain.

USING THE INSTRUMENT.

To receive the short wavelength broadcast transmissions, connect the aerial to A_1 and the earth to E, and short circuit the contacts of the loading coil socket. With the switch in the "receive" position, put the wavelength plug in the socket connected to the end of the coil, and the detector plug in the socket connected, say, to turn 58. Roughly set the detector and tune in a signal. Then carefully set the detector, and find by experiment the best position for the detector plug. The coil and condenser will tune a normal aerial between 250 and 500 metres without setting the condenser in the series position below about 0·0002 microfarad. To tune in signals of longer wavelengths, such as 5 XX remove the short-circuiting plug from the loading coil socket and insert a plug-in type coil. For 5 XX a No. 100 or 150 coil may be employed. Connect the condenser in parallel by joining A_1 and E with a wire, and connecting the aerial to A_2 and the earth to E.

High resistance telephones should, of course, be employed with a crystal receiver, and the best aerial and earth that can be made.

When the instrument is to be used as a wavemeter, short-circuit terminals A_1 and E, and put the switch in the "transmit" position. The telephones and detector are then disconnected from the coil, and the buzzer and battery are connected across the coil. Sparking at the contacts of the buzzer may be reduced by adjusting the resistance of the shunt. It is a good plan, therefore, to find by experiment the best value for the shunt. A usual shunt resistance is 20 ohms, corresponding with a length of 15 ft. of No. 28 Eureka wire.

Instead of exciting the circuit to be tested by holding the wavemeter near the circuit, it is easier and productive of better results if a small coil of about 5 turns of insulated wire is connected by flexible leads to the terminals A_1 E, and this coil held near the circuit to be excited. This inducing coil should be made quite rigid by binding with tape or string, and the connections wound quite tight into a flexible lead in order that its electrical constants shall not change with use.

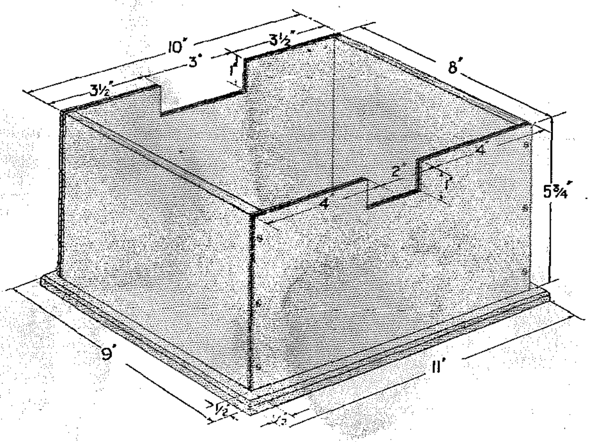


Fig. 7. A sketch of the box of the instrument, which is of simple construction.

THE GREENLAND RADIO STATIONS.

BEFORE very long it is expected that Greenland will have in operation an entirely new system of wireless stations. Plans for such a scheme had been made prior to the war, but during the world conflict these had to be laid aside. At the conclusion of hostilities, however, plans were revised and the preparatory work resumed, with the result that during the Danish royal visit to Greenland in 1921, wireless connection was first established between the King's ship on the West Coast of Greenland and the International Telegraph Service.

The stations now nearing completion are situated at Julianchaab, Godthaab, and Godhavn, on the West Coast, and at Angmagssalik on the East Coast of Greenland. The contract has been in the hands of the Danish Radio Company.

The Julianchaab station, constructed on the Poulsen-Arc system and employing a power of 5 kilowatts, has an aerial of the umbrella frame type suspended from a mast some 250 feet high, surrounded by six smaller masts. This station has been designed specially to communicate with the Faroe Islands, a distance of more than 1,300 miles. Of a smaller type are the stations at Godthaab and Godhavn, which will cater only for local traffic and will use a power of ½ kilowatt. The East Coast station at Angmagssalik, erected at the special request of the Danish-Icelandic Committee, is primarily intended to transmit meteorological reports for the benefit of fishermen and should prove of great value in providing warnings of approaching storms.

The greatest obstacles in the construction of the stations have been their isolated situation and the difficulties of transport over the vast distances involved, in addition to the fact that work of this kind is impossible during the winter. O. L. V.

BRITISH AND AMERICAN RECEIVERS.

The author of this article is in a position to discuss the relative merits of British and American components in an authoritative manner, as he has spent a good deal of time in the States. It would appear that while British sets are superior in many respects, the British manufacturer does not produce so many useful devices for the amateur and home constructor.

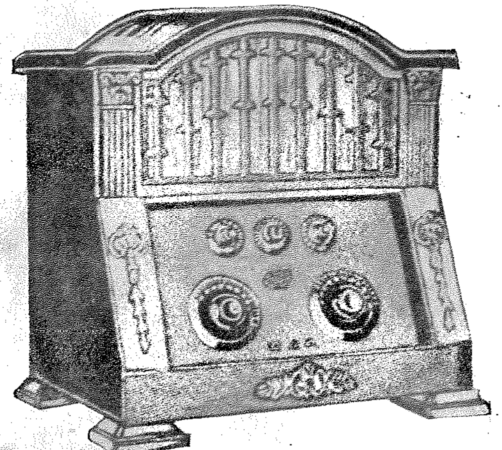
By N. P. VINCER-MINTER.

IN view of the fact that the regulations restricting the holder of a broadcast licence to the use of British-made sets and components came to an end with the new year, it is not out of place to consider briefly what effect this is likely to have on British sets and components.

It will undoubtedly lead to a large influx of foreign manufactured goods, and as by far the largest amount is likely to come from America, it would be well for us to consider in what respect, if at all, American sets and components are superior to those manufactured in the United Kingdom.

It may be said definitely, in the first place, that taken as a whole, British sets and components are superior to those manufactured in the U.S.A., both in quality of workmanship and in quality of reproduction. Nobody who has listened to the reproduction of music and speech on both a high-class American and a high-class British set would be the least doubtful which to purchase; in fact, it may be said that even a moderately good quality British set is to be preferred, from the musician's point of view, to the very best that America produces.

This is not so much due to the fact that American manufacturers are lacking in skill in the design of good transformers, etc., as to the mentality of the American people. Anybody who is intimately acquainted with modern American music, or has had the opportunity of comparing the performances of average quality orchestras to be met with in theatres and restaurants in the two countries will readily understand the true reason why the quality of reproduction in British sets is so greatly superior to that in those which emanate from the U.S.A. Indeed, the performance of an orchestra which would be considered but mediocre in England is usually termed "highbrow" on the other side of the water. The same may be said of wireless sets and loud speakers, particularly the latter. Turning to the other side of the question, however, it must be admitted that from the point of view of selectivity, sensitivity, ease of control and variety—not to mention artistic appearance—the palm must be awarded to the Americans. This is also explicable by means of the mentality and environment of the American people. The average American possesses a strong trait in his character for going one better than his neighbour, and in the matter of wireless, this exhibits itself in the form of logging the largest possible number of stations. It must be remembered that even here in England, the first question that the prospective buyer of a valve set usually asks is whether the set is capable of receiving all the B.B.C. stations and some continental, thus indicating a desire not only to be able to receive *all* the transmissions from his own country but some from foreign countries also. Owing to geographical size, this desire



The Bestone 5-valve receiver with built-in loud speaker and battery compartment.

is fairly easily met in the case of the Englishman; but the American who also exhibits the same desire, only in a more pronounced form, must possess a far more sensitive and selective set to fulfil this purpose. When one considers the vast size of the United States, where often a man may be living surrounded on every side for a thousand miles by his own country, the very bad atmospheric conditions, especially in the southern states, and the large number of stations operating on a comparatively narrow band of wavelengths, it is not to be wondered at that the Americans are far ahead of this country in producing sets in great variety of really selective and sensitive "DX" capabilities.

From the point of view of artistic appearance also, American-made sets show a marked superiority over those made in this country. In this respect we are not referring to the hundred guinea type of cabinet set, whose artistry cannot, of course, be denied, but to the ordinary type of good quality set which sells at prices ranging from £20 to £40 or thereabouts.

The typical American type of set, where the valves are mounted behind the panel in a rather elongated form of cabinet, presents a far more pleasing appearance than do the sloping panel type or even the upright type where valves are behind the panel. The American set, with its false bottom enabling the whole of the "works" to be withdrawn and stood independently on the table, is also far better from the point of view of ease and efficiency in wiring. It is gratifying to note that some British manufacturers have already realised this point. One has only to glance through the advertisement pages of any of the American radio journals to note the large number of really efficient and attractive-looking sets at not unreasonable prices, to be acutely aware of how much greater is the range of choice accorded to American purchasers. Although, of course, some of the claims made in these advertisements are typically American, it must be admitted that on the whole the sets are highly efficient.

The cabinet work of the average American set, particularly the low priced ones, is usually much better than that which is to be found in English sets. The cabinets are usually robust, and the general finish superior.

SHORT WAVE SETS.

There is undoubtedly a very great need on the British market for efficient sets for low wavelengths from fifty up to about two hundred metres. The Americans are very much to the fore in this respect, and there are a great number of really efficient low loss sets to be had for this very interesting band of wavelengths. British manufacturers, on the other hand, are very much behind the times in this respect; the general idea which appears to exist among them is that the use of the ordinary standard design of set employing plug-in coils is all that is necessary.

It would be all to the good, therefore, if some of the more progressive manufacturers in this country broke away from conventional design and evolved something that was not merely somebody else's set "dished up" in another form.

COMPONENTS.

Turning to the question of components, the general quality, with one or two glaring exceptions, is, as we have mentioned previously, superior to American made components, but the same cannot be said from the point of view of variety and ingenuity.

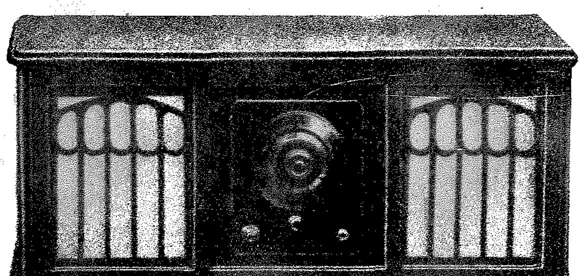
With regard to valves, we have nothing to fear from the Americans. British-made valves are on the whole far better than any foreign manufactured valves, more especially those valves designed specially for low frequency amplification. British valves are more efficient technically, are longer lived, and are, comparatively speaking, to be had in a far greater range of characteristics than those in America. Another important factor is that they are infinitely cheaper, which fact, of course, must not be taken to indicate that they should not be cheaper than they are. There is, however, a great opportunity for an enterprising British manufacturer to produce a good "soft" valve for rectification purposes, for there is undoubtedly a big demand for them, especially among single valve users who have to rely upon Dutch manufacturers for this product. In America some quite remarkable results have been achieved on single valve sets with soft valves requiring an anode voltage of about 20 volts.

Turning to low frequency transformers, the British-made article again exhibits a very marked superiority. Indeed, the performances of some of the cheaper variety of American transformers would bring a blush to the cheeks of even the most hardened junk manufacturer in this country.

Loud speakers are another instance in which we lead and others follow, or at least attempt to do so. There are, of course, one or two makes of high-class British loud speakers to be obtained in America, but these cannot be classed as of American design. The quality of reproduction in the average American loud speaker is very raucous. Any foreign visitor walking through a high-class radio store in New York during broadcasting hours has no need to be informed of this fact; in fact, the particular make of loud speaker, which is usually designated as the last word in tonal purity in America, would scarcely find a place in the average "middlebrow" household in England. The inferiority of the American loud speaker is especially marked in the cheaper brands, and for five dollars it is possible to purchase an instrument whose performances are, as its makers truthfully assert, unparalleled.

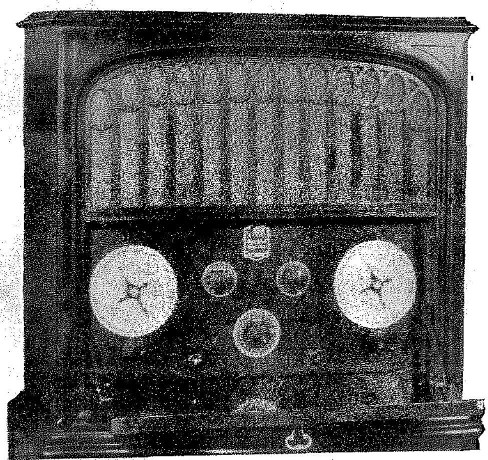
GADGETS.

Having said this, however, it must be admitted that the American "radio-fan" has a far larger range of components and useful "gadgets" at his service than is the case with the English amateur, apart from the fact that there are many indispensable components in which America holds first



This receiver has four valves, including one stage of high-frequency amplification. The loud speaker is built in, and there is room for the batteries. One knob tuning is employed to tune the aerial and H.F. circuits.

place from the point of view of quality. By far the most important of these is variable condensers. So far as we are aware, there is not a single variable condenser on the home market at the present time which can truthfully be said to compare favourably with a high-class American article. The first point which strikes one on examination of an American condenser of first class quality is its extremely robust construction. It is un-



The Radiola Super-Heterodyne Receiver.

doubtedly a real "engineer's job," and is not reminiscent of a "made-in-Germany" toy, an aspersion which cannot altogether be withheld from a great many high-class English condensers. One can insert one of these condensers into a set with a definite feeling of assurance that after many months' or even years' usage the plates will not touch nor in any way get out of alignment. The Americans also produce some most excellent variable condensers having a geared movement enabling very fine tuning to be obtained. These gears are not merely stamped out and roughly assembled but are very precisely machined. From actual experience it can be said that the presence of this gearing does not in any way reduce the electrical efficiency of the condenser; in fact these condensers are electrically as well as mechanically sound. The variable grid leak, another small but important component, is another item which has been brought to a great pitch of efficiency and reliability in America, the usual design being of the "fixed-variable" type, in which a number of fixed grid leaks of definite value are placed in series with each other by means of a rotary switch. The variable portion of the leak is, of course, in series with this, and as it has only a range of ½ megohm, very fine adjustment of grid potential can be obtained, as it requires very many turns of the "knob" to cover the ½ megohm range.

Another component which has been greatly neglected in this country is the variocoupler. This extremely useful and neat component is in almost universal use on the other side of the water, and it would be an excellent thing if it were possible for the British public to obtain these in greater variety. We are fairly well supplied with variometers, but even here there is much room for improvement in the design of low loss formers.

One particular component for which there is a very great need in this country is a low loss tuner unit for short waves of from 50 metres upwards. In America it is possible to obtain these units in great variety of design, the usual design consisting of a skeleton-wound aerial, secondary and reaction coil, mounted very efficiently, with a marked absence of metal spindles and such like absorbers of energy on these very high frequencies. It is greatly to be regretted that these cannot be obtained in this country. Complete Reinartz tuning units for incorporating into sets are also greatly the vogue among American manufacturers. Complete L.F. amplifying units mounted on a rigid framework for incorporating into multivalve cabinet sets are also to be had. With the exception of the transformer, it may be said that the design of them is excellent.

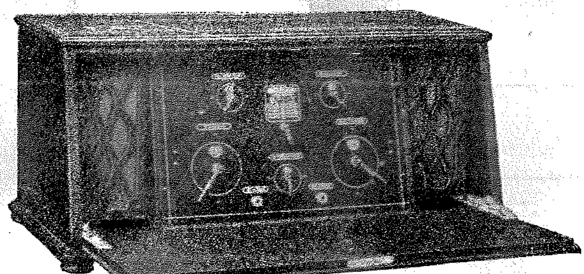
The variety of reasonably priced lead-in tubes and earthing switches to be obtained on the other side is greatly in excess of those obtainable in this country. With the exception of a few highly priced ones, these components seem quite unheard of in this country, the usual article supplied by the local dealer being a flimsy article with nuts of quite inadequate size and ebonite tubing of doubtful quality.

Aerial masts are a further instance in which we are sadly deficient. It should be possible to obtain jointed masts for aerial erection at reasonable prices, but this is certainly not the case at present.

A very important point, to which it is gratifying to note that British manufacturers are at last paying some attention, is that of ebonite, it now being possible to obtain good quality ebonite in standard sizes. In America, however, it has been possible for the past three years to obtain good quality ebonite or bakelite, either matt or polished, each piece of ebonite being enclosed in a sealed envelope, thus obviating any possibility of the panel being scratched whilst in the possession of the dealer.

The question of cabinets also might receive attention, the average cabinet sold to amateurs usually being constructed very flimsily of three-ply wood and French nails, and polished either in a very inferior manner or merely stained.

It is possible in New York and other American cities to go into any reputable radio store and ask for a complete set of



A four-valve receiver by the Michigan Radio Corporation. This set has one stage of high frequency, detector, and two stages of low frequency amplification. The set is equipped with a self-contained loud speaker, and there is ample room for the batteries.

parts to construct the set described in such and such a radio journal, and in return one will be handed an attractive cardboard box containing the complete set of parts according to the author's specifications, the parts being arranged in boxes in a similar manner to sets of Meccano parts. Many manufacturers also make up boxes of parts to construct sets according to their own design, the box containing blueprints and full instructions, in addition to the complete set of parts.

Attractive accumulator cases are further items which might well be introduced into this country, the usual practice over here being either to hide this article under the table out of sight or to place a rather dirty and unsightly-looking crate next to an otherwise neat outfit. American accumulator manufacturers usually supply attractive mahogany boxes for their accumulators, these boxes being fitted with terminals, of course. When it is desired to remove the accumulator for charging, the box is opened and the accumulator is removed in an inner crate complete with carrying handle. High tension batteries are similarly housed.

Many components obtainable at almost every radio store in America are quite unknown here. Among these are "vario-transformers," which are complete units consisting of an efficient H.F. transformer with variable coupling between primary and secondary, and with a variable condenser incorporated into the unit. Complete neutrodyne transformers to cover a specific band of wavelengths and oscillator coupling units and intermediate frequency amplifiers for incorporating in "super-hets" are further instances of this nature.

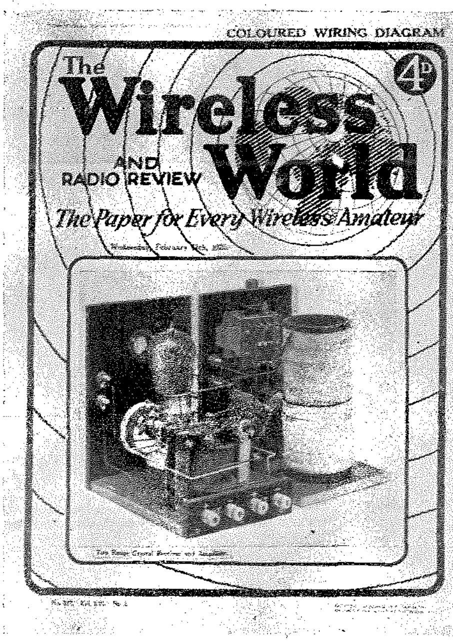
Another small but ingenious component to be obtained over there is what is known as the "plug-adaptor." When one possesses a set using plugs and jacks for 'phone connections, it often happens that one desires to try another pair of telephones or loud speaker, and a difficulty arises owing to the fact that the extra pair of telephones are not fitted with a plug. In America it is possible to purchase plugs whose "handle" consists of a small flat platform on which are mounted two or more pairs of terminals, thus allowing telephones not provided with jacks to be connected. Other plugs may be obtained containing spring clips into which the tags of the telephone may be quickly inserted.

There are a large number of very ingenious and necessary little components such as the foregoing which may be obtained at almost any radio dealers in America, but which are quite unobtainable over here. Taken on the whole, it is mostly in the matter of these small but extremely ingenious and well made "gadgets" in which the American manufacturer excels. Of course it may be argued that the British amateur is capable of constructing most of these "gadgets" himself, many of them being far more ingenious than the American-manufactured article, but that is not the point; the British amateur is also quite capable of constructing a set equal in efficiency to the best manufactured set on the market, but this cannot be taken as an argument for offering no complete sets for sale in this country.

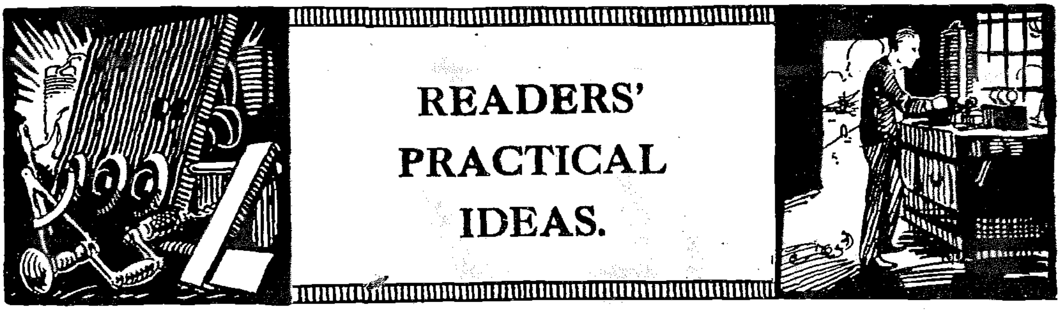
It therefore behoves our home manufacturers, if they do not desire to unduly "feel the draught" caused by the possible advent of an avalanche of American components, to set their house in order in this respect. That they are capable of producing as good and even better sets and components than the American is undoubted, but it possibly needs an impetus such as the opening of the British market to American goods, in order to rouse them from their lethargy.

It is earnestly to be hoped that we shall not have a flood of foreign junk components dumped on the home market, as American and Continental junk is on the whole far more "trashy" in design and manufacture than anything the British junk manufacturer has evolved, even in his most inspired moments.

LOOK FOR THE NEW COVER NEXT WEEK



This is an illustration of the new cover design for the next issue of the *Wireless World.* In our Editorial of this week we refer to the changes which are to be incorporated in this new series of the Journal.

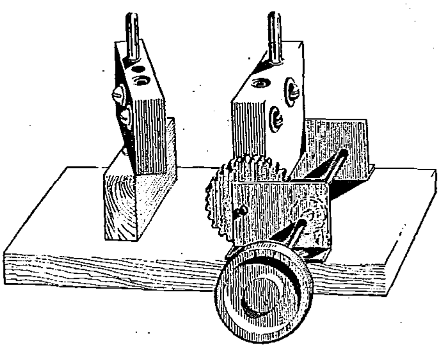


READERS' PRACTICAL IDEAS.

This section is devoted to the publication of ideas submitted by readers and includes many devices which the experimenter will welcome.

Coil Holder with Slow Motion Adjustment.

IN the accompanying diagram a method is given for constructing a two-coil holder. Coil holders are somewhat expensive and by following the design given a considerable saving in cost may be effected. For critical adjustment a double movement is provided, and it will be seen that one holder can be rotated whilst the other is operated through Meccano gearing.



A home-constructed two-coil holder.

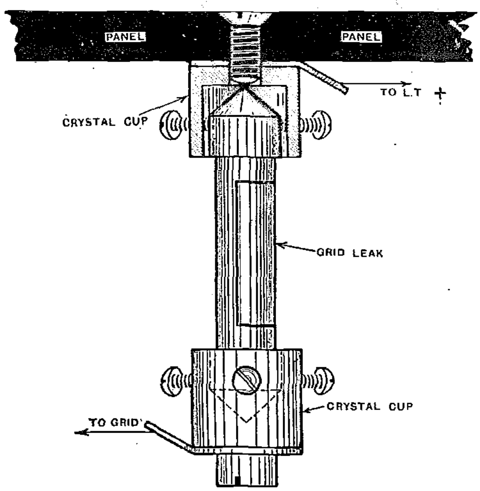
The angle pieces are made up from No. 16 gauge brass, while the rods are Meccano spindles. The base is a piece of ½ in. or ¾ in. hard wood, as is also the block which carries the pivotted holder. The pivot is a length of 4 B.A. studding screwed tightly into the wood block, and allowing the ebonite holder to rotate fairly stiffly. If desired, a handle can be attached to the rotating holder to eliminate hand capacity. Flexible leads are taken to four terminals to pick up connection with the remainder of the receiving circuit.

The reader will find that this coil holder is both simple and inexpensive to make up and with it most critical adjustment can be obtained. T. C.

Mounting Grid Leaks.

IT is not always realised that crystal cups are suitable in size for clamping on to the ends of grid leak resistances. Crystal cups are obtainable with a centre hole in the base which provides for mounting on the underside of the panel, and with screws which normally clamp the crystal in position.

The method of using a pair of crystal cups is shown below, and it will be seen that a

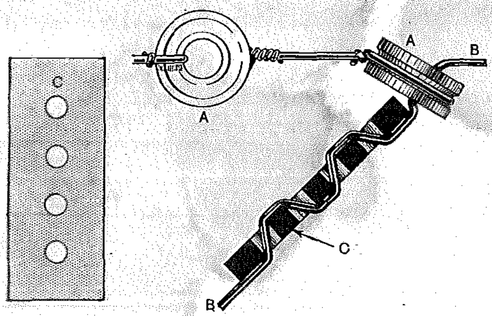


Using crystal cups for making contact with a grid leak.

screw has been inserted into the end of the lower one to carry a tag to which a soldered connection can be made. G. N.

Terminating the Aerial.

AN adjustable method of aerial termination is much to be preferred to the usual arrangement in which a portion of the wire is bent back and twisted either round the down lead or the aerial itself. With the end of the aerial made off by twisting it is not an easy matter to regulate the tension so that the aerial hangs reasonably taut.



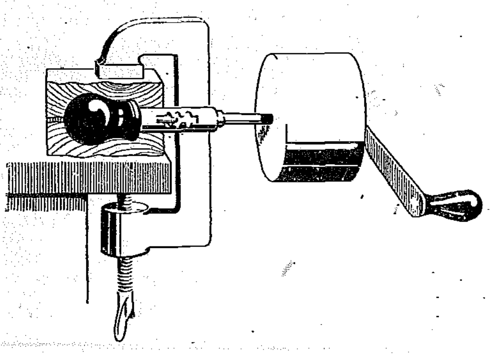
Adjustable aerial termination.

The diagram shows an easily constructed aerial adjustor. It is made up from a piece of ebonite (C) drilled with four holes through which the aerial wire (B) passes.

H. A. T.

Winding Single Layer Coils.

BELOW is shown a simple device for constructing single layer tuning coils. The arrangement will be seen to consist of a ratchet screwdriver clamped to the bench by means of two blocks of wood and carrying a wooden cylinder on its stem. A suitable handle may be secured on to the end face of the wooden cylinder.



A coil winder making use of a ratchet action screwdriver.

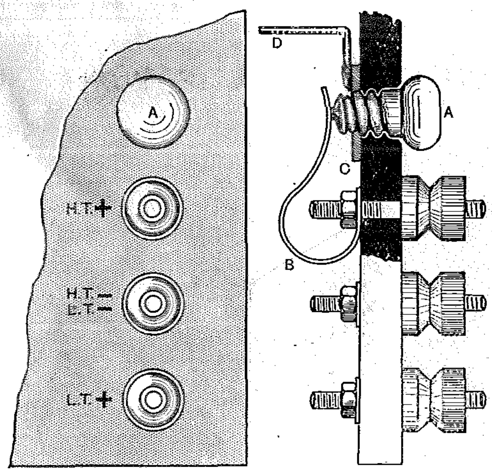
The ratchet adjustment is set so that the handle can only be rotated in one direction and as a result the wire passing from the reel on to the former cannot run slack.

The wooden cylinder should be made to a suitable size to meet general requirements, and the formers may consist of cardboard or ebonite tube. A set of cylinders of various sizes should be constructed, and if sketched out the job can be passed to a wood turner who will make them up quite cheaply.

O. I.

To Save Your Valves.

A FLASH lamp bulb let into the instrument panel in no way detracts from the appearance of the set, and may save pounds by preventing filament burnouts.



A flash lamp connected in the high tension battery lead will prevent the valve filaments from being destroyed by accidental contact with the plate socket.

The bulb is mounted on the panel and is connected in the positive lead from the H.T. battery. Accidental misconnection will only result in the destruction of the bulb, which can be replaced for a few pence.

A section of the instrument panel is shown, and the bulb A may be either screwed into the ebonite or a suitable holder C fitted. B is a piece of brass spring which makes reliable connection with the centre lamp contact, whilst D is the H.T. lead to the receiving apparatus.

L. W. A.

STABLE H.F. AMPLIFICATION WITH SELECTIVITY.

The author describes a circuit for high-frequency amplification which is easily handled and remarkably effective. As will be seen, an uncommon circuit is employed.

By J. SOMERSET MURRAY.

THE following notes were suggested by an article in *The Wireless World and Radio Review* for September 19th, 1923, by W. James, on "Short Wave H.F. Amplification." Though no claim is made for novelty or originality, it is hoped they may interest experimenters. They are an attempt to apply the electrostatic method of coupling, without the attendant disadvantages introduced by self-oscillation and instability where tuned circuits are used. No real advantage other than selectivity is gained when employed only as a one-stage high frequency amplifier.

THE PRINCIPLE OF THE CIRCUIT.

The series circuit suggested in Fig. 5 of the before-mentioned article is repeated as Fig. 1.

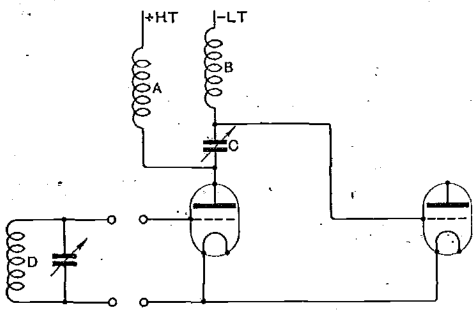


Fig. 1. *The principle of the circuit.*

In this, BC is the series resonant circuit. It is suggested that the condenser C should be of small capacity, *i.e.*, below 0·0001 μF. In practice it was found that the amplification obtained varied considerably with the value of the condenser C, even over quite a small range of wavelengths. Furthermore, the choke A through which the H.T. was fed to the anode, more or less took control of the tuning. By that I mean that when reaction was applied to the tuned circuit D and the set tuned to a strong carrier wave, it would oscillate when detuned in the direction of the optimum λ of A. It would perhaps have been more stable if the choke

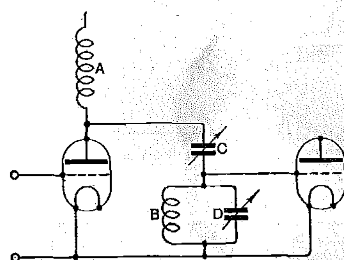


Fig. 2. *A modification of Fig.* 1.

used had been of resistance wire, but this was not tried. The actual choke used was 180 turns of 30 D.S.C. wound on a 3 in. ebonite former. However, it showed that the choke played too important a part in the tuning for results to be really satisfactory.

The next step was to tune the circuit BC by a parallel condenser across B; and the circuit when redrawn is shown in Fig. 2.

In the actual test circuit, C was 0·00005 μF maximum and D 0·0005 μF maximum. The same choke was used. When C was very small, *i.e.*, 0·000015 or so, a tendency to self-oscillate was noticed, and at the same time variations in C called for variations in D, if the wavelength was to be kept constant; but above a certain value, signal strength and tuning remained constant over a considerable range of variation in C.

A receiver was constructed embodying this principle for two stages of H.F. amplification. While instability was noticed if

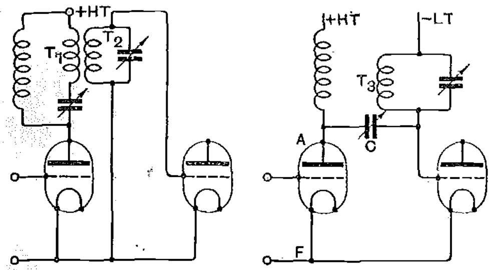
C was again made very small, for values above 0·00004 μF the set could be made perfectly stable.

ANALYSIS OF THE CIRCUIT.

When examined closely the circuit is seen to be very similar to Fig. 6 in Mr. James' article, shown here as Fig. 3.

Actually the only difference is the employment of an auto-coupled transformer T_3 in place of T_1T_2, as shown in Fig. 4. Incidentally this accounts for the variations in tuning when C is small.

However, C may also be considered as an electrostatic coupling condenser between the H.F. potentials across AF and the tuned grid circuit. In fact before the value of C is decreased so much that it seriously affects tuning conditions a loose-coupling effect is noticed; selectivity is increased to such an extent that, quite apart from any distortion which may or may not be introduced by reaction, the set acquires a very low pitch; this disappears when C is made larger, and the increased purity is accompanied by atmospherics. To obtain selectivity with more amplification, reaction may be employed on the tuned grid circuit and a larger value of C inserted. This set works quite satisfactorily both as regards selectivity and stability. The great advantage is that it enables the valves to be used with a considerable normal negative grid voltage without introducing external damping to counteract self-oscillation. The circuit employed by the writer is shown in Fig. 5.



Figs. 3 and 4. In Fig. 3 a tuned transformer is employed, and in Fig. 4 a tuned auto-transformer.

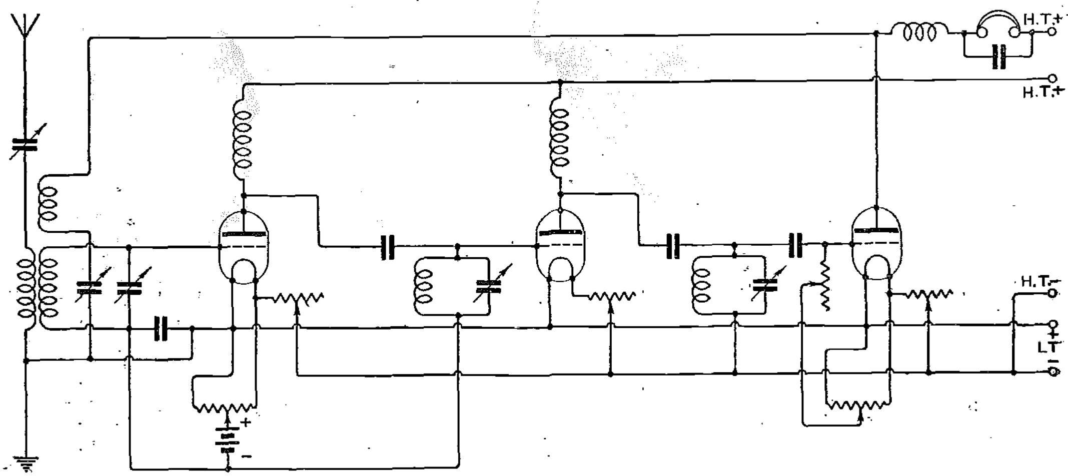


Fig. 5. The final circuit used by the author.

RUSSIAN AMATEUR HEARD.

Sooner or later the amateurs of Russia were bound to make themselves heard in Western Europe and this has apparently been accomplished for the first time by a transmitter in Novgorod. His call sign, R-1FL, was picked up at 9.20 p.m. (G.M.T.) on January 19th by Mr. Marcus F. J. Samuel, of St. John's Wood, London.

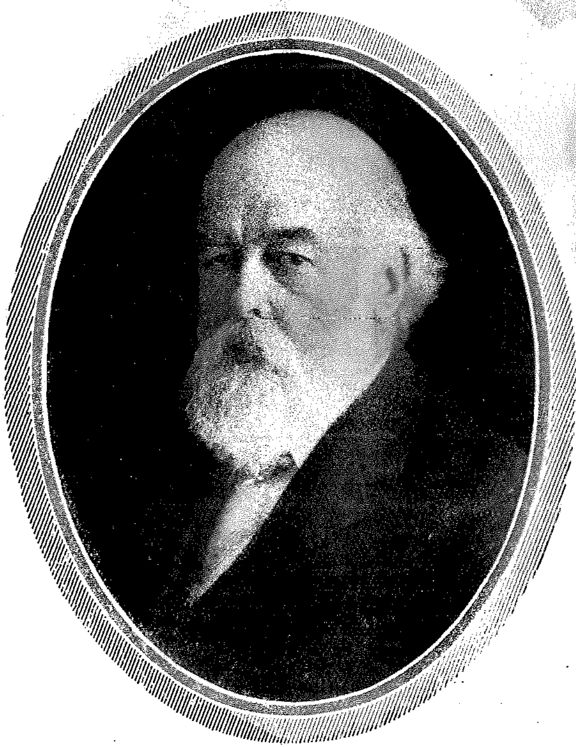
R-1 FL was calling CQ on about 110 metres with an A.C. note and was heard at R 5 on a two-valve receiver

MATTER AND RADIATION.

The Presidential Address delivered before the Radio Society of Great Britain on January 21st, 1925.

By SIR OLIVER LODGE, F.R.S.

THERE are three societies in London which specially deal with radiation: the Radio Society is one, the Röntgen Society is another, and the Optical Society is a third. They deal with radiation from different points of view, but they are all primarily concerned with waves in the ether. Optics is an ancient science which speaks for itself; it treats of the special kind of radiation which affects the eye and photographic plates. In a sense the whole gigantic subject of spectrum analysis belongs to it; but probably that has a society of its own: it certainly has disciples and eminent workers of its own who employ marvellously perfect instruments and attain results of surpassing accuracy. The obtaining of extremely well defined and complicated line spectra, and the deciphering of their message, strike me as among the most remarkable and beautiful of the activities of man in the physical realm. To the uninitiated eye a spectrum looks like nothing but confusion—as the stars do on a clear wintry night—innumerable and hopelessly unintelligible and confusing. But in both regions law and order reign and have been apprehended by the human mind. Depend upon it that the Universe is intelligible—ultimately intelligible—however complicated and hopeless it sometimes appears.



Sir Oliver Lodge, F.R.S., the President of the Radio Society of Great Britain.

The subject of spectrum analysis has a past of considerable magnitude, going back to no less a person than Sir Isaac Newton. The Röntgen Society, and the Radio Society, are new comers, and take up their subject as developed chiefly through the years which have elapsed of the present century. They have taken hold of facts discovered at the end of the Nineteenth Century, and have applied them to human life in a rapid and astonishing way. They both deal with ether pulses, but of how different size! One deals with the biggest waves which humanity has generated and used, waves exceeding but comparable in size to the aerials which have excited and emitted them. The other deals with ether pulses of excessive minuteness, smaller even than the atoms of matter, the smallest waves which have ever been detected and employed.

Everyone knows, however, that the properties of ether are so simple and fundamental that all waves, of whatever size—whether radio waves, or luminous waves, or X-rays—all travel at exactly the same pace; and their laws of transmission are fairly well known. To detect the smallest waves, phosphorescent material or photographic plates must be used: to detect the intermediate waves, the physiological instrument called an "eye" suffices; to detect the largest waves, a rectifier has to be used, either a crystal or a vacuum valve, and then, by aid of that remarkable invention the telephone, they make appeal to the human ear.

It may be said (with some appearance of paradox) that we know less about how the luminous waves are detected than about either of the others. That which goes on in the retina of the eye we are very much accustomed to, but no complete or satisfactory theory has yet been evolved; and the subject of colour vision is still a theme of controversy. Moreover, though we know how to generate radio waves and X-rays, we do not yet know how to produce light; nor, save for the eye, have we any satisfactory measuring instrument for it. We produce X-rays by suddenly stopping electrons, flinging them at high speed against a target. We produce radio waves by setting up electromagnetic oscillations, using the two fundamental properties of the ether, elasticity and momentum—which Clerk Maxwell proved to us were electric and magnetic respectively. The electric properties of the ether give us the necessary recoil, or elastic recovery from the strained condition that we call electric charge; and the magnetic properties of the ether give us the necessary momentum or impetus which enables the discharged current to rush past the position of equilibrium and pile a charge up in the opposite direction—just like the momentum of a pendulum bob or the wire of a musical instrument.

But if we seek to generate light waves, neither of these methods suffices; the waves are too small for the one operation, and too big for the other. All we can do, at present, is to throw the atoms of matter into the confused and irregular agitation that we call heat; or in some other way get them to clash together (as they do in chemical combination), and trust to the properties of the atoms themselves to emit waves of suitable size—as a bell does when it is struck by a hammer. The generation of light is still a sort of blindfold method; you make a body hot and await the result.

Atomic Construction.

All this is well known; I only remind you of it. But the discovery of the electron and of the structure of the atom is beginning to throw some light even on this process. We know now (or think we know) that an atom is a kind of solar system of electrons, in which they are revolving round a nucleus in a certain number of selected stable orbits; and we have reason to think that they only radiate when they drop from one orbit to another. The nature of the orbits, and the laws of electron motion in the atom, have now been elucidated, chiefly by the genius of Prof. Bohr, of Copenhagen, whose theory has been confirmed to a surprising extent and in astonishing detail by elaborate spectrum analysis; that is, by exact and metrical analysis of the radiation emitted. By means of that radiation the electrons in different kinds of atoms have been counted; the province of chemistry has been invaded by physics; and our views as to the constitution of matter have been immensely enlarged and in some respects revolutionised.

In speaking on matter and radiation one cannot but refer, however briefly, to these great developments of twentieth century physics. But the Radio Society, as such, is not concerned with small waves, nor with what goes on in the interior of atoms, except that it utilises the electrons which are thrown off by heated matter to confer rectifying power upon a valve.

Apart from that, a radio engineer deals mainly, not with individual electrons, but with the crowd of loose electrons which exist in a metal; his phenomena and his instruments are of a visible and tangible size. When he throws electrons into oscillation they do not quiver individually like a bell; they surge like a great crowd, rushing along and propelling themselves against an elastic barrier, the insulating ether. The elasticity of the ether throws them back again, when they have reached the end of their journey, along a conductor, and they surge to and fro for a time like a panic-stricken crowd. It is not panic but magnetism that keeps them moving. Their momentum is due to the inertia of the ether, in the shape of the magnetic field which surrounds them. So they rush in a current through their position of equilibrium, and pile themselves up at the other end of the conductor, to be thrown back again by electric elasticity once more. Oscillations are always due to the interaction or combination of elasticity and inertia.

We in this Society deal, therefore, with events on a large scale, involving enormous numbers; just as we do in machinery when we deal, not with atoms, but with millions and billions of atoms. The number of atoms in a piston-rod or a fly-wheel must be reckoned in trillions or quadrillions; the number of electrons which are surging in a wireless aerial is of the same order. When we drive machinery we do not attend to what the atoms are doing or how they are constituted, and when we send out radio waves we need not know exactly what the electrons are doing. We do not even know exactly why they are loose in a metal; whether they are wandering about in it like a sort of gaseous atmosphere quite detached from the atoms, or whether they are quickly passed from hand to hand, as it were, like fire buckets. For all practical purposes they are loose, but no final judgment has been pronounced as to the reason of this practical looseness. There are many partial theories of metallic conduction; very ingenious, but outside our scope to-day. We know that even in a metal the loose electrons are not quite free of the atoms, because they jostle them; they make the atoms shake as they rush by, so that a wire conveying a current can get red hot. Their energy, therefore, in an ordinary conductor is soon dissipated—rubbed down into heat.

But this kind of frictional dissipation does not seem essential. If a metal is cooled down to near absolute zero, so that its atoms are still and quiet—frozen, as it were, into position—the electrons are not frozen—not at all; they are as mobile as before. But now they no longer jostle the atoms; their paths seem clear and open. So that a current started in such a metal does not lose energy, is not rubbed down into heat, but continues by its own magnetic momentum for hours or days, or even a week.

All this is very instructive for those whose business it is to study atomic processes and realise what electric conduction is really like, but for practical purposes it is not necessary to understand or contemplate all that. Sufficient knowledge about conduction for practical purposes is embodied in the law of Ohm, the simple law which says that current is proportional to the force which propels it—a law quite analogous to Newton's second law of motion. In fact, electricity obeys many of the laws of matter, and we see good reason for that now, because we have learnt that matter is electrically composed.

Production of Radiation.

But how do we generate radiation, and what is radiation? Radiation is purely an etherial phenomenon; it is a pulsation or vibration or quiver or tremor in the ether. How can matter generate waves in the ether? A tuning fork can generate waves in air—any musical instrument can—but not in ether. There is no mechanical connection between ether and matter. I have tried to carry ether along by spinning a steel disc at the utmost speed, and it won't go; there is no handle or grip. Mechanical motion and ether are independent. There is no viscosity, no friction. However dense the ether may be—and I hold that it is enormously dense—it has no viscosity, and in no way affects locomotion. That is why it is so difficult to experiment on; and that is why things move so freely. That is why the earth can spin for ever, and why the planets can move without propulsion and without loss. The only link between matter and ether lies, not in mechanics, but in electricity and magnetism.

An electric charge is an etheric thing. It is concentrated on an electron, that is, on a constituent of an atom, but its field extends into the ether without limit. Electric charge is the connection between the two things—the matter nucleus and the ether field—and thus we get elastic recoil.

When a charge moves it develops magnetism; lines of magnetic force surround its path. They, too, are in the ether. Magnetism is wholly etheric; its lines do not end on material nuclei—they do not end at all. They are closed rings surrounding the paths of electronic locomotion; they are linked on to such paths, they confer momentum. There lies the other connection.

But neither an electric charge nor yet a magnetic field generates radiation. You must have both, an electric and a magnetic field superposed, at right angles to each other. Then you get radiation, travelling with the velocity of light, at right angles to both. This, when properly stated, is called Poynting's Theorem—an outcome of Clerk Maxwell's work.

How do we get this combination, this electromagnetic combination? An electric charge is all electric; a steady electric current is practically all magnetic. But if you suddenly change the speed of a moving charge, if you suddenly vary a current, if you suddenly move or stop an electron, or suddenly reverse its motion, then an electromagnetic wave starts out. Radiation is produced by changing the velocity of electrons—by accelerating or retarding them—and in no other way. This theory we owe to Sir Joseph Larmor: it is developed in his book "Aether and Matter" (published in 1900). It is the foundation of our modern knowledge about radiation.

In his theory centripetal acceleration, with no change of speed, but only change of direction, will do equally well—will equally well generate radiation. That I venture to doubt; I think there must be change of speed. Bohr's theory of the atom certainly suggests that, though without explanation. I expect to see Larmor's theory modified in that direction; but at present what I say is unorthodox.

Meanwhile we know that there is a reciprocal action; a sudden jerk of an electron generates a wave; that same wave can cause a similar jerk in another electron. All this is studied under the head photo-electricity: I daresay there will be a society some day for the special study of that; for I anticipate it will prove of great importance.

Photo-Electricity.

Atoms when properly jostled not only emit radiation, they may emit electrons. Any metal, if clean, ejects electrons when stimulated by the right kind of radiation, that is radiation of the right frequency: and to each metal belongs a certain characteristic frequency. Metals like gold and silver do not lose substance when exposed to light, any more than treasury notes do: they have to be exposed to X-rays before they respond. But light metals like potassium and sodium respond to ordinary light; and so, fortunately, does something in the retina of the eye. These substances fling away electrons at a characteristic speed when they feel luminous tremors: and it is to that strange and at present hardly accountable emission that vision is due; but for this we should not be able to see. I doubt very much if the electric tremors affect the nerves directly; they stimulate something specially adapted to respond to the vibrations. It is as if the eye contained three different substances, each of which responds to its own particular frequency—its own particular length of wave; thus giving us the means of detecting what our mind interprets as three different colours, red, green and violet: of these three-colour sensations it is known that all colour impressions are compounded.

But what is it that stimulates the nerves at all? I believe that it is the electrons, which are thrown off by the atoms with considerable violence. The energy with which the electron is thrown off depends on the substance, and on the kind of light which can stimulate that substance; it does not depend on the intensity of the light. No matter how feeble the light, the response is the same: the only difference is that feeble light can only stimulate a few atoms, a strong light can stimulate a great number. But an exceedingly feeble light makes some respond, and that is why the eye is so tremendously sensitive. The nerves have not got to appreciate the ether tremors directly: what the nerves feel is the shock of the ejected electron, which strikes them with a speed of some thousand miles a second. This is the theory of vision which is in process of being born, and which I feel sure contains the clue that has to be worked out by physicists and physiologists in combination. The eye is like a receiving instrument for detecting radio waves of extremely short and definite wavelength: it was the first wireless receiving instrument employed by man; nor by man only, but by nearly all the animals. Vision is a photoelectric phenomenon. I make that rash statement, and say that the burden of proof, and especially the burden of disproof, rests upon future experimenters.

Nor do animals alone possess this property. Vegetation possesses it too: not in the form of an eye, for there are no nerves to be stimulated, any more than there are in a photographic plate: the result in their case is not vision but chemical action. The stimulus of radiation, throwing out the electrons from atoms of matter, causes rearrangement among the molecules, chemical rearrangement. In any of these photoelectric cases the formation of images may result, that is to say the formation of patterns which our mind can interpret as images, just as it can interpret the scattered spots made by a process block; but the formation of images is a secondary result, not due to the radiation or the atoms directly, but to external optical devices, such as lenses; which alter the distribution of the incident radiation, concentrating it in some places, and diminishing it in others, so as to give a pattern of light and shade, a sort of line or spot engraving—it may be of a temporary, it may be of a permanent character. The formation of the pattern belongs to optics; it is no part of the primary result.

Vegetation has no optical appliances, and there is no pattern. But the green leaves of trees and plants contain a substance which responds chemically to light, and it is owing to this primary chemical response that sap is elaborated, vegetable tissue formed, and trees can grow. The growth of vegetation I believe to be a photoelectric phenomenon. And this view is strengthened by the now known fact that plants can be stimulated, not only by radiation, but by the discharge of electricity in their neighbourhood. Electrical stimulus probably achieves directly what ether waves achieve indirectly, that is to say, a rearrangement of the electronic constituents of atoms.

I made many experiments at one time (which have never been published) of the photoelectric response of different kinds of plants. Leaves of trees, if insulated and connected to an electroscope, certainly become charged, either with positive or negative electricity as the case may be, when submitted to ultra-violet light. That being so, depend upon it that they have learnt, so to speak, how to utilise sunshine in this way and adapt it to their own purposes. The growth of vegetation, like photography and vision, is, I believe, a photoelectric phenomenon.

Thermionics.

Thermionic emission is another branch of the subject, one which we owe mainly to Professor O. W. Richardson, though it was begun by Frederick Guthrie long ago, and, as everyone knows, it has been admirably applied by Professor Fleming and others in the rectifying valves, which are now almost domestic implements in many homes.

Thermionic emission, though analogous to photoelectricity, is rather different; it is not so exact and economical and precise a process. Heat is an irregular jostling; the atoms are thrown into vibration or clashed together, and the result is that a hot body not only radiates, but throws away electrons too. The electrons flung off from a hot body do not seem to emerge with any characteristic velocity, but with every kind of velocity. It is more like the emission of atoms from the surface of a warm liquid, or indeed from any liquid—the process known as evaporation.

There appears to be nothing electric about ordinary evaporation; it seems like a mechanical process. Some molecules are jostled and pitched out, while others enter and take their place; evaporation and condensation are always going on. When the atmosphere is thoroughly damp, evaporation does not cease; it is only balanced by equal condensation. It is just like radiation in that respect. In a room of uniform temperature the objects in it are in equilibrium, not because they cease to radiate, but because they receive as much as they emit. Radiation is going on from every piece of matter, until it is at absolute zero. An evaporating liquid may emit more molecules than it receives; in that case it will be losing weight. It may receive more than it emits; in that case it will be getting heavier. But the interchange is continuous. So it is in radiation. The interchange between matter and ether is always going on. Every piece of matter is emitting waves and also receiving them. If it emits more than it receives it is getting cooler; if it receives more than it emits it is getting warmer. Unless, indeed, it makes use of the received radiation for chemical or other purposes, so that the energy takes some form other than that of heat.

Thermionic emission is a kind of electrical evaporation. In your vacuum valve you keep the filament hot in order that electrons may evaporate from it. Above it you keep a positively charged anode, not hot at all, which is ready to receive electrons, but not to emit them. So the stream can only go in one direction; hence you get an action like that of a valve. A valve is something that lets a procession through one way, but not the other; like a mouse-trap, or the valve of a pump. Hence, with such a valve, you can rectify the oscillations stimulated by received ether waves, accumulating all those of one sign and rejecting those of opposite sign. Some crystals are able to do this without a vacuum, for reasons best known to themselves; and so you have crystal rectifiers, which you can use as receivers in the process of converting the fearfully rapid ether pulsations into the moderately rapid vibrations which can be utilised by a telephone and which affect the ear as a more or less musical note.

Radio Telephony.

But, as all the members of this Society know, Dr. Lee de Forest saw a way to improve Fleming's vacuum valve by introducing a regulator of traffic in the procession of electrons, in the shape of a grid; that is to say a sort of policeman who sometimes stops the traffic and sometimes lets it through. And by this means he enabled the valve to do more than rectify, to do more than would suffice for dots and dashes of the Morse code; the grid enabled or compelled the electrons to follow every fluctuation, to give all the peculiarities appropriate to different kinds of musical instruments, to follow with precision the consonants and vowels of human speech, and to reinforce or magnify their strength.

It is a very simple device, one that seems natural enough now: just as the telephone is a very simple invention. The marvel to me is, not so much that the electrons can be controlled and made to follow all the infinitely various modifications of speech and music, but that an iron plate can do it. All that the iron plate really does is to vibrate as it is compelled; big, small, quick, slow—whatever the forces inflicted on it are—it responds to them all. There are a few it doesn't like: it fails to discriminate clearly between "f" and "s"; but for the most part it responds with precision. It does not attempt any analysis; it imparts to the air all it gets: and whether we are reciting Shakespeare or reproducing the imaginations of Beethoven, they have to exist for a time in the curious mechanical inorganic unintelligent unconscious form of quivers in an iron plate and condensations and rarefactions in the air. No analysis is attempted till it reaches the ear: there in our head we have a receiving organ to which is imparted these same vibrations; but associated with the drum and its mechanical mechanism is a marvellous instrument, the inner ear, which analyses the movements into its components and imparts the appropriate stimulus to the fibres of the auditory nerve: it analyses the acoustic vibrations, as the eye analyses the optical vibrations: one is an air instrument, the other is an ether instrument.

But whence comes the interpretation? How do we get back from this confusion of movements (which in the intermediate stage is nothing but movement), how do we get back to the ideas of Shakespeare or Beethoven? Here we leave the ground of physics and physiology: we enter on the domain of psychology, and, as far as I know, we have no clear answer. All we can say (or at any rate all I can say) is that if our minds are superior to those of animals and savages, if they are not hopelessly beneath the scope of the mind which formed those conceptions, then somehow or other our mind is stimulated to receive some fraction of them, and to realise something of their creator's intention. We are, as it were, mechanically, or it may be electrically (which is the same thing), put into touch with minds greater than, but in some respects like our own. And thus it is that, on a lower level, ordinary human speech and intercourse is all conducted. Mind can speak to mind, but (as some think) only through the intervention of mechanism.

That is a position that can be controverted —a controversy upon which I do not now enter. I only point out that the ordinary process, to which we have grown accustomed, contains much that is mysterious, much that we hardly understand, very much that is astonishing; and I suggest that a direct mental communication, without mechanical intervention, may some day seem simpler, easier, and more natural.

Radiation Possibilities.

Now let us go back to the connection between radiation and matter, and to the electric units of which matter is composed.

Electric units are not all of one sign: they are positive and negative. There are electrons and also protons. When they come near together they tend to neutralise each other's outside influence; that is why ordinary matter is electrically neutral. A little friction will disturb and separate them, but they will get together again as soon as they can. Whenever they approach each other, falling together, they radiate, for their speed is obviously changing. The more violent the clash, the more vigorous the radiation. Do they ever actually inextricably clash, and annihilate each other? It is not known that they ever do; there seems to be something that keeps them apart, though they get very close together. Things on the earth seem too staid and quiet to allow of an actual destructive clash, or anything like mutual extermination. But the operation is conceivable, and as we now know that some of the stars have a temperature to be reckoned in millions of degrees, strange and violent things may be going on there. Perhaps some day they will be made to go in a laboratory, on a very small scale.

We can at least contemplate the process and ask what would happen if they did; the answer is clear enough. The two opposite charges would vanish in a puff of radiation; all that would persist of them would be their energy; there is no destroying that. The energy would be no longer localised in specks of matter, but would be travelling across space with the speed of light; it would now wholly and obviously belong to the ether. This process it is to which astronomers make appeal for the intense radiation from stars, and especially the unimaginably intense radiation in their interior, which distends them by its pressure as a football bladder or a motor-tyre is distended by the compressed air inside. It is not compressed air in the stars, it is compressed light; the pressure of light may become enormous, though here we have the utmost difficulty to detect it. Anyhow, some special process has to be imagined to account for solar or stellar radiation of this violence, enduring without perceptible loss for *millions* and *billions* of years.

But if the units of matter thus clash and destroy each other, matter must be disappearing. There is conservation of energy, there is no conservation of matter. What is matter at one moment may become radiation at another. Dr. Jeans tells us that the sun loses 4,000,000 tons of matter every second. That is the rate at which is is radiating ether waves—converting matter into ether energy and radiating it away. The data are simple enough, the arithmetic is easy, anyone can check the calculation. Four million tons a second it is. Of it the earth receives the equivalent of about two and a-half hundredweight a minute; but the earth radiates nearly as fast as it receives. Four million tons a second sounds a lot, but it makes no perceptible difference to the sun. It can go on expending itself at that rate for millions of centuries without any obvious change. In time, of course, it must exhaust itself and fade, but that time is not yet.

Much more might be said on that subject, but not now. What I want to ask is, is there any reciprocity about this process? Matter can turn into radiation. Can radiation turn into matter? I surmise that it can, but not under ordinary conditions. I guess that the waste radiation careering through space from all the innumerable suns and through innumerable millenniums must have some result. I imagine them to be generating matter in the far depths of space; which matter can then by gravitation fall together and reproduce or keep in maintenance the whole material cosmos. I see no ultimate dissipation of energy in the universe. I see energy passing from matter to ether and back again. That process, in simple form, we constantly experience—emission on the one hand, absorption on the other. Energy is always passing from matter to ether and back again. The energy of matter is called kinetic; the energy of ether is called potential. All activity is the result of interchange—transference and transmutation of energy.

Ether Theory.

But now note that if an electron can for any reason have its beknottedness untied and be converted into ether, it must be really composed of ether all the time. I have no doubt that it is. An electron is peculiar or modified ether, and so is a proton. But electrons and protons together constitute an atom of matter, and atoms of matter constitute the whole of what we see and handle, the objects around us, and the planets and the stars. Is matter, then, a peculiarity or modification of the ether? That is exactly what I think is the truth. The object of physics in the long run will be to explain all material phenomena, first in terms of electricity and magnetism, and then those in terms of ether. I look forward to the time when we shall realise that the whole of the material universe, and all the phenomena we are acquainted with, are ether in different kinds of motion. Not locomotion, but spinning motion, vortex motion; the kind of motion elaborated by the genius of Helmholte. Such a structure for the ether began to be considered in an optical connection by McCullagh, of Dublin, was taken up by G. F. FitzGerald, was elaborated by Lord Kelvin, and also by Prof. W. M. Hicks, ultimately taking a form which has been called "a vortex sponge"—an incompressible, absolutely continuous medium, full of excessively fine-grained vorticity; able to transmit transverse waves, and presumably able to be modified here and there into the peculiar configurations which we have not yet fully learnt to understand, but which we have named electrons and protons.

There is more to be said, though probably I have now said enough, and have taken you rather far from the daily exercise of wireless signalling, about the recent developments of which you know quite as much, and probably more than I. But I should just like to say, briefly, that there is reason to believe that the ether is not only of enormous density, but also is under a gigantic pressure, 10^{33} dynes per square centimetre, and that this it is which holds the electron together, in spite of the self-repulsion of its electric charge. Poincaré and Langevin, between them, have shown that this theory will account for the size of an electron and put it in equilibrium. And we know that its electric field accounts for its apparent mass. What we do not yet understand is the remarkably greater extra mass of the proton. Why should that be 1,840 times as heavy as an electron? What does this number, 1,840 or 1,845, mean? Is it really an exact number? I think it must be. I make a guess that the electron is hollow, an ether vacuum, its electric charge just compensating the pressure and preventing collapse. That guess can be justified if an ether vacuum is allowed. What has become of the material extracted? I guess that it has been jammed into the nucleus of the proton, and that somehow it is going to account for the strange and at present empirical number 1,845.

Conclusion.

I leave you in a region of speculation. There is no time to justify or elaborate these suggestions; some are not ripe for elaboration, others are. It is true that modern physics contains a great deal of inevitable speculation, but it is not rash and random speculation; it is all of the nature of working hypothesis based upon half-understood facts, and it clamours to be tested by experiment and observation. Speculation is comparatively useless until it can be made definite, so that it can be tested; but if it suggests experiment it is of high value. Indeed, we cannot do without it unless we are pursuing the regular course of orthodox dynamics, which, as you know, in the hands of Newton and his great disciples carried us very far, but which has now begun to show signs, not of weakness, but of lacunæ, gaps, or interstices, which it is our business to fill up. A framework or scaffolding is a most useful structure, but it does not pretend to be the complete edifice. It does not fill in the minuter details. In physics we do not deal only with the gross and tangible things which affect our senses; we seek to penetrate the atoms, we enquire into the properties of the connecting medium. Matter is excessively porous, here a particle, and there a particle, with great spaces between; it is not really the continuous substance it appears. When we deal with the infinitely small, dynamics begins to fail us; new and extraordinary entities force themselves on our attention. Predicates have to be quantified in a new and unusual sense. Matter resolves itself into discontinuities, and these are unintelligible without a continuous ether uniting them.

There is any amount to say about the ether, but not now. All we are concerned with now is its power of transmitting waves. That alone shows that it has metrical properties. These waves are intimately associated with matter; we have recently learnt how to produce and how to detect them. Most of us leave the production to others; we only annoy people when we emit them—they call it howling—but reception is easy. You hang out a material wire, containing lots of loose electrons, in the ether of space, and straightway the waves are collected and brought into the house. Whether you detect them or not, there they are. Like many other things amid which we live, we might be ignorant of them. We should know nothing about them had we not taken the trouble to receive them, to prepare means, and to listen in, as an act of faith.

Whether as generators or as receivers, it might be said that the whole object of this Society is—a better understanding, and a more efficient utilisation, of the recently discovered and fundamental connection between Matter and Radiation.

THE EXPERIMENTER'S NOTE BOOK.

By W. JAMES.

A Stable Super-Heterodyne Receiver.

THERE are several advantages to be derived by using a resistance-coupled high-frequency amplifier in a super-heterodyne receiver. Suitable resistances are quite cheap, they are easily connected in the circuit, and no difficulty is experienced in securing effective amplification, provided a reasonably high wavelength is employed. Perhaps the most *important of the advantages, from the point* of view of telephony, however, is the fact that such an amplifier does not distort the signals when properly adjusted.

Distortion may, of course, be caused by sharply tuned circuits. When tuned circuits are employed and the amplifier is adjusted to a fairly high wavelength, such as 10,000 metres, distortion due to the sharpness of the tuned circuits is almost bound to be caused, more especially when the signals are strengthened by employing reaction. The higher notes are weakened, and the resulting speech or music is low toned. When anode resistance couplings are employed, this type of distortion does not occur, provided the values of the resistances, grid condensers, grid leaks and grid bias are correctly chosen.

It would therefore seem to be ideal to employ a resistance-coupled amplifier, but it should be remembered that the amplification obtained is not quite so high as when a well-built transformer-coupled amplifier is employed, and that a higher anode voltage is required. The amplification can be brought up to the desired level by adding another valve, and the cost of the extra anode battery is practically negligible compared with the expense of the valves themselves; but there is another serious drawback. A resistance-

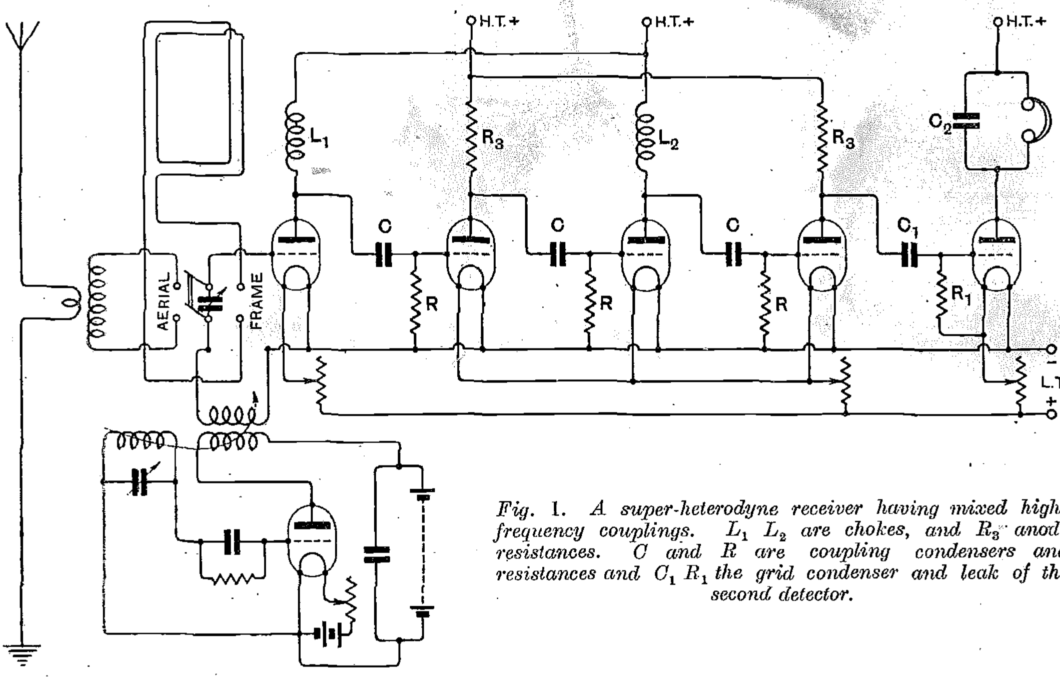


Fig. 1. A super-heterodyne receiver having mixed high-frequency couplings. L_1 L_2 are chokes, and R_3 anode resistances. C and R are coupling condensers and resistances and C_1 R_1 the grid condenser and leak of the second detector.

coupled amplifier is usually noisy; that is, there is a background of noise which is usually of sufficient intensity to spoil moderately strong signals, and to render the weaker signals unintelligible. The noise may be reduced considerably, and some of the advantages of this form of coupling retained by employing mixed couplings, as indicated in Fig. 1, where two of the anode circuits have resistance couplings. With this arrangement noises are not amplified to any great extent, the circuit is stable, and usually does not give trouble through self-oscillation. Further, there are only the two circuits to be adjusted to the same wavelength, namely L_1 and L_2.

This type of circuit does not appear to be extensively employed, partly, I think, because its advantages are not sufficiently well appreciated. It is one which I can recommend from experience with several super-heterodyne receivers. Probably only those who have tried to stabilise an amplifier with three stages (four circuits) of tuned transformer or tuned anode amplification appreciate the difficulty in preventing howling and in cutting out long wavelength interference.

Reflexing a Super-Heterodyne Receiver.

Many of the commercial super-heterodyne receivers have one or two stages of reflex amplification, and there is nothing to prevent one from doing this with satisfactory results, provided care is taken in choosing the components employed, and in properly arranging them in the circuit. It should be remembered that the wavelength of the H.F. portion of the circuit is considerably higher than many are accustomed to deal with. For instance, if the wavelength of the H.F. amplifier is 10,000 metres, the frequency is 30,000 cycles, which compares with an average frequency of about 750,000 cycles for broadcasting, and the highest audible frequency of about 7-10,000 cycles.

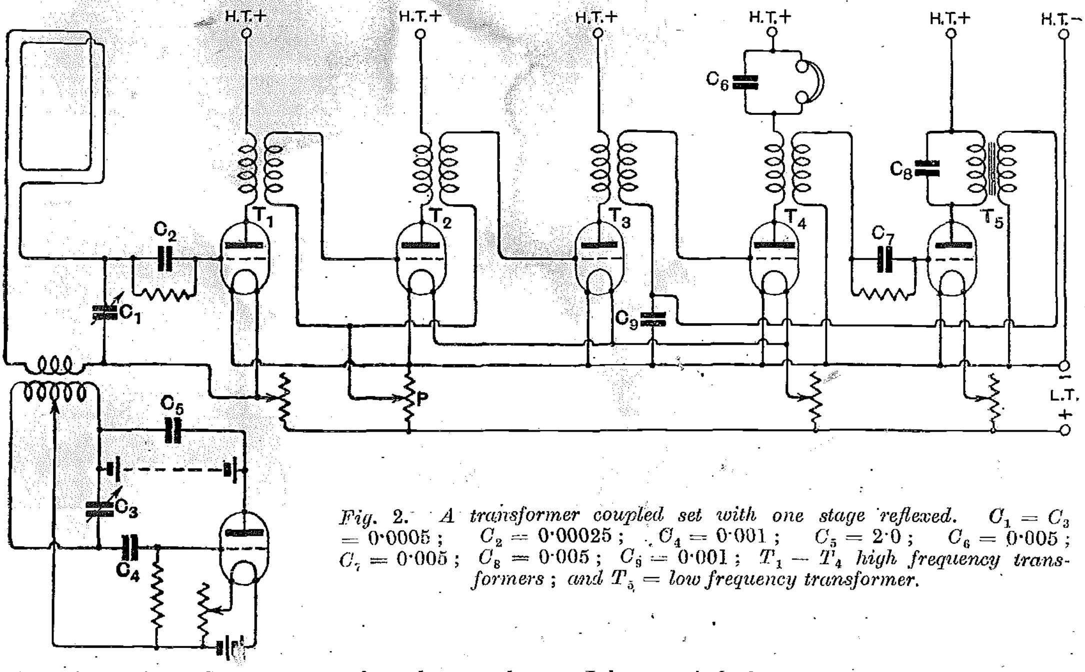
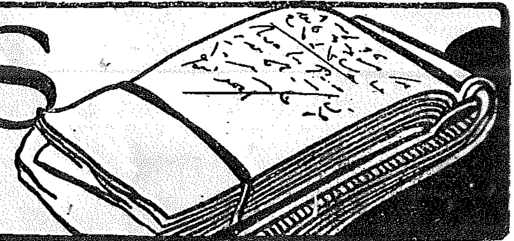


Fig. 2. A transformer coupled set with one stage reflexed. $C_1 = C_3 = 0{\cdot}0005$; $C_2 = 0{\cdot}00025$; $C_4 = 0{\cdot}001$; $C_5 = 2{\cdot}0$; $C_6 = 0{\cdot}005$; $C_7 = 0{\cdot}005$; $C_8 = 0{\cdot}005$; $C_9 = 0{\cdot}001$; $T_1 - T_4$ *high frequency transformers*; *and* T_5 = *low frequency transformer.*

I have tried the circuit of Fig. 2, having the values given in the caption, with satisfactory results. Only one stage is shown reflexed, as usually distortion is produced when a second valve is so connected. A second stage, of course, may be usefully employed to strengthen weak signals, but when the signals are of good strength I prefer to employ an additional valve of the power type as an amplifier. If a valve having ample emission and a low impedance is employed, the quality and strength are usually very much better than when a second valve of the H.F. amplifier is reflexed. It is, of course, advantageous to reflex the valves when filament and anode current have to be kept at as low a value as possible.

NOTES & NEWS



KDKA, the well-known Pittsburg broadcasting station, is reported to have been heard in the Bismarck Archipelago, north of New Guinea, a distance of over 9,000 miles.

* * * *

The new broadcasting station at Moscow transmits on a wavelength of 1,200 metres and employs a power of one kilowatt.

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Mr. R. L. Royle, of Palmers Green, London, effected two-way communication with Australian 3BQ on January 20th.

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A listener at Jesselton, North Borneo, claims to have heard the chimes of Big Ben broadcast from 2 LO.

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Major H. Lefroy, J.P., who was prominently associated with Army wireless during the war, has been appointed a director of Marconi's Wireless Telegraph Co., Ltd.

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The Director-General of the German Railways, Herr Oeser, states that wireless telephony apparatus is to be installed on all express trains.

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ENGLISH ANNOUNCEMENTS FROM PORTO RICO.

That announcements from WKAQ, the San Juan broadcasting station, Porto Rico, are made in English as well as Spanish, has been discovered by Mr. K. R. Crawshaw, a Halifax reader. Unless reception is very clear, however, it is quite easy to imagine that the whole announcement is in Spanish, states Mr. Crawshaw, owing to the strong Spanish accent. WKAQ, which operates on 360 metres, was picked up by our correspondent on a three-valve receiver (1—v—1).

MR. FLEWELLING'S SHORT WAVE TESTS.

Daily transmissions on 64 metres are being carried out by Mr. E. T. Flewelling (9 XBG), of circuit fame, from his station at Chicago. Music is transmitted from midnight until 12.30 a.m., followed by C.W. and telephony until 12.45 a.m. Mr. Gordon Ritchie, of Glasgow, states that he received faint music from 9 XBG on January 13th.

HEARD IN ALL CONTINENTS.

In having his signals picked up in South Africa, Mr. F. L. Hogg (2 SH), of Highgate, is now able to claim that his transmissions have reached every continent. The South African amateur who received 2 SH towards the end of last year is Mr. L. G. Hughes, of Johannesburg, who describes the experience in an interesting letter. 2 SH was first heard on 120 metres but has subsequently been well received on 90.

According to Mr. Hughes, very few British amateurs can be heard in Johannesburg, whereas little difficulty is encountered in picking up quite a number of Americans. As in all tropical countries, atmospherics are the bane of the wireless man in South Africa, and Mr. Hughes states that he can draw sparks $\frac{1}{4}$ in. to $\frac{1}{2}$ in. long when manipulating the earth switch !

At the time of the above transmission, Mr. Hogg was employing a power of under 80 watts with raw A.C.

MIDDAY RECEPTION OF U.S.

Mr. S. K. Lewer (6 LJ), of West Hampstead, states that he has recently been receiving signals from many of the 1st District American amateurs as late as mid-day ; he has also heard them as early as 6.30 p.m.

SCANDINAVIAN TRANSATLANTIC TEST.

A morning test between American and Swedish amateurs, organised by *Radio-Bladet*, and under the control of the American Relay Radio League, was carried out from 7 to 9 a.m. on Sunday, February 1st. The Americans undertook the transmission side of the test, whilst the Scandinavians endeavoured to "log" as many Americans as possible in the time at their disposal.

The checking arrangements were in the hands of the A.R.R.L. and we understand that two prizes are being awarded, one to the American who was most widely heard, and one to the Scandinavian amateur who picked up the greatest number of American stations. The result of the test has yet to be announced.

AUSTRALIA WORKED DURING ECLIPSE.

During the recent solar eclipse some very fruitfu experiments were carried out by Mr. E. J. Simmonds (2 OD), of Gerrard's Cross, Bucks, in the course of which he succeeded in communicating with Australian 3 BQ and in picking up signals from New Zealand, 4 AK. This, of course, was during the afternoon, whereas the usual times for receiving

Australian and New Zealand amateurs are the early evening and early morning respectively.

From 2 p.m. onwards 2 OD sent out regular signals at intervals of ten minutes, with a special code word which was changed with each transmission. These transmissions were received by Capt. Arison, of Edinburgh, who compiled an interesting graphical record demonstrating that signals steadily increased in volume until the eclipse had reached its maximum.

At 3.40 p.m. GHH (Mosul) was heard strongly, and at 4.15 p.m., shortly after the eclipse had reached a maximum, New Zealand 4 AK was heard at a strong and steady strength, but although communication was attempted, 2 OD received no response. A call came, however, from A 3 BQ, and contact was at once established, good signals being exchanged. In the course of the conversation, 3 BQ mentioned that 45 minutes previously he had been in touch with U 6 ABK, this also being an unusual time for such a communication. The New Zealand station was again heard by 2 OD at 4.50 p.m., working with GHH.

It is interesting to note that in all cases the signals were unusually clear and steady.

Several other readers picked up Australian stations during the eclipse.

TELEPHONY TESTS FROM SCHENECTADY.

Simultaneous morse transmission on 100 and 30 metres is being carried out every Saturday-Sunday night by 2 XI, the General Electric Company's station at Schenectady, states Mr. J. Gordon Ritchie, of Glasgow. The times of these transmissions are from 11 p.m. to 3 a.m., and from 5 a.m. to 7 a.m. Reports, which should be as full as possible, are invited, and will be acknowledged by radio. We understand that on January 10th several English amateurs' reports were acknowledged in this manner, including those from 5 DN, 2 NM and 2 KF.

2 XL intends "going on the air" with telephony on 100 metres early in the present month, and reports on this are specially desired.

AN OPPORTUNITY FOR PHOTOGRAPHERS.

Wireless enthusiasts who are also photographers will learn with interest that by arrangement with *The Amateur Photographer*, photographs of general wireless interest may be submitted to the editor of that journal with a view to their forming cover illustrations for *The Wireless World*. Photographs accepted for this purpose will be paid for at the rate of two guineas. Details of this scheme, which also applies to photographs accepted for the inside pages of *The Wireless World* at the rate of half-a-guinea, will be found in the current issue of *The Amateur Photographer*.

FRENCH AMATEUR'S TESTS.

A regular transmitting schedule is being adhered to by French YZ, of Colombes, Seine, who transmits on 50 metres at the following times (G.M.T.):—Daily, except Sunday, for thirty minutes, at 2.30 p.m., 4.30 p.m., 6.30 p.m. and 8.30 p.m. On Tuesday, Thursday and Saturday, from 4.30 p.m., till midnight; on Wednesday, Friday and Sunday, from 5 a.m. to 7.30 a.m.

Reports, which would be much appreciated, should be addressed to F. Lecroat, 2 Rue de Bournard, Colombes, Seine.

CHEAPER VALVES.

Our readers will welcome the important announcement that the prices of Marconi Osram valves have undergone a further reduction. The following is a schedule of the new prices, which came into operation on February 2nd.

Type.	Present List Price.	New List Price
"R"	12/6	11/-
"R5V"	12/6	11/-
"DER"	21/-	18/-
"DE3"	25/-	21/-
"DE4"	30/-	26/-
"DE5"	35/-	30/-
"DE5B"	35/-	30/-
"DE6"	25/-	22/6
"LS5"	55/-	50/-

Calls Heard.

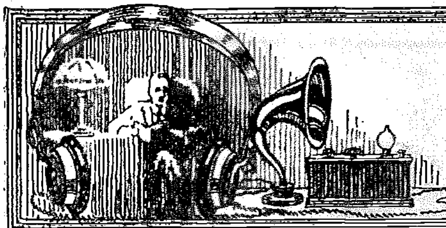
Eastbourne, Sussex. (January 1st to 10th.)
French: 8 BF, 8 BN, 8 DP, 8 EU, 8 ÉU, 8 FK, 8 FOK, 8 FZ, 8 GI, 8 GK, 8 RG, 8 RQ, 8 RZ 8 SG, 8 UU, 8 WK, 8 WL, 8 ZB, 8 ZUE, 8 ZUT. American: 1 BHM, 1 MY, 2 AZY, 2 BGB, 2 CJX, 2 WX, 3 ADE, 3 BDO, 8 XB, NKF. Italian: 1 AM, 1 CF, 1 CXM, 1 KX. Dutch: 0 BU, 0 MR, 0 NL, 0 RE. Swedish: SMXX, SMZU. Finnish: FN 1NA. Danish: 7 ZM. Unknown: 3 CM, 9 CS, 4 AB, 3 WB. (A. Roach.)

Felixstowe, Suffolk.
French: 8 CA, 8 CL, 8 COA, 8 CO, 8 CS, 8 FP, 8 HE, 8 JBL, 8 NC, 8 RB, 8 RH, 8 RJ, 8 SSU, 8 TT, 8 XH, 8 XX, 8 ZW. Dutch: 0 AD, 0 AZ, 0 CS, 0 MA, 0 MC, 0 QR, 0 RN, 0 WP, 0 ZA. American: 1 GB, 1 OZ, 1 TZ, 2 DY. Finnish: 3 DV. Canadian: 1 AR. Argentine: DA 8. (All below 200 metres.) (R. T. Frost.)

Lower Broughton, Manchester.
French: 8 AB, 8 AÉ, 8 AAA, 8 BV, 8 CZ, 8 EM, 8 FK, 8 GG, 8 GI, 8 GP, 8 GS, 8 SG, 8 SM, 8 SSV, 8 SSU, 8 UU, 8 XU, 8 ZZ. Dutch: 0 AD, 0 BA, 0 RE, 0 LA, 0 NL, 0 ZN. Swiss: SMXX. Belgian: 4 SS. Danish: 7 ZM, 7 GQ. American: 1 AD, 1 AG, 1 AX, 1 ANA, 1 ARE, 1 ARY, 1 AXZ, 1 BDT, 1 CA, 1 CM, 1 CEI, 1 ERI, 1 HN, 1 SF, 1 VJ, 2 AG, 2 AW, 2 BY, 2 BM, 2 CB, 2 WL, 3 CH, 3 CBR, 7 BDS, 8 TR. (W. Clough.)

Cathcart, Glasgow. (January 1st to 15th.)
British: 2 CC, 2 DX, 2 HS, 2 KZ, 2 KW, 2 NM, 2 NN, 2 OC, 2 OD, 2 RB, 2 SZ, 5 LS, 5 MO, 5 NN, 5 TZ, 5 OK, 6 FA, 6 FG, 6 GH, 6 LJ, 6 NF, 6 TD. French: 8 AAA, 8 BF, 8 BV, 8 BN, 8 CS, 8 DP, 8 ÉN, 8 ÉU, 8 EU, 8 ÉM, 8 FC, 8 FJ, 8 GV, 8 GN, 8 GK, 8 HS, 8 HSG, 8 MT, 8 MN, 8 NS, 8 RG, 8 SM, 8 SSU, 8 SSV, 8 TK, 8 VP, 8 VTI, 8 WAL, 8 WK, 8 WU. Dutch: 0 BQ, 0 NL, 0 LL, 0 RE, 0 REU, 9 ZN. Belgian: 4 UC, 4 AX, P 2. Swiss: 9 AD, 9 BR, 9 LA. Italian: 1 AM, 1 FC, 1 RE.
(0—v—0 Reinartz, indoor aerial.) (A. T. Wilson.)

Whimple, Devon.
French: 8 AAA, 8 AB, 8 AL, 8 AMZ, 8 AQ, 8 ÁVF, 8 BAP, 8 BF, 8 BO, 8 BP, 8 BRG, 8 CA, 8 CK, 8 CM, 8 CO, 8 CPP, 8 DKV, 8 DL, 8 DY, 8 ÉM, 8 ÉN, 8 ÉV, 8 FC, 8 FG, 8 FMA, 8 FQ, 8 FY, 8 GGA, 8 GH, 8 GI, 8 GK, 8 GO, 8 GP, 8 HS, 8 HSF, 8 HSM, 8 II, 8 JV, 8 LPR, 8 NB, 8 NS, 8 SPR, 8 SSC, 8 SSM, 8 SSU, 8 SSV, 8 TM, 8 UU, 8 WAL, 8 WK, 8 XR. Belgian: 4 AX, 4 RS, 4 SS, 4 YG. Dutch: 0 AA, 0 GG, 0 KC, 0 LL, 0 MS, 0 NF, 0 RE, 0 RZ, 0 ZN. Italian: 1 AM. Swedish: SMZY. Swiss: 9 AA, 9 AB. Finnish: 2 NM, 2 NC. Danish: 7 QF. British: 2 ASH, 2 DR, 2 FN, 2 IL, 2 JX, 2 KW, 2 LH, 2 OD, 2 VQ, 2 WV, 2 WY, 5 CS, 5 MO, 5 NN, 5 OM, 5 QR, 5 SA, 5 VQ, 6 LJ, 6 NF, 6 NH, 6 QB, 6 RM, 6 TD, 6 TM, 6 US. (0—v—0 and 0—v—1.)
(G. F. FitzHerbert.)



AMONG THE SOCIETIES.

The headquarters of the Kingston and District Radio Society are now at Kingston Lodge, London Road, and meetings are held regularly on Mondays at 8 p.m. On February 9th a Social Evening is to be held to which all wireless enthusiasts in the district are invited.

* * * *

A forthcoming visit of Captain P. P. Eckersley is announced by the Ilford and District Radio Society. The Chief Engineer of the B.B.C. will speak at the Ilford Town Hall on March 26th, the meeting being open to the public at popular prices. In order to cope with the large attendance which is expected it is understood that "Marconiphone" loudspeakers will be installed.

* * * *

On January 22nd Mr. J. A. Partridge, more familiarly known as "2 KF," gave an extremely interesting lecture before the Beckenham and District Radio Society, taking as his subject: "Short Wave Transmission and Reception." Various types of aerial, their advantages and disadvantages, were discussed in detail, after which the lecturer dealt with the best circuits for pure reception. The Society is making arrangements to hold an exhibition at an early date. A feature of the exhibition will be a competition for home constructors.

Mr. F. L. Hogg (2 SH), of Highgate, London, photographed in his "den." Signals from 2 SH have been heard in every continent.

* * * *

The manufacture of condensers was treated in an informative lecture given before the Tottenham Wireless Society on January 16th, by Mr. Hayward, of the Dubilier Condenser Co. By means of a series of lantern slides the members were able to watch the processes of condenser manufacture from the mica mines in India to the product as it leaves the factory.

On January 21st Mr. Tracey provided an instructive lecture on "Set Design and Lay-out," in which useful hints were given as to the best positions for components in different circuits. Mr. Tracey raised an important point which is often forgotten. In the construction of a valve set it is advisable first to decide what type of valve is to be used, and then to design the set to suit the valve.

* * * *

The Dublin Wireless Club is conducting a series of lectures specially for beginners.

On Thursday, January 22nd, an interesting loud speaker demonstration was given with a four-valve receiver constructed by members of the club. In order to render the wiring easily visible the components were mounted on a board. The construction and working of the set were thus explained so as to be understood by all members.

* * * *

At the fourth annual meeting of the Kensington Radio Society held on January 15th, various useful suggestions were put forward with a view to making the Society's monthly meetings still more attractive. Several of these were adopted and it is hoped that as a result, attendances will grow.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 4th.

Institution of Electrical Engineers—Wireless Section. At 6 p.m. (light refreshments at 5.30 p.m.). At the Institution, Savoy Place, W.C.2. Lecture: "The Optimum Damping in the Auditive Reception of Wireless Telegraph Signals." By Mr. L. B. Turner, M.A., and Mr. F. P. Best, M.Sc.

Radio Research Society, Peckham. Discussion: "Rejector Circuits." Lecture: "Wavemeters."

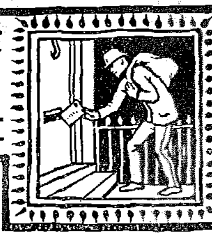
THURSDAY, FEBRUARY 5th.

Luton Wireless Society. At 8 p.m. At the Hitchin Road Boys' School. Lecture and Demonstration: "Fault Find'ng on Wireless Instruments." By Mr. C. S. Dunham.

FRIDAY, FEBRUARY 6th.

Sheffield and District Wireless Society. At 7.30 p.m. At the Department of Applied Science, St. George's Square. Ordinary Meeting.

READERS PROBLEMS

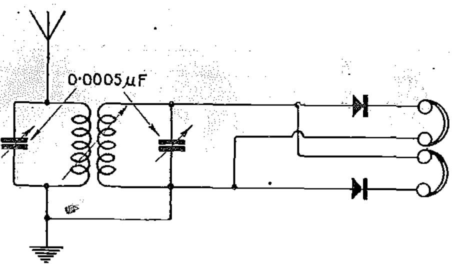


Readers desiring to consult the "Wireless World" Information Dept. should make use of the coupon to be found in the advertisement pages.

METHODS OF OBTAINING INCREASED EFFICIENCY FROM CRYSTAL SETS.

A READER asks for a selective crystal circuit, in which each half cycle of the oscillatory current in the tuner circuit can be made to energise different pairs of telephones.

We illustrate below a circuit suitable for accomplishing this. Two pairs of telephones are used, and it will be found that, using this method, the signal strength in each pair of telephones is equal to that in the telephones of a conventional circuit, using one pair only. A single pair of telephones may be used if desired by connecting each individual earpiece in the position occupied by each pair of telephones in the diagram.



A special crystal receiver.

Another method is to employ two telephone transformers with their input windings individually connected in circuit with one crystal. The output windings can now be connected in series with each other and with a pair of telephones. When using several pairs of telephones in conjunction with a crystal set it will usually be found that better signal strength will be obtained if each pair of telephones is operated in conjunction with a separate crystal, the various pairs of telephones and their associated crystal all being connected in parallel across the tuning inductance.

EFFICIENCY OF ACCUMULATOR CELLS CONNECTED IN PARALLEL.

A READER who is intending to abandon the use of bright emitter valves in favour of dull emitters of the 2-volt type, has asked whether it would be better to obtain large capacity accumulators of the single cell type or to connect the three cells of a 6-volt accumulator in parallel. He also wishes to know if this type of valve can be considered equally efficient to those valves requiring 4 to 6 volts to operate them.

It is usually found to be far better to employ a separate 2-volt cell to operate these valves rather than to utilise the cells of a 6-volt unit connected in parallel. The reason is that when cells of any type are connected in parallel there is almost sure to be a certain amount of inter-action set up due chiefly to the varying potentials of the individual cells of the unit. This is more noticeable in the case of dry cells connected in parallel than with secondary batteries. If the cells of a 6-volt accumulator are used separately care must be taken that all are fully charged before an attempt is made to connect them in parallel. Otherwise, if one is fully charged and another is not, there will be a current discharge from one to the other.

With regard to dull emitters of the 2-volt class it may be said that they are equal in every respect to their bright emitter prototypes for all ordinary work. Provided that those 2-volt valves, such as the D.E.6, which are specially designed for the work, are used, they give most excellent loud speaker results.

THE USE OF INDOOR AERIALS.

FROM time to time we receive requests for advice on the best type of indoor aerial to employ from readers who, by reason of dwelling in a flat or some similar cause, find themselves unable to make use of the conventional type of outdoor aerial.

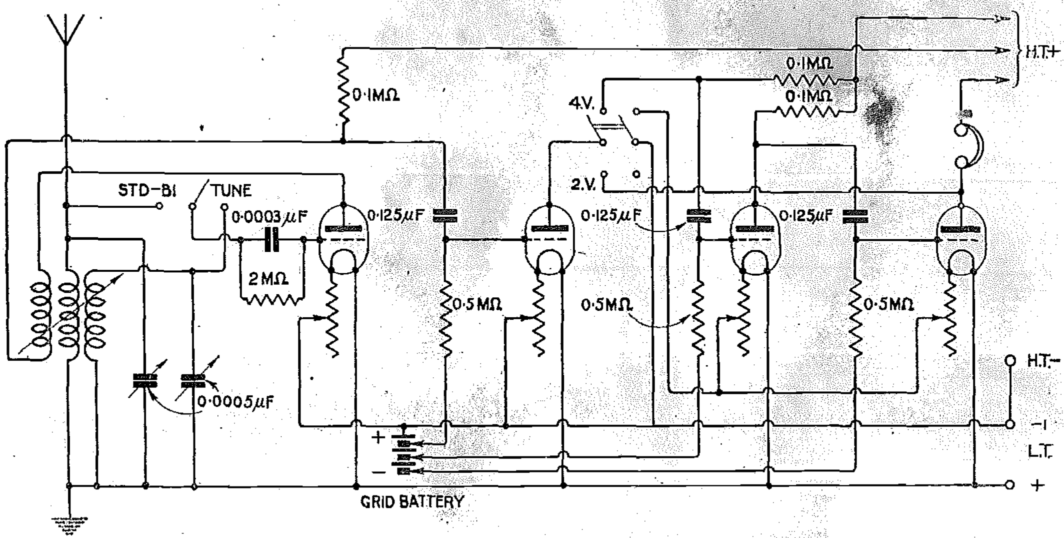
The actual design of aerial which can be used depends, of course, on the space which is available for the erection of an indoor aerial. Probably the most efficient indoor aerial which can be erected is that consisting of two widely spaced parallel wires stretched in the loft of a house and running the entire length or breadth of the building. Usually better results will be obtainable by using two widely spaced wires than if a greater number of wires with closer spacing were employed, but this is, of course, a matter for individual experiment. Very often it will be found that with an aerial of this type results obtainable fall very little short of those experienced with the conventional type of outdoor aerial. In the case of many aerials which one sees erected a few inches above a lead roof or running parallel and in close proximity to the gutter spouting, better results could probably be obtained by the use of an indoor aerial.

In many houses, of course, a loft is non-existent, and in these cases an aerial has to be erected elsewhere. If possible it should be erected in an upper room and be of as great a length as possible. Usually it will be found that a long single wire tretched the full length of a passage is more effective than several short parallel wires stretched across a single room, but here again no hard and fast rule can be drawn. Turning to the question of more or less "freak" aerials, such as the use of the electric light mains, there is much scope for experiment. The results obtained from the electric light mains vary so much in different houses that one hesitates to go to the expense of purchasing one of the special adaptors sold for this purpose when it may be quickly found quite useless. This type of aerial can, however, be easily tested out by wrapping a piece of tinfoil round one of the electric globes and attaching it to the aerial terminal of the set. It is sometimes found that the use of the electric bell wiring gives better results than are obtainable from the lighting mains. Connection may be made to either of the contacts in the ordinary electric bell push, and no fear of damage to the bell system need be anticipated. It may be found that good results are obtained from the telephone system. In order to use this method there is no need to tamper with the telephone connections in any way, or otherwise to infringe the regulations of the postal authorities. Provided that the desk type of telephone is fitted all that need be done is to place the telephone on a metal tea tray, the tray itself being connected by a wire to the aerial terminal of the set.

A Four-Valve Receiver Giving Good Selectivity and High Quality Reproduction.

We have received a letter from a correspondent living midway between three of the B.B.C. stations, asking for a wiring diagram of a selective four-valve set which will give the utmost purity and which is stable and easily controlled. He wishes to use resistance coupling for the L.F. valves if possible.

In order to meet the requirement of good selectivity, loose coupling is used, with a switch for changing over to direct coupling when required. As no high frequency amplification is employed, the set will not be unstable when using loose coupling. The first L.F. amplifier can be of the type having a high M value, such as the D.E.5 B. The final valve should not in any case be of this type, and if very strong signals are expected to be delivered to the grid of the second amplifier, this should also be of a type similar to the final valve, but in cases where weak signals are being received it may be of the D.E.5 B. type. A common H.T. tapping is given for the first and second amplifiers, but separate grid bias is provided, so that if valves of the D.E.5 B. and D.E.5 type are used in these respective positions, both anode voltages will be similar, but with, of course, separate values of grid bias. A switch is provided for cutting out the last two valves when headphone reception is desired. It is not recommended that the usual grid leak type of resistance be used in the anode circuits. Wire wound resistances, similar to those described on page 379 of the December 17th issue of this journal will be found to give very much better results.



A four-valve receiver having a valve detector and three stages of resistance-coupled low-frequency amplification.

The Wireless World and Radio Review

VOLUME XVI

FEBRUARY 11th—JUNE 24th, 1925

Published from the Offices of "THE WIRELESS WORLD"
ILIFFE & SONS LTD., DORSET HOUSE, TUDOR ST., LONDON, E.C.4

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FEBRUARY 11th to JUNE 24th, 1925

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The Wireless World AND RADIO REVIEW

No. 287. VOL. XVI. No. 1.

Assistant Editor: F. H. HAYNES. Editor: HUGH S. POCOCK. Assistant Editor: W. JAMES.

Editorial Offices: 139-40, FLEET STREET, LONDON, E.C.4 - Telephone: Central 7713 (4 lines).

Advertising and Publishing Offices: DORSET HOUSE, TUDOR STREET, LONDON, E.C.4. - Telephone: City 2847 (13 lines).

Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street. *Telegrams: "Cyclist Coventry." Telephone: 10 Coventry.*

BIRMINGHAM: Guildhall Buildings, Navigation Street. *Telegrams: "Autopress, Birmingham." Telephone: 2970 and 2971 Midland.*

MANCHESTER: 199, Deansgate. *Telegrams: "Iliffe, Manchester." Telephone: 8970 and 8971 City.*

Subscription Rates: Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries abroad, £1 3s. 10d. per annum.

OUR FUTURE POLICY.

By THE EDITOR.

WITH this issue we present to our readers the first of a new series of *The Wireless World*. The appearance of this number also marks an important event in the history of the Journal. Hitherto published by The Wireless Press, Ltd., *The Wireless World* has now been acquired by Iliffe and Sons Ltd., publishers of a number of important specialised journals, including *Experimental Wireless, The Autocar, The Motor Cycle, The Amateur Photographer*, etc. This change of ownership insures that *The Wireless World* will be conducted under an editorial policy entirely independent of any commercial or other wireless interests.

In view of the fact that the size and cover design as well as the general appearance of the Journal has undergone a change with this issue, it is well to remind those who have not been familiar with *The Wireless World* in the past that this is not a new publication, adding to the already large number of wireless periodicals recently published, but, on the contrary, *The Wireless World* has behind it the proud record of fifteen volumes dating back over ten years, and entitling it to the distinction of being the world's first wireless journal.

It has been our endeavour, as far as possible, to indicate our future policy by carrying into effect with the present number changes which we consider will result in a definite increase in the popularity of the Journal, whilst the general character of *The Wireless World*, so widely known in the past, will be retained.

The Wireless World has recorded developments in the science of wireless almost since the first practical applications were made possible. Every new step and every fresh achievement has been chronicled accurately and with due regard to a proper sense of proportion. This policy of the past we believe to be even more desirable at the present time, when discrimination between important and unimportant developments is often rendered more difficult because the general public is led away by journalistic "stunts," when the importance of any device or invention may appear directly proportional to the publicity which it receives. We believe that more than ever the need exists for a wireless journal of a popular character where the utmost attention is paid not only to technical accuracy but also to the honest presentation of new phases of development in such a manner that the reader may recognise the relative importance of every new contribution to a science which has become of such universal interest.

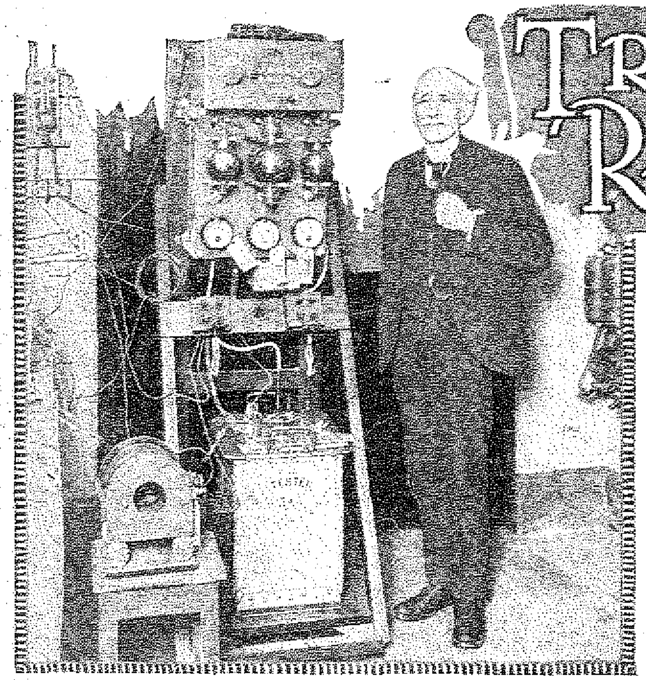
In order that all aspects of wireless may be dealt with, it is essential that expression should be given to the points of view of a number of wireless workers who can write on subjects with which they are intimately associated. In this way a wide variety of interests can be catered for, and, whilst certain articles may at first be found a little beyond readers who have only recently taken an interest in wireless, yet a little later on their appeal will be just as great as it is to those who may have had many years of wireless experience.

Designs for receivers and experimental apparatus for home construction are to be a strong feature of our issues, and here our first consideration will be to incorporate new ideas either in the circuits employed or in the general design, whilst paying the utmost attention to efficiency and accuracy in technical detail.

On the lighter side we are pleased to have the opportunity of re-introducing to our readers, by means of a series of cartoons depicting the troubles of the listener-in, a humorous artist whose work has afforded entertainment for many readers of *The Wireless World* in past volumes.

Our primary object is to make *The Wireless World* the indispensable Journal of every wireless amateur, but to ensure being able to carry out this aim we recognise that we are largely dependent upon the goodwill and co-operation of our readers.

We therefore invite our readers to write to us expressing their views on the present number, and we shall welcome any suggestions which are put forward with a view to improving upon our present standard.



Training of the Radio Engineer

A Talk on what is Expected of those who hope to Succeed in the Profession of Wireless Engineering.

By Dr. J. A. FLEMING, F.R.S.

THERE can be no question that radio-engineering has become an integral and important part of electrical engineering and of the electrical trades generally. One has only to notice on a journey by rail or tram through the suburbs of London or any large town the number of houses and gardens decorated with an aerial, and to remember that at least a million persons have Post Office licences for broadcasting reception in Great Britain, to realise that the radio business must employ an immense amount of capital and a large personality.

Wireless Offers a Big Field.

Not only is there the business of making and supply-complete receiving instruments or parts for constructing them, but there is the corresponding work in constructing the appliances for, and working the broadcasting stations. Then there is the immense field of marine inter-communication, comprising all the construction of the wireless transmitting and receiving plant for ships and the equipment of coast stations.

Lastly, there is the still greater work of the design and equipment of long-distance stations calling for knowledge and ability of a very high order. For all this work there must be the supply of properly trained men. The true wireless man, like the true poet, is unquestionably born and not made, but even without great genius, yet with well-trained natural abilities, there is room in the business of wireless for the right men.

Let no one, however, think it is an easy-going, gentlemanly occupation which calls for no strenuous work. Quite the contrary. The simplest problems are all worked out, and those that remain for solution are very difficult. No one can rise above the lower levels unless he has it in him to make some new contribution to the subject by way of invention or discovery.

That being the case, we may briefly mention the kind of training which should be undertaken.

Assuming a good school education, up, say, to the level of the London "Matric" examination, it is certainly necessary to take a course of training in a technical college or university. Radio work demands a very thorough knowledge of physics and of some parts of chemistry, and something more than an elementary knowledge of mathematics if the student is to be able to read much of the current literature and to follow discussions and papers at the Wireless Societies' meetings. Also a general knowledge of telegraphy and telephony is essential. If the student has the faculty of storing up in his memory information acquired in lectures and by reading, and of reproducing it readily in answers to examination questions, then it may be of advantage to take a degree in engineering, say, the London B.Sc., or some equivalent at another university. There are men, however, who have not the knack of grappling with exams, and yet have very useful personal qualities. In real life it is not so important to have ready-made information stored up in the memory as to know where to go to get that information at the right moment.

The Importance of Personality.

This brings me to notice the question of personal qualities in relation to engineering work. The great engineering firms and Government Departments long ago recognised that ability to answer questions in examinations is after all a poor test of the possession of those qualities which make for success in life. A young man may have taken first-class honours in some degree examination and yet be a lamentable failure when put into a workshop, electrical testing room, factory, or commercial work. Therefore, it is the custom now to subject candidates for positions in such establishments to a *viva voce* personality examination. The General Post Office include this test and award marks for it in their entrance examination for positions as Assistant Engineer in the G.P.O., and other large engineering companies do the same.

The qualities they desire to find in such candidates are

Training of the Radio Engineer.—
the possession of a certain alertness of mind, energy, perseverance, power of grappling with difficulties when left alone, general virility, and a pleasing address. A young engineer has in course of time to control labour. Organised labour at the present time requires special knowledge, courtesy, sympathy, and yet firmness in dealing with it, and a man without tact or with ill judgment may create great difficulties in supervising or directing workmen.

Keeping Fit.

Another matter of importance is bodily health and strength. It is the greatest mistake for a youth to neglect physical training, or to sacrifice health by neglect of proper exercise, by ignorance of physiological laws and principles, or excess of any kind. A very necessary acquisition is the power of clear and accurate description. Science students are apt to be very deficient in the power of expressing their thoughts well in writing. A young engineer may have to make reports on work or results of experiments, and his superiors will judge him very much by his ability to write such reports in good terse English, in well-chosen language, with all essential information set out logically and clearly arranged. This requires practice, and does not come by nature.

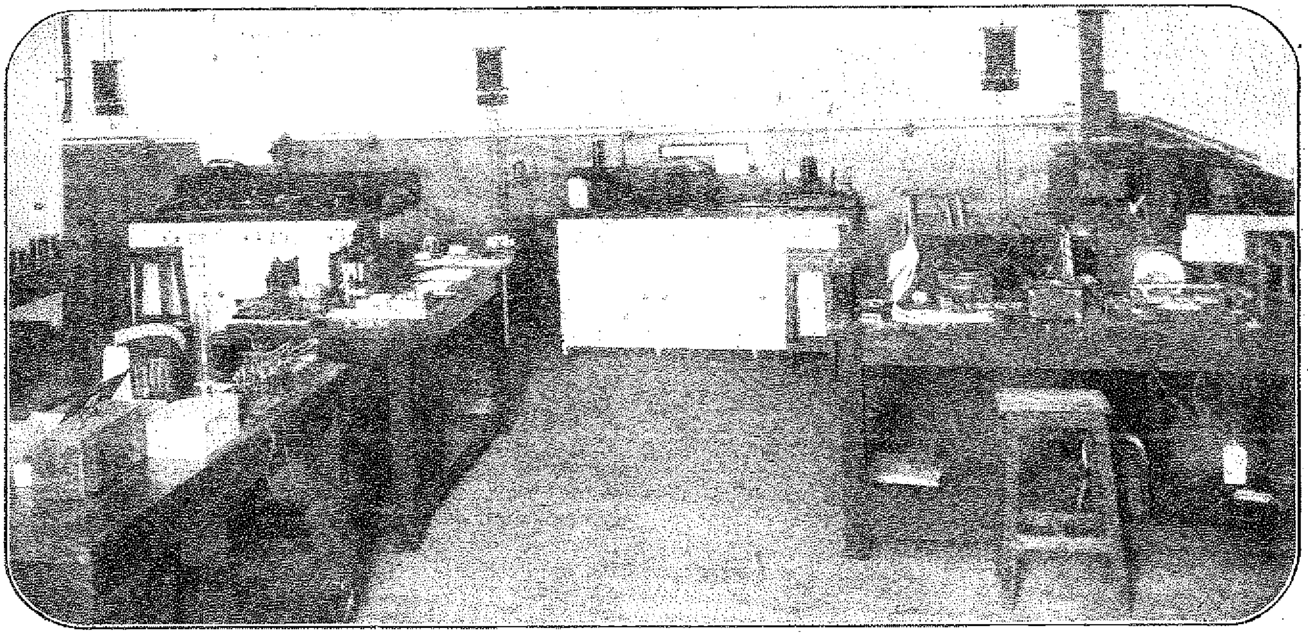
The Value of a Foreign Language.

Furthermore, as a radio engineer will be very likely to be sent to work in some distant country, a colloquial knowledge of some foreign language will often be a determining factor in selection for certain posts. A young man who has a little knowledge of Spanish would find that of assistance in securing a post in South America. The power to speak a little French or German is a great help in subsequently acquiring any other Latin or Gothic language.

A Wide Knowledge Goes a Long Way.

Then, again, there are many subsidiary accomplishments which are certainly very useful; such as a little knowledge of surveying, practical photography, and skill in drawing are all useful in making reports, also manual dexterity in the use of tools, and, without doubt, a little practical knowledge of "First Aid" work, and what to do in accidents, bodily injuries, or other risks to life.

Above all, character is of basic importance. Strict truthfulness, honesty, integrity, loyalty to the call of duty, and that valuable quality we call "playing the game," which is one of the chief advantages of a public school education, are possessions which in the long run may take a young engineer farther than power to answer examination questions or cramming up book knowledge.

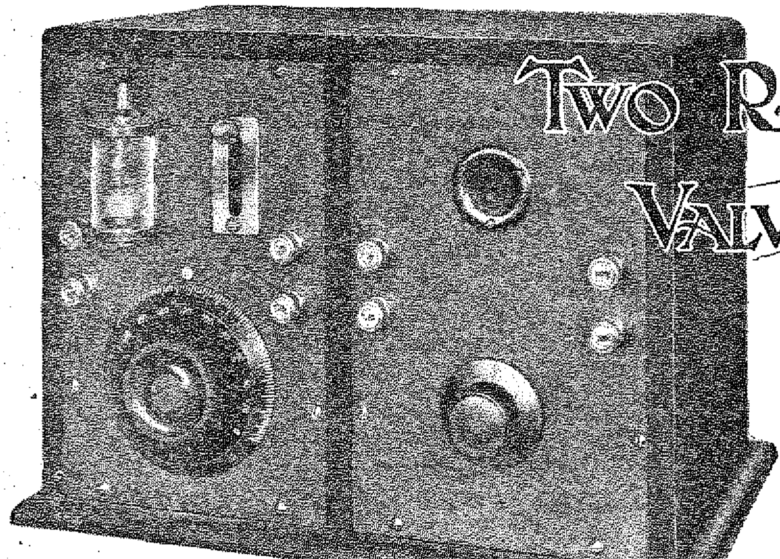


The new Radio Laboratory at University College, Gower Street, where Dr. Fleming is professor of Electrical Engineering. The Laboratory has been entirely equipped under the direction of Dr. Fleming and provides for all kinds of wireless tests and measurements to be made.

Employers want men on whom they can rely not to let them down and who will not always make their own personal advantage the moving motive of their actions.

Engineering is a profession which, therefore, makes a call for a many-sided training. Radio-engineering in particular demands a very extensive knowledge of difficult subjects.

In some things more may be learnt from men than from books. The moral is, join the Radio Society in your district, and keep yourself in touch with what is being done. Make it your aim to know something of everything in radio work, and everything of something, but try to get away from beaten paths, and bear in mind that to make your mark you have to do something which has not been done before, or to show the world how to do something better than has been previously attained.



TWO RANGE CRYSTAL and VALVE RECEIVER

A Home Receiver, tuning to 5XX and the Local Station.

By

F. H. HAYNES.

An easy to operate set, tuned by means of a single knob, and giving a choice of two programmes. Simplicity of construction combined with good appearance has been the aim of the author. This receiver is particularly suitable where battery charging is a difficulty.

Design.

IN designing a receiver intended solely for broadcast reception certain aims should be made.

(1) **Easy Manipulation.**—The inexperienced listener cannot make simultaneous adjustments on two dials, neither can he operate a set which relies for its sensitiveness upon the critical control of self-oscillation. The tuning adjustments must therefore be limited to the manipulation of a single knob for the purpose of rendering *reception at maximum strength*. In the set here described the tuning is carried out entirely by rotating one condenser dial.

(2) **Low Battery Power** and maximum signal strength for the current consumed.—By making use of a dull emitter valve as an amplifier following a crystal detector stronger signals are obtained for the battery current consumed than by any other arrangement when the receiver is connected to an average outdoor aerial and located at a distance not exceeding 25 miles from a broadcasting station of normal power, or 100 miles from the long wave high power transmitter. A valve of the .06 class is quite satisfactory for use as a low frequency amplifier following a crystal detector, and can be operated daily for many months from a small 4-volt accumulator. The high tension battery, which normally may consist of 45 or 60 volts, will, if of reliable manufacture and carefully looked after, give twelve months' service with this receiver.

(3) **Provide a Choice of Two Programmes.**—Now that the B.B.C. operates in addition to local stations a high-powered set, and intend shortly to give a service from two stations in London, the receiver is fitted with a change-over switch to bring about the necessary alteration in wavelength. On the 300 to 500 metre band of wavelengths the variable condenser is connected in series with the tuning coil, and to tune to 1,600 metres the condenser connections are changed over so that it is joined across the coil and at the same time some additional turns of wire are included.

If the design is carefully followed the reader will find when using 100ft. of single wire as an aerial if the switch is thrown for long wave reception after tuning in to a wavelength of about 370 metres that he will be approximately in tune with the 1,600 metre transmission. This does not imply that the receiver should only be connected to such an aerial, for it will be seen when making up the set that allowance has been made for working on large aerials by providing tapping points on the coils so that the desired stations are tuned in with the variable condenser in a mid-position.

(4) **Sensitive and Free from Distortion.**—The crystal as a detector is not as sensitive as an oscillating valve, but a good crystal can possess a remarkable degree of sensitiveness unaccompanied by the distortion which results when using a valve in an oscillating condition. As compared with a non-oscillating valve detector the crystal probably gives better results without, of course, the expenditure of battery current. The single stage transformer coupled note magnifier cannot produce a noticeable degree of distortion and yet renders the combined set exceedingly sensitive.

(5) **Non-Interfering.**—Valve detectors are invariably designed to oscillate, and in the process of tuning as well as when finally adjusted usually energise the aerial and create interference. Although most receiving sets on the market are built in this way, the user of the set here described may perhaps reap some satisfaction in the knowledge that his set can in no way interfere with other people's reception.

In addition to the foregoing considerations the ques-

Two Range Crystal and Valve Receiver.—
tion of expense and probable limitations in skill of the home instrument maker have not been overlooked, whilst the complete outfit should possess a workmanlike finish rivalling in appearance any set on the market.

Construction.

Components.—The accompanying table gives a list of the parts needed.

COMPONENTS REQUIRED.

1. CRYSTAL SET.

- *$\frac{1}{4}$ in. high grade ebonite, $4\frac{5}{8}$ in. × $7\frac{1}{8}$ in., or squared up $4\frac{1}{2}$ in. × 7 in.*
- *Variable condenser ("J.B." pattern) 0·0005 mfds.**
- *4-pole change-over switch (Utility), with lever and nickel plated finish.*
- *Crystal detector and reliable crystal.*
- *4 terminals. Those shown are "Calpax" and nickel plated.*
- *6 in. of ebonite or good strawboard tube $2\frac{1}{2}$ in. in outside diameter.*
- *Piece of planed mahogany, $\frac{3}{8}$ in. thickness (Hobbies, Ltd.), from which a piece $4\frac{1}{2}$ in. × 6 in. can be made with the grain parallel to the longer dimension.*
- *2 oz. of No. 16 S.W.G. tinned copper wire or two coils of "Glazite."*
- *1 length of "Sistoflex" tubing.*
- *1 doz. tags.*
- *4 oz. No. 24 double cotton covered wire.*
- *4 oz. No. 28 double silk covered wire.*
- *1 doz. No. 4 × $\frac{3}{8}$ in. brass wood screws with countersunk or raised heads.*
- *2 ft. of resin-cored solder.*

2. AMPLIFIER.

- *$\frac{1}{4}$ in. high grade ebonite panel $4\frac{5}{8}$ in. × $7\frac{1}{8}$ in., or squared up $4\frac{1}{2}$ in. × 7 in.*
- *$\frac{1}{4}$ in. ebonite panel, $1\frac{3}{8}$ in. × $4\frac{5}{8}$ in., for terminal strip, $1\frac{1}{4}$ in. × $4\frac{1}{2}$ in.*
- *Filament rheostat, 30 ohms, on china base (Grafton Electric Co.) or Ashley type.*
- *1 "Athol" valve holder.*
- *1 Reliable intervalve transformer.*
- *8 Terminals.*
- *Mahogany base $4\frac{1}{2}$ in. × $6\frac{1}{8}$ in. × $\frac{3}{8}$ in.*
- *2 doz. tags.*
- *Connecting-up wire.*
- *2 ft. of resin-cored solder.*
- *Valve window $1\frac{1}{4}$ in. over all diameter for $\frac{3}{4}$ in. hole, nickeled or dull nickeled.*
- *1 doz. No. 4 × $\frac{3}{4}$ in. brass wood screws with countersunk or raised heads.*
- *Piece of pliable indiarubber about $1\frac{1}{2}$ in. × 2 in. × $\frac{1}{4}$ in. or $\frac{3}{8}$ in.*
- *Mahogany for cabinet, or a standard cabinet can be purchased (Pickett Bros.).*

The crystal set should be constructed first, neglecting the amplifier and cabinet if the reader intends to make the latter himself. When the cabinet is to be purchased ready-made it should be procured before a start is made on the panels, so that the ebonite can be filed accurately to fit.

Marking Out the Panels.—Each panel, before truing up, should be about $\frac{1}{16}$in. oversize all round. One edge is trued up by filing, holding the panel in a carpenter's vice with the edge just projecting. If such a vice is not available, an ordinary metal parallel-jawed vice may be used with pieces of wood clamped on to both sides of the ebonite and with the grain vertical in order to eliminate vibration while filing.

Working from the trued-up edge, which should be quite straight and at right angles to the face, the exact dimensions of the panel may be marked out. A piece of paper lightly pressed over the front of the cabinet will pick up an impression which can be transferred to the panel by pricking through at the corners. Scratch lines should be ruled with a straight-edge. After carefully filing down to the scratch lines, the edges may be finished by rubbing them on a piece of medium grade carborundum cloth laid on a flat surface.

The positions of the holes must be accurately indicated by scratch lines, taking care that the screws for attaching the crystal detector and the change-over switch will fall on lines which are exactly parallel to the vertical edges. It is presumed that the reader will adopt the type of condenser and switch shown, but with the large variety of crystal detectors obtainable the positions of the fixing holes are, of course, subject to variation; yet the setting out should be symmetrical about the two cross lines indicating the centre. All points where holes are to be made should be centre punched with the panel resting on a firm flat surface.

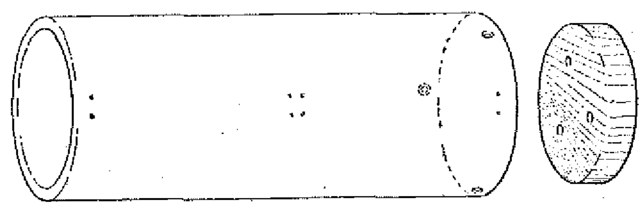
Drilling.—The Morse twist drills used must have keen cutting edges to avoid the risk of breaking away pieces of ebonite round the holes. The panel may be clamped down flat on to the table or held in the vice backed up with a piece of thick wood. Alternatively, two holes may be made, one at the top and one at the bottom of the panel, so that it can be screwed down to the bench for drilling the remainder.

If the large holes for the resistance and condenser spindles are to be enlarged to size with a rat-tail file, circles should be scribed on the panels before the centre holes are put through.

The large hole required for the valve window may be made with a carpenter's brace and bit, using a $\frac{1}{8}$in. hole as a guide for the centre and cutting from both sides of the panel. When a brace is not available for this job, a $\frac{1}{4}$in. hole is put through at the centre and six others on a 1in. circle spaced one radius apart.

The slot for the change-over switch is made by drilling a row of holes a little smaller in diameter than the width required, joining them up with the rat-tail, and finishing the sides straight with a small flat file.

Rubbing Down the Panels.—When rubbing down, the panel should be attached to the bench by means of screws or three nails after snipping off their heads. Using medium grade carborundum cloth wrapped round a block of wood, a good matt surface may be obtained by rubbing with a circular movement,



Ebonite former with wooden plugging piece.

**Erratum.*—In the circuit diagram the condenser capacity is shown as 0·0003 mfd and should be amended to 0·0005 mfd.

Two Range Crystal and Valve Receiver.—whilst a to and fro motion exactly parallel with the longer sides gives a very pleasing effect. When a suitable surface is obtained the rich black colour of the ebonite may be restored by treatment with a trace of oil.

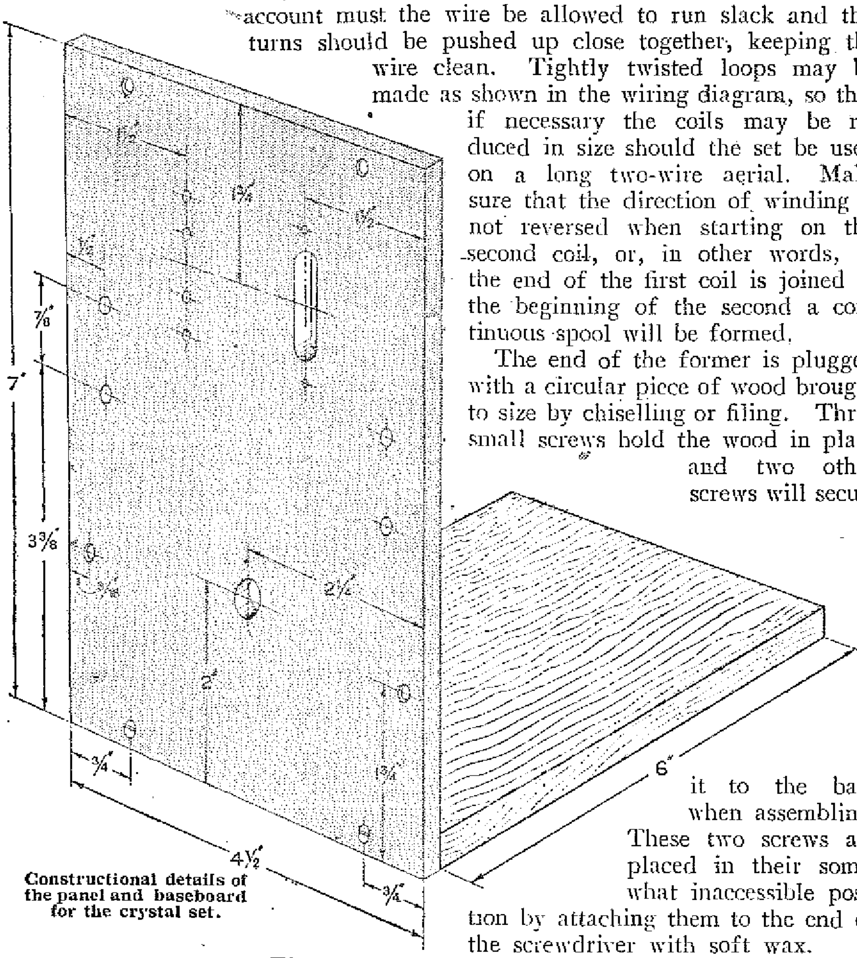
Making the Tuning Coil.—The wire may be wound upon either an ebonite or cardboard former. If cardboard is used it should be thoroughly dried in a warm oven, and while still hot liberally impregnated with shellac varnish and again baked. If this is not done the cardboard will be affected by the humidity of the atmosphere causing it to shrink and at the same time reducing the electrical efficiency of the inductance.

Care must be taken in sawing an ebonite tube to size to avoid splitting it. A line should be used as a guide, and the ends may be finally trued up by rubbing on carborundum cloth.

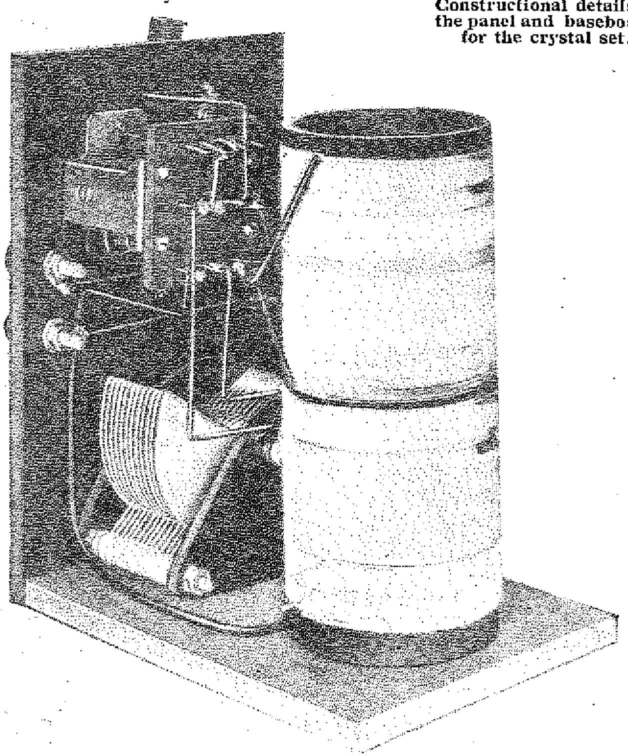
Four pairs of $\frac{1}{32}$in. holes should be drilled for terminating the ends of the windings or, alternatively, ribbon loops may be used.

Single-layer coils are usually best wound by hand. On no account must the wire be allowed to run slack and the turns should be pushed up close together, keeping the wire clean. Tightly twisted loops may be made as shown in the wiring diagram, so that if necessary the coils may be reduced in size should the set be used on a long two-wire aerial. Make sure that the direction of winding is not reversed when starting on the second coil, or, in other words, if the end of the first coil is joined to the beginning of the second a continuous spool will be formed.

The end of the former is plugged with a circular piece of wood brought to size by chiselling or filing. Three small screws hold the wood in place and two other screws will secure it to the base when assembling. These two screws are placed in their somewhat inaccessible position by attaching them to the end of the screwdriver with soft wax.



Constructional details of the panel and baseboard for the crystal set.

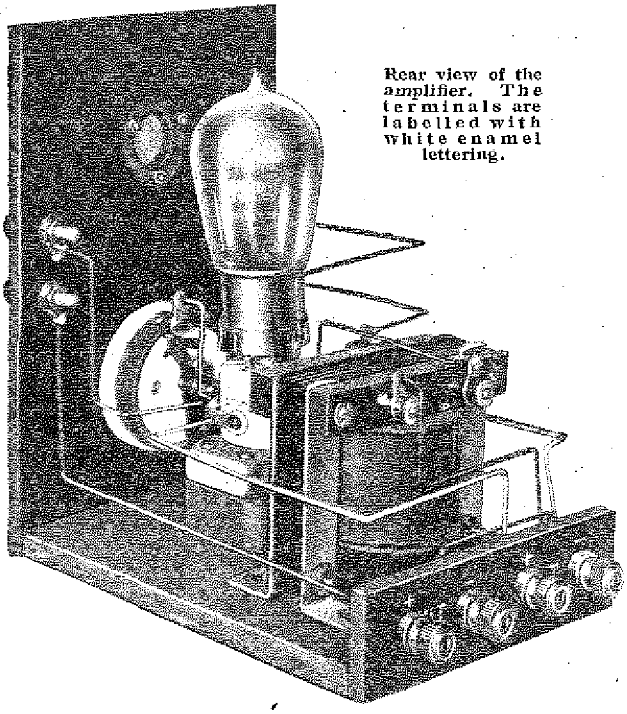

Behind the panel view of the crystal receiver. The leads from the coils are covered with insulating sleeving.

The Anti-Microphonic Valve Holder.—Dull emitter valves are well known to be microphonic, and often so much so that when making tuning adjustments and other movements near the set pronounced ringing noises are heard in the telephones. By mounting the valve holder on a piece of pliable indiarubber the microphonic properties are practically removed. Constructional details for this simple device are shown.

Baseboards and Terminal Strip.—The wooden bases used to carry part of the apparatus are best made from ⅜in. mahogany, which may be purchased already planed clean. Should the sides of the cabinet not be exactly square, as is often the case, the baseboards may be made a little narrower than the ebonite panels. The ends must be finished perfectly square, which can be accomplished by filing so that the panels make a good right-angle fit. The length of the amplifier baseboard may be finally adjusted with the terminal strip in position so that panel and terminal strip each fit flush.

Assembling and Wiring Up.—The apparatus should be attached before joining the baseboards to the panels.

No. 16 S.W.G. tinned copper or "Glazite" insulated wire in three colours is used for connecting up. It should be straightened in lengths of about 10ft. by securely attaching one end and pulling on the wire with pliers until it can be felt to appreciably stretch. The



Rear view of the amplifier. The terminals are labelled with white enamel lettering.

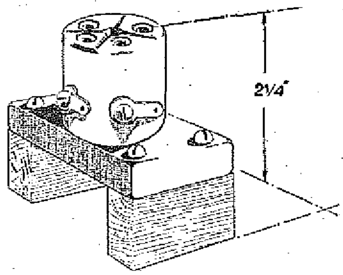
wire should be then snipped up into pieces of about 2ft. and carefully handled to avoid bending.

Tags must be fitted over all points of connection to avoid over-heating of components and to facilitate the making of good joints. Only right-angle bends are made in the wires, and jointing is best done using a small hot, but not red-hot, iron, and resin-cored solder. Alternatively, soft tinman's solder may be used with the merest trace of "Fluxite." The special "Ezi-Wiring" inset should render the work of connecting up quite simple.

Operation.

Good reception should first be obtained with the crystal set, apart from the amplifier. The signal strength obtainable will depend entirely upon the merits of the crystal employed. Many of the crystals on the market are thoroughly reliable specimens of synthetic galena. "Hertzite" is one of the original crystals of this type, and can be relied upon to give satisfactory results. A crystal detector with a micrometer adjustment simplifies the process of obtaining a suitable contact.

The local and the 1,600 metre station should be received with the condenser somewhere near a central setting. Should it be necessary to adjust to the 180° position of the condenser, one should introduce some additional turns on to the coils by rewinding with finer wire, but this will only happen when working on an exceedingly short aerial. On the other hand, should it be found that maximum signal strength is obtained when the condenser is adjusted to less than 6° from zero the end sections may be removed on one or both of the ranges. Again, this will only happen when the aerial dimensions are far in excess of the 100ft. authorised by the Postmaster-General.

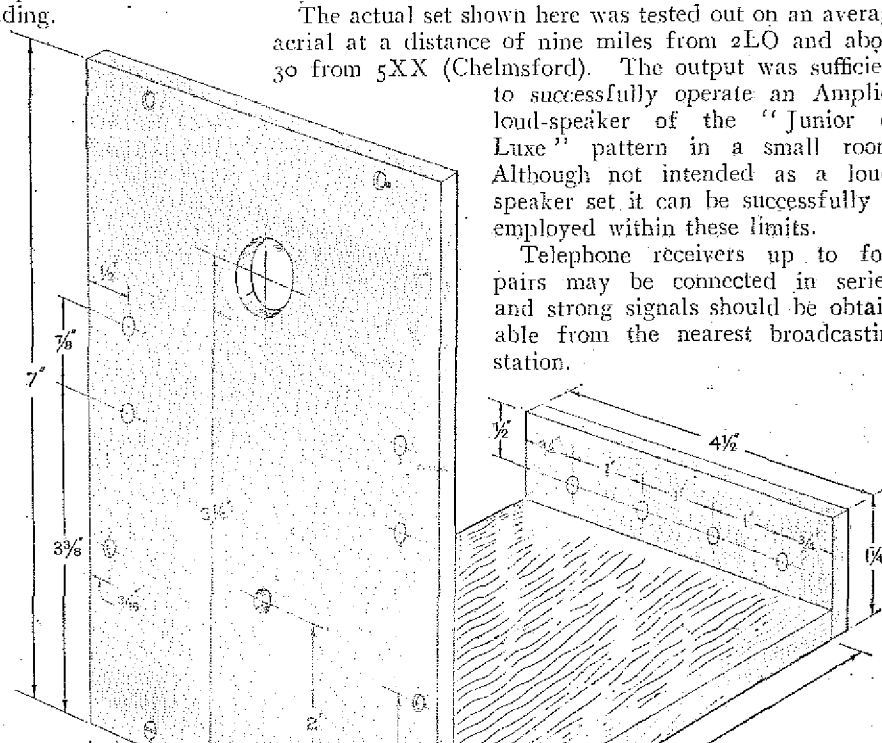


Microphonic valve noises are avoided by supporting the valve holder on an indiarubber platform.

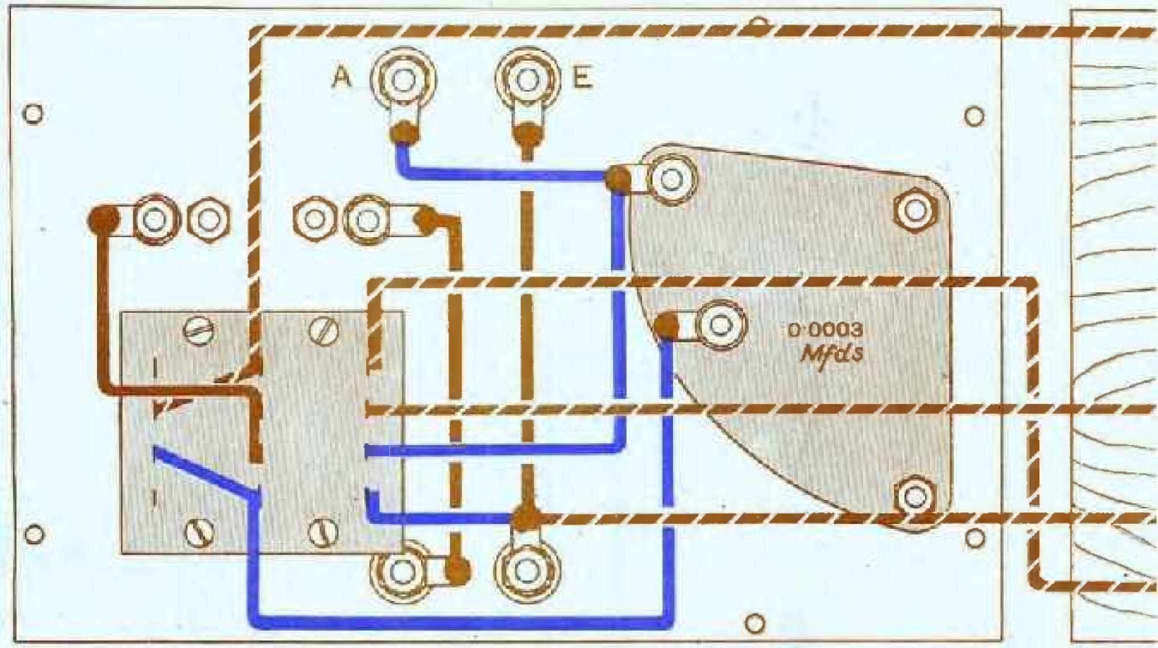
In bringing the amplifier into operation, connect the terminals through with short pieces of wire and transfer the telephones to the opposite terminals. With the valve inserted and the filament resistance in the "off" position, connect up the filament battery. Gently turn on the filament current with the resistance and examine the valve to see that the filament is glowing. When the H.T. battery is connected to its terminals strong signals should be obtained from the outfit, providing the tuner is properly adjusted.

The actual set shown here was tested out on an average aerial at a distance of nine miles from 2LO and about 30 from 5XX (Chelmsford). The output was sufficient to successfully operate an Amplion loud-speaker of the "Junior de Luxe" pattern in a small room. Although not intended as a loud-speaker set it can be successfully so employed within these limits.

Telephone receivers up to four pairs may be connected in series, and strong signals should be obtainable from the nearest broadcasting station.



Details for making up the panels and base of the amplifier. The baseboard must be adjusted to length when the cabinet is available.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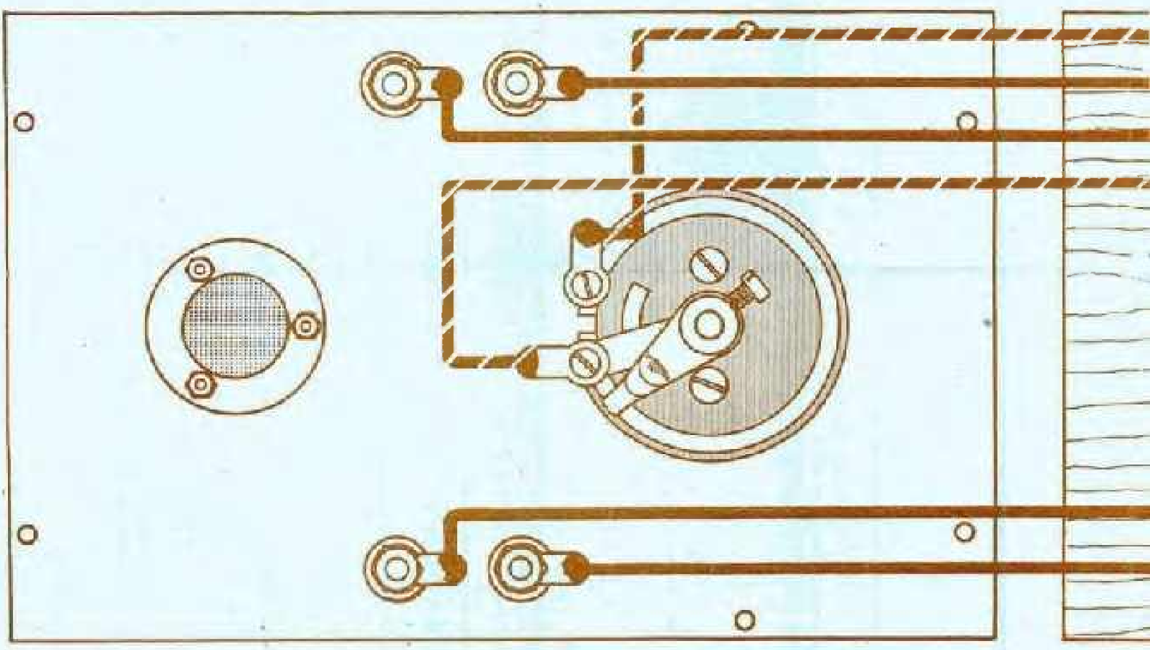

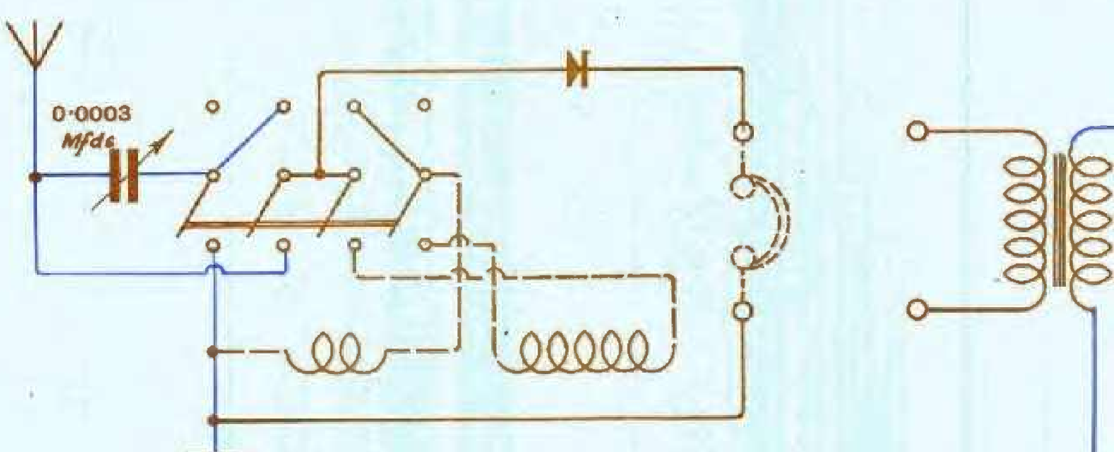
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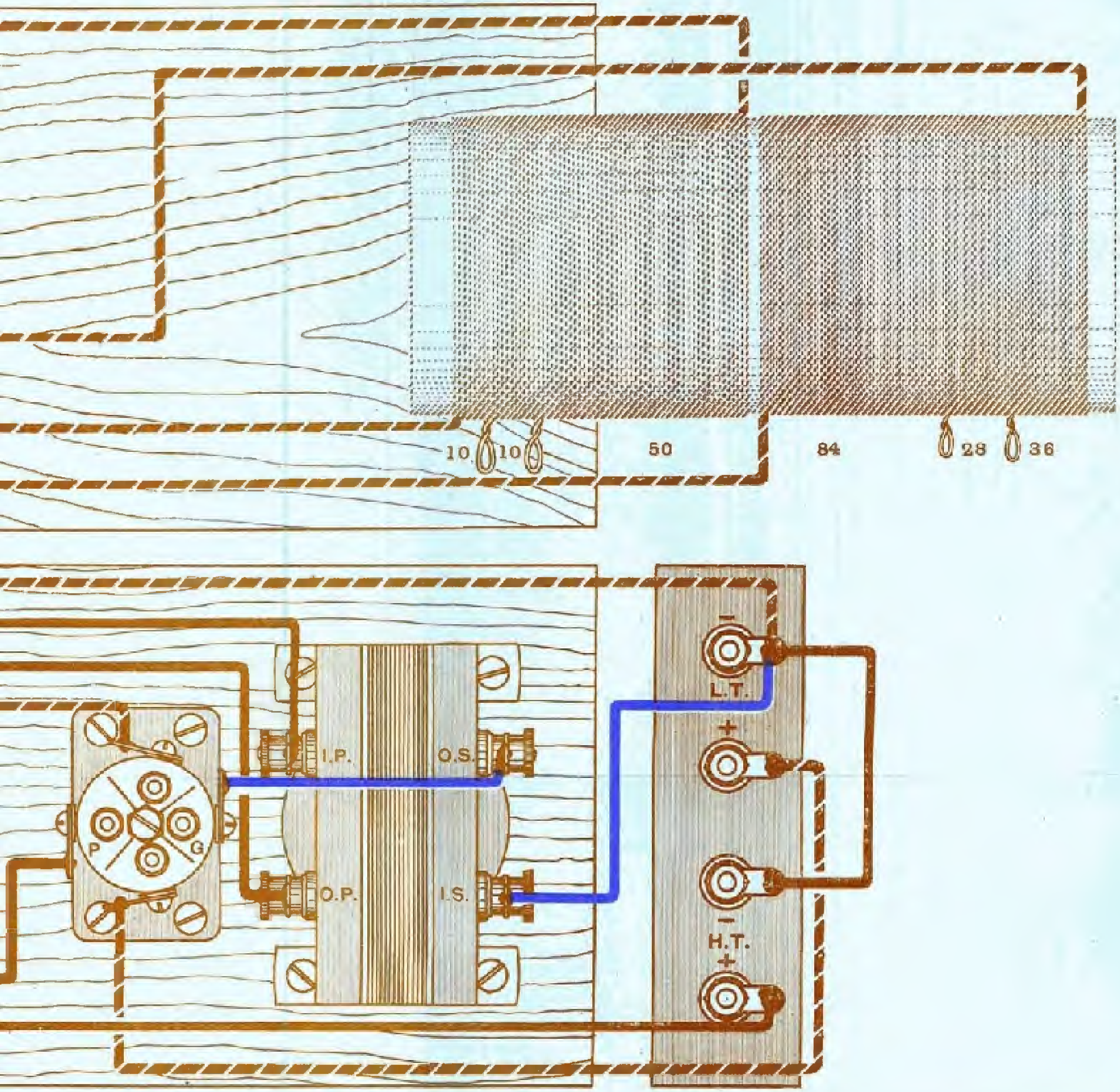
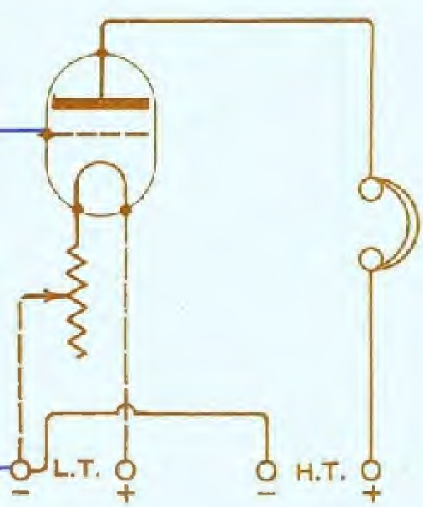




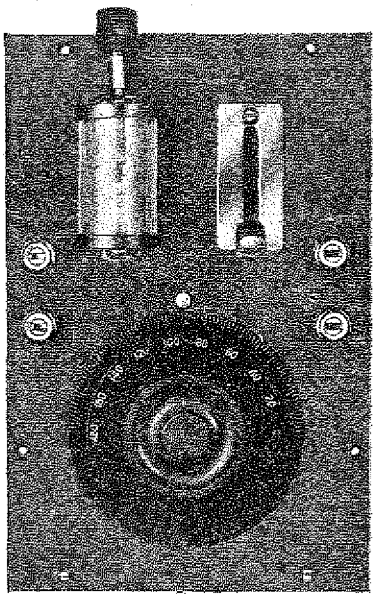
TWO RANGE CRYSTAL RECEIVER AND AMPLIFIER.

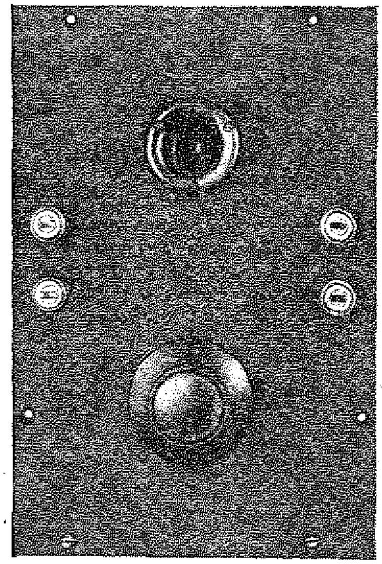
The Wireless and Radio Review World

Printed in Great Britain by THE CORNWALL PRESS Ltd., 1-6 Paris Garden, London, S.E.1.

Two Range Crystal and Valve Receiver.—

The Accessories.—A few words concerning the setting up of a good aerial will not be out of place, for where a crystal is used as a detector it is essential to pay careful attention to the construction of the aerial. It is probably unnecessary to point out that the aerial wire should be as high as possible, and particularly is it important where surrounding objects exist, such as trees or tall buildings. It should be the aim to arrange the aerial wire to be at least higher than any adjoining structures which are likely to cause screening.

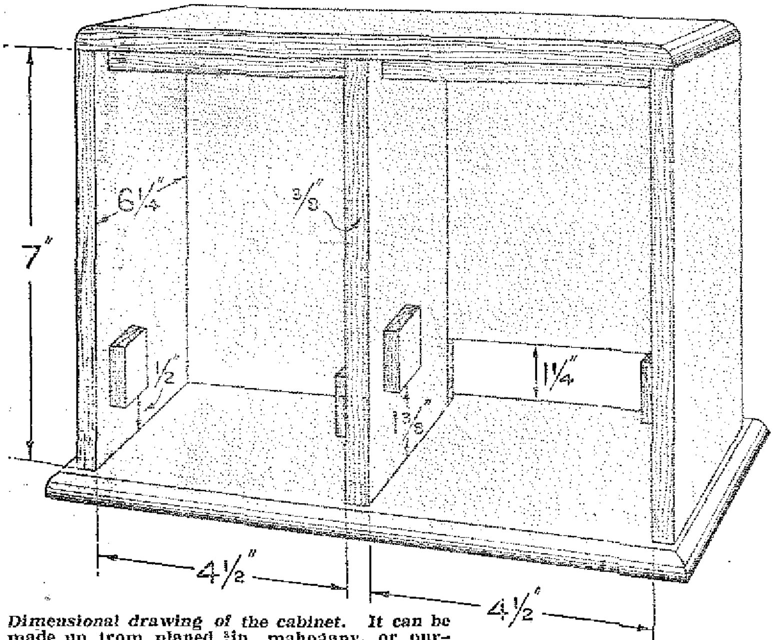




Front views of the finished set. The upper terminal on the left is connected to the aerial. Labelling is scarcely required as the identity of the terminals is obvious. The white spot indicating the setting of the condenser is a piece of knitting needle driven tight into a hole and rubbed down with the panel. A scratch line will serve equally well. The valve window may be replaced by a grating of seven holes. The amplifier terminals are linked across to the crystal set with two short pieces of straightened No.16 tinned wire.

The far end of the aerial may usually be supported by a light pole about 35ft. in height, whilst the leading-in end can as a rule be secured to a chimney stack. A short mast about 10ft. in height erected from the roof usually improves reception, though it is better not to attempt the setting up of a roof mast unless the reader has some experience in roof work. The lead-in should drop away from the aerial so as to be well clear of walls, gutters, spoutings, etc., and should take a short and direct path to the aerial terminal of the instrument. One hundred feet of single wire makes a good aerial, whilst if the supporting mast is well stayed a two-wire aerial may be constructed, using 5ft. lengths of stiff bamboo as spreaders. The aerial wire should, for preference, be enamelled and not too heavy. The earth connection should be as short as possible, and make either reliable connection to the water main or be soldered to a sheet of galvanised iron buried in moist soil.

Of the valves of the dull emitter type consuming a minimum of filament current might be mentioned the D.E.3, B.5, A.R.06, and the D.06. As these valves pass a filament current of only 60 milliamperes and operate on a filament voltage of 3 to 3.5, it will be found that quite a small accumulator will give many months' service. Special accumulators have been introduced for operating these valves, and mention might be made of the D.T.G. pattern, which is obtainable in a charged condition and rendered active merely by the addition of acid. Two of these cells will be needed to give 4 volts. It is important that the maker's instructions given on the label should be most carefully followed.



Dimensional drawing of the cabinet. It can be made up from planed 3/8in. mahogany, or purchased ready made.

A high-tension battery should be purchased, giving a maximum voltage of 45 to 60, and it is not essential in this instance to provide tappings for various voltages, when using valves of the types mentioned above. The reader is reminded that an accidental short circuit to either the filament heating or H.T. battery will in all probability ruin it, and for this reason the leads used for connecting up should be attached to the instrument terminals before the battery terminals.

There is no need to disconnect the batteries when the instrument is out of use, but one must always be quite sure that the filament resistance is turned to the off position. The aerial must never be left connected through to the set, but should be earthed by means of a suitable switch or disconnected from the aerial terminal and joined to the earth lead.

AMPLIFICATION BY MEANS OF REACTION.

An Important Article Discussing the Effects of Reaction on Weak and Strong Signals.

By CAPTAIN H. J. ROUND, M.I.E.E.
(*Chief of Research Department of the Marconi Company*).

This article discusses the most important subject of the effect of reaction. The author shows that reaction with a valve reduces the resistance of an aerial to zero with weak signals. With strong signals, however, the resistance of the aerial tends to increase, and therefore the effect of reaction as a means of increasing signal strength is reduced.

THE complexity of actions in a wireless telephone receiver, even one of the simplest type, is very great, and the following remarks may possibly initiate further research into the subject.

An aerial has certain constants: inductance (L), capacity (C), and resistance (R). At resonance, if a steady alternating E.M.F. is applied to it, R determines the value of the current in the aerial. At resonance the current is determined by $i=\frac{E}{R}$. Away from resonance the current is determined by all three constants, L, C, and R, and

$$i = \frac{E}{\sqrt{R^2 + \left(2\pi n L - \frac{1}{2\pi n C}\right)^2}},$$

n being the frequency of the current, and E the E.M.F. A wireless telephone signal consists of a carrier wave and side waves representing the modulation. In broadcast work these side waves extend from 50 cycles to 10,000 cycles on either side of the carrier wave. Consequently, if we tune to the carrier wave, its current value in the receiving aerial is merely determined by R, whereas the strength of the side bands is determined by R, L, and C.

The Effects of Reaction.

By applying reaction with a valve to a circuit containing R, we can effectively reduce the value of R to an extremely small value, but, unfortunately, owing to the fact that the valve characteristic is not straight, this reduction of R is not constant with amplitude.

The tendency to reaction or, in other words, the negative resistance applied to the circuit by the valve, may decrease with the amplitude of signal; it may increase (the Turner trigger condition), or it may be kept constant over small ranges of amplitude, but it is extremely difficult economically to keep it constant over any great range of amplitude. The more usual and stable case—when one goes into oscillation smoothly by increasing the reaction coupling [not with a click]—is when the tendency to reaction decreases with the amplitude of signal; that is, the effective R increases with amplitude, and in this case a valve that is weakly oscillating will actually stop oscillating if a signal of sufficient strength arrives.

The point involved here is rather intricate. An oscillatory circuit made of copper coils and a condenser, however low its resistance, behaves according to Ohm's law. That is, the ratio of current to voltage is the same for all amplitudes. A circuit with reaction behaves as one of lower resistance than it actually is, because energy is triggered from the battery by the incoming applied force. The triggered energy is proportional (for one factor) to the average slope of the valve characteristic through the amplitude through which it is being swept. If the amplitude increases, the average slope will alter.

This results in the actual current not being quite proportional to the applied force for all values of the latter. One effect of this is that if, during the time one signal is being received another enters, the first signal immediately alters in strength—or if a valve is oscillating and a signal arrives, the strength of the oscillations alter.

However, the larger the valve, or the more valves in parallel, or the more the plate voltage applied to the valve, providing care is taken to choose the best point on the characteristics, the better is this constancy of R over large ranges of amplitude.

A standard broadcasting receiving aerial tuned to 300 metres (frequency 10^6) has the following constants approximately:

L = 125 mics. C = 0.0002 μF. R = 20 ohms.

(Of course, this is only a crude guess at the average.)

If a voltage of 100 volts is applied over a range of frequencies from $10^6+10,000$ to $10^6-10,000$, the currents produced would be those in column 1 (*Currents produced when Resistance is 20 ohms*) of the table.

Frequency.	Current when Resistance is 20 Ohms.	Current when Resistance is 5 Ohms.	Current when Resistance is 1 Ohm.	Current when Resistance is Zero.
$10^6+10,000$	4.0	6.3	6.6	6.6
$10^6+5,000$	4.7	11.0	13.0	13.0
$10^6+2,000$	4.9	17.0	31.0	33.0
$10^6+1,000$	5.0	19.2	55.0	66.0
10^6+500	5.0	19.8	80.0	130.0
10^6+100	5.0	20.0	99.0	660.0
10^6 —	5.0	20.0	100.0	—
10^6-100	5.0	20.0	99.0	660.0
10^6-500	5.0	19.8	80.0	130.0
$10^6-1,000$	5.0	19.2	55.0	66.0
$10^6-2,000$	4.9	17.0	31.0	33.0
$10^6-5,000$	4.7	11.0	13.0	13.0
$10^6-10,000$	4.0	6.3	6.6	6.6

Amplification by Reaction.—

If, however, by means of reaction we reduce the 20 ohms successively to 5 ohms, 1 ohm, and then to zero, the further results shown in the table will be obtained.

I have plotted all these results in the curves of Fig. 1. These curves will repay some consideration. The carrier wave steadily increases with the reduction in R; this is of enormous value in increasing the sensitiveness of our detector, because of its square law of rectification.

The strength of signal from any side wave will increase steadily up to the point where the bend of the rectifier is effectively swept through by the carrier wave, due to the increase of the carrier wave alone. Of course, the bend of the rectifier is never very clearly defined. If our transmitting station be ever so weak, as long as it is constant in wavelength we can bring this carrier wave up, by micrometer adjustments of the reaction, to a value which will render the sensitiveness of the detector system to the side waves (and to the mush) linear.

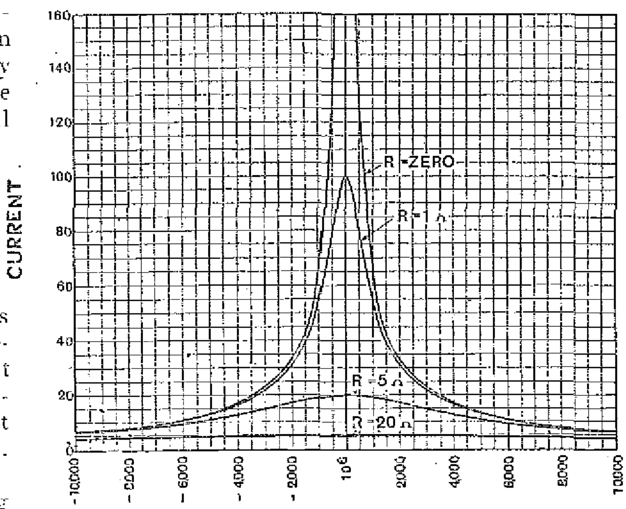


Fig. 1.—The value of the current flowing in the circuit over a range of frequencies when the circuit has resistances of 20, 5, 1, and zero ohms.

Note Magnification.

The meaning of this is that any magnification now required should be given at that frequency where magnification can be obtained most economically, i.e., by a L.F. magnifier.

But what of the resulting sound produced from a telephone station?

All the side waves should be equally represented, but from any of the curves it can be seen that the low note frequencies have larger amplitudes than the higher note frequencies. In the limiting case the amplitudes obtained are $\frac{1}{n}$ times the correct amplitude, where n is the difference of frequency from the carrier. The result would be to make speech and music very soft and low toned.

Mr. T. L. Eckersley and Mr. P. W. Willans some time ago suggested passing the rectified currents through a resistance and small choke coil and afterwards magnifying the voltage across the choke coil. It will be seen that the voltage across the choke is proportional to n times the voltage across the resistance and choke up to a value of n, where $2\pi n L$ is still small compared with the resistance. The result would be a complete correction of the $\frac{1}{n}$ error, but with as complete an elimination of the square law of the detector as is desired.

Note magnifier transformers designed with insufficient turns have a strong tendency to reduce the lower frequencies somewhat according to this law, and are thus suitable for use on sets in which one desires to work very close to reaction, but they should be used only with the rectifier, and not in the later note magnifying stages.

What, however, of the normal case when reaction is applied only to that point which does not muffle signals —no correction devices being applied?

Gain is immediately obtained over the no-reaction case, because of the increase of the carrier wave, and this is probably the more important gain. Then, depending entirely on our telephones and amplifier circuit (obviously high-toned circuits and telephones are more favourable for this purpose), the magnification can be carried to the point where muffling occurs.

Curve 5 ohms of Fig. 1 is one in which there is not too much tilting of the curve for the ordinary receiver.

It would depend enormously on our initial strength *what total magnification this represented, but it could* be estimated in any particular case if the voltage of the signal was known and if the curve of the rectifier was also known.

As a rough guide, we can say that equal signals will be given at a range of $\sqrt{4} \times \sqrt{4}$ times the distance at which no reaction is used if we could assure no attenuation of the signals, but very obviously a good amateur sweating up everything to the limit without much regard to quality could beat this easily.

The Effect of the Size of the Aerial.

An interesting point arises here. Suppose our reaction is applied to the aerial. If we increase the capacity of the aerial to double, our resistances are not increased (this one can prove experimentally), but our L value at some particular frequency is $\frac{1}{2}$ what it was before; that is, $2\pi n L$ is $\frac{1}{2}$ of the previous value, and consequently in the limiting case where $R = O$, all side wave amplitudes are double the value in the previous limiting case.

Certainly, if we are using the voltage across our inductance, this has gone down, but a ratio of transformation will get this up to the correct value again.

Consequently, if we cover as large an area as possible with aerial wires arranged to keep R low by paralleling, and put a suitable ratio transformer to the rectifier, providing we can bring our valve up to the reaction point, we can increase our range.

Owing to the curvature of the valve characteristic, one cannot guarantee the law of increase of signals at the same receiving place. That will depend on the valve used, and definitely as the aerial capacity increases the reaction will have to be increased to get near the sensitive point till we may arrive at a capacity where the damping of the aerial is too great for R to be reduced to zero by the valve. This increase of aerial capacity is not of real practical interest, as a very little more note magnification will replace any possible increase which could be brought about by the aerial.

Amplification by Reaction.—

An interesting case is that of the tuned anode circuit with two valves.

Is it better to react on to the aerial with the first valve, or to react on the tuned anode with the second valve?

In ultimate sensitiveness with dead weak signals, I think there is little in it. The constants of an aerial are about the same as those of the tuned anode circuit (the aerial resistance having its equivalent in the damping of the plate circuit of the first valve). In either case the amount of possible magnification without serious distortion is obviously the same. In general in this case it seems as though that circuit with the greater damping should be reacted upon.

If signals are fairly strong, as the first valve magnifies the signals, it would seem somewhat better to react on the aerial with the first valve, as signals are weakest here, and reaction likes weak signals. But if by chance the circuit is a reflex one, then the first valve is not a good one to use for reaction purposes, because the large modulation of the first valve characteristic by the note signal varies its reaction capabilities.

Reception with a Frame Aerial.

It is quite easy to see that a frame aerial, although it will get less induced voltage than the aerial, will give results not unfavourable compared with the aerial.

Its R is less if made with the same L and C value as the aerial. Less reaction will be required than when an aerial is used to bring it to the zero R position. Weak signals will now be in direct proportion to the applied E.M.F., but because the valve is less used owing to the smaller R, the tendency will be for the low value of resistance due to reaction to be maintained up to a bigger amplitude, thus lessening the apparent final result in comparison with an aerial.

The Effect of the Rectifier.

Further complications are added by the rectifier.

A crystal applies varying damping to the aerial, depending upon the strength of signal.

A valve with a grid leak and condenser as rectifier not only applies varying damping to the circuit, but the very way it gives a note signal tends to vary the reaction effects if it is used as the reaction valve.

Everything points to keeping weak signals in the rectifier circuit only and in using plenty of note magnification, but strong jamming, of course, will utterly ruin all the wonderful magnification, and can only be guarded against by frame reception or loose coupling to the aerial.

Constancy of the Carrier Wave.

And what about the constancy of the carrier wave of stations?

This is the worst feature of all, for unless the carrier is very constant we are almost helpless.

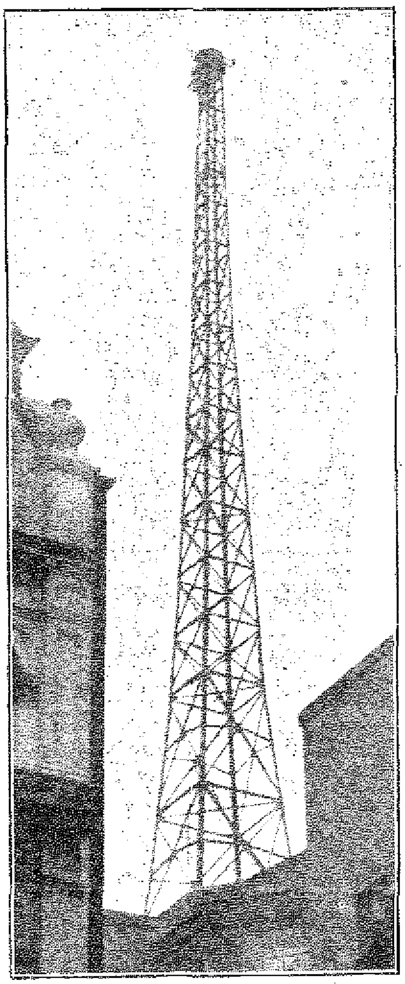
I can guarantee that most of our English stations are as steady as it is at present economical to make them, but are they constant during modulation? In other words, does the act of modulation affect the carrier wave?

I have evidence that, even on the best of regulated sets, there is some trace of wobbling of the carrier with the modulating frequency, but it is intensely difficult to prove this point.

Undoubtedly the above supplies an explanation of the wonderful sensitiveness of the so-called "zero beat" condition, but in that condition at its best the set is not controlling its own oscillation, because the carrier wave just prevents it doing so; but if you go slightly out of tune with the carrier, your receiver will now oscillate on its own.

Depending on the strength of the carrier wave and the strength of the reaction is the range of adjustment over which the set will be controlled by the carrier wave. This for maximum results should be reduced by adjustment to the narrowest practical range.

Searching should, of course, never be done in the critical state except on a small frame.



THE NEW 2LO.

In a few days testing should begin at the new London broadcasting station which, as most of our readers are aware, will occupy a position on the roof of Messrs. Selfridge's in Oxford Street, London, W.

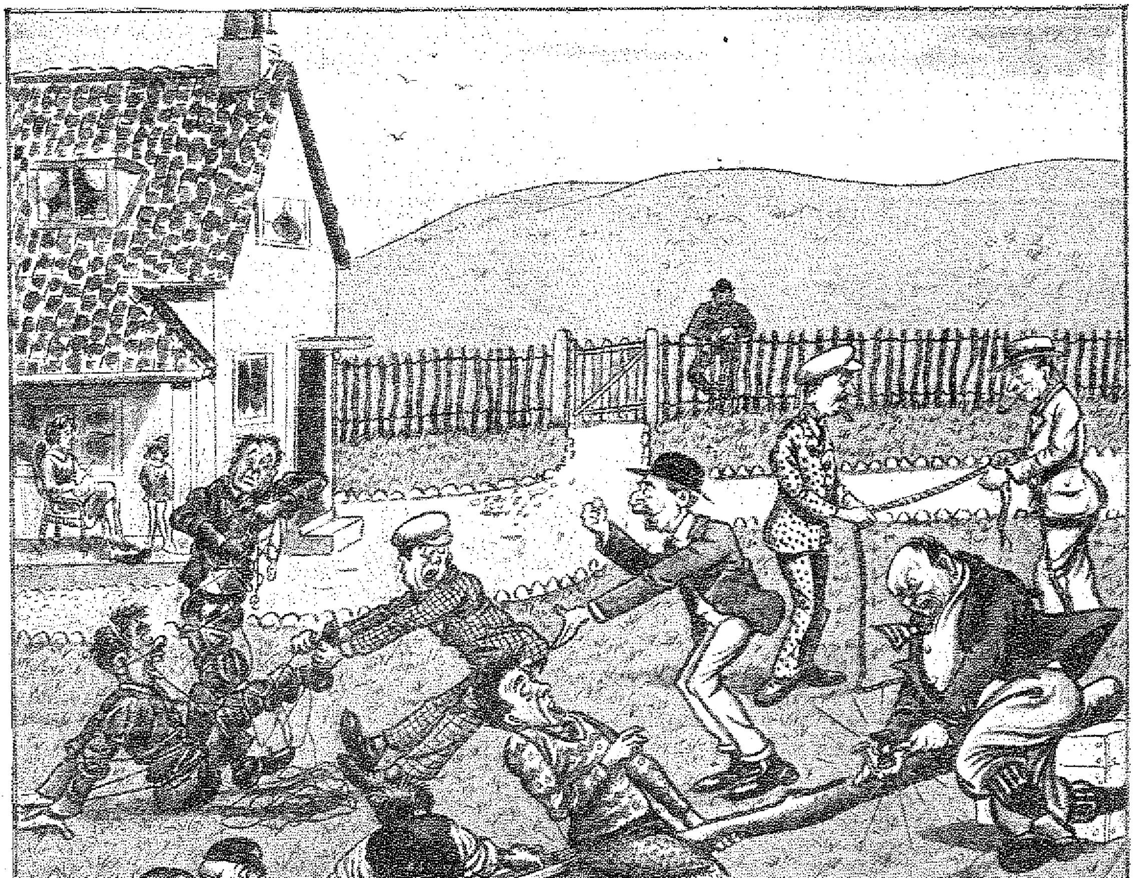
The aerial, of the inverted "L" type, is being supported by two 125ft. lattice towers, one of which is seen in the photograph. As the building itself is some 100ft. high, the tops of the masts will be 225ft. above road level.

To most readers, probably, the interesting point in regard to the new station will be its power of three kilowatts, which is twice that at present employed at London and the other main stations.

It is anticipated that the range of the station will be very greatly increased, but at the same time it is likely that the presence of such a powerful transmitter in the centre of London may make reception of other stations even more difficult than it is at present during the transmission times of the old 2LO.

It is understood that the earth will be obtained by connection to the steel framework of the building, and this added to the great height of the aerial should make the station very efficient.

THE TROUBLES OF THE "LISTENER-IN."

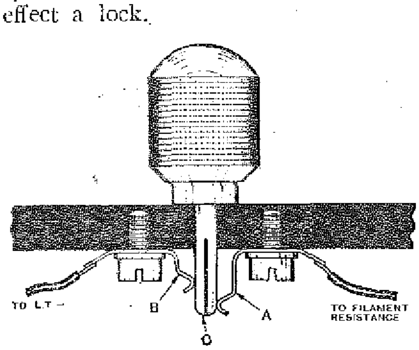


No. 1.—Rigging the Mast.

A Section Devoted to New Ideas and Practical Devices.

A FILAMENT LOCK.

To prevent the receiving set from being tampered with by unauthorised persons, a simple switch can be fitted capable of being operated only by a special plunger, which is therefore in effect a lock.



Using a plug to break the filament circuit. To be effective as a "lock" the contacts must be beneath the panel.

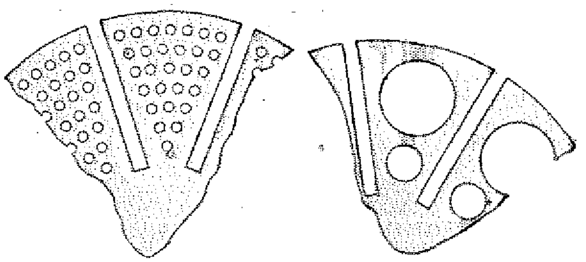
A simple form of construction is shown with the contacts A and B made of hard brass spring and connected in the lead between the valve filaments and a battery terminal, whilst the plunger C is made up from a split peg such as is used for plug and socket contacts.—J. V. P.

o o o o

IMPROVING BASKET COILS.

The basket coil is extensively used owing to its easy construction and good efficiency. The type wound on a slotted former is usually preferred to the form of construction which makes use of a centre boss and a number of spokes for temporarily supporting the turns while winding.

It is probable, however, that the use of insulating material between the turns of the wire, such as a piece of cardboard does to some extent lead to a loss of efficiency. An obvious remedy is to punch a number of holes in the card, reducing it so that it is just capable of providing the necessary support. Two such methods of punching the cards are shown. The punch can be constructed from a piece of brass tube sharpened at the end like a cork borer.—L. L.



Method of reducing dielectric loss in card wound inductance coils.

Valves for Readers.

For every practical idea submitted by a Reader and accepted for publication on this page the Editor will forward by post a receiving valve of British make.

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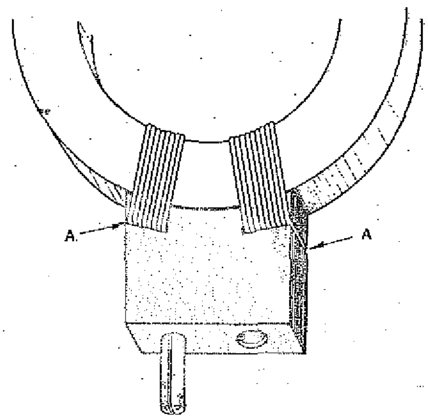
MOUNTING HONEYCOMB COILS.

Various methods are used by manufacturers of plug-in coils for securely attaching the winding to the ebonite piece carrying the plug and socket, and the amateur who makes his own plug-in coils often finds difficulty in reproducing the form of fixing adopted in the commercial types. The accompanying illustration shows a very simple way of securing the ebonite piece to the coil, and gives quite a strong attachment. The coil is bound on by means of thread passing through



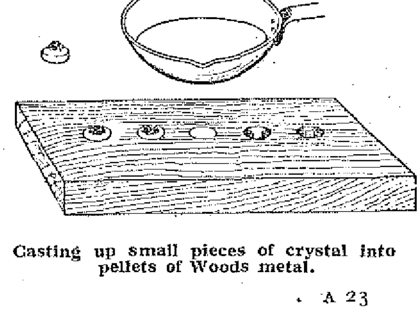
A good way of securing a home-made tuning coil to a plug and socket mount.

the two sawcuts A, which for small coils need not be deeper than $\frac{1}{8}$in.—W. J. S.

o o o o

MAKING USE OF SCRAP PIECES OF CRYSTAL.

When breaking up a large piece of crystal to produce specimens of convenient size for use in the detector, pieces of crystal break away which are unfortunately too small to be held by the screw. These small pieces can be rendered of service by mounting them in small beads of Woods metal. A number of holes about $\frac{1}{4}$in. deep by $\frac{1}{2}$in. in diameter are drilled



Casting up small pieces of crystal into pellets of Woods metal.

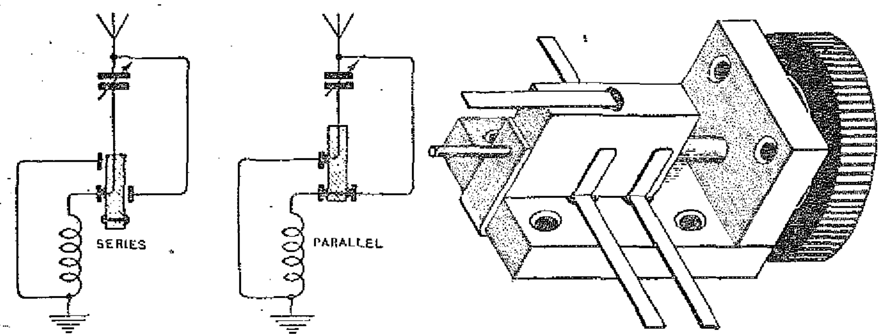
Novelties from our Readers.—

in a hard wood board. The Woods metal is melted in a ladle, and a small quantity poured into each hole. Before the metal sets, pieces of crystal are placed in position, using a small pair of forceps. The crystals thus mounted can usually be lifted from the holes in the wood, but if this is found to be difficult a chisel can be used to link up the holes, leaving the mounted crystals free.—P. A. N.

o o o o

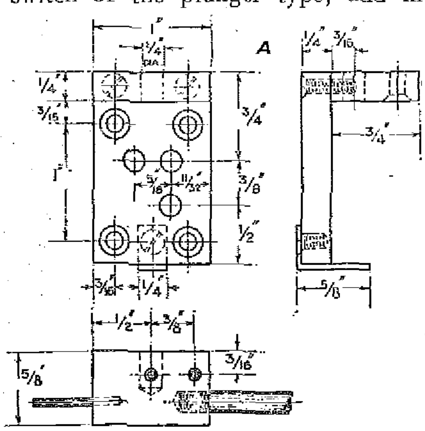
PLUNGER SWITCH FOR SERIES-PARALLEL CIRCUITS.

Many circuit diagrams indicate the use of a series-parallel switch for connecting the aerial tuning condenser either in series with the tuning inductance or in parallel across it. To produce the necessary change in the connections a double pole two-position switch may be used, but if it is desired to take up as little panel space as possible, it then becomes necessary to construct a switch with contacts behind the panel.



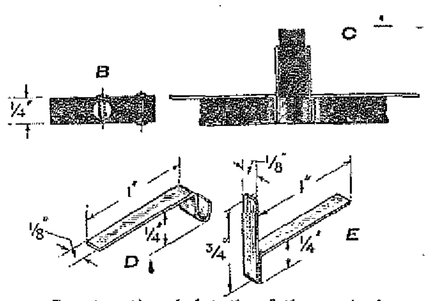
A plunger type series-parallel switch and the manner of connecting it in the tuning circuit.

Details are given for building a switch of the plunger type, and in which the difficulty of switch contacts making uncertain connection has been overcome.



Details for making the plunger type series-parallel switch.

The details of drawing A give all the necessary dimensions for constructing the ebonite pieces and the end bracket, whilst B is a section through the sliding block. The various contact pieces are shaped as shown in D and E, whilst the two circuit diagrams show the method of connecting up the finished switch.—R. B. E.



Constructional details of the contacts.

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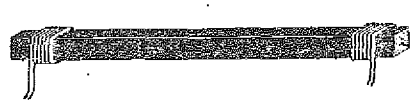
GRID LEAKS AT LITTLE COST.

Reliable leaks may be very easily constructed by dipping matches, after having removed their heads, in Indian ink. Long immersion in thick ink will produce a resistance of comparatively low value, while by using thin ink and dipping only one side of the wood, higher resistances may be obtained.

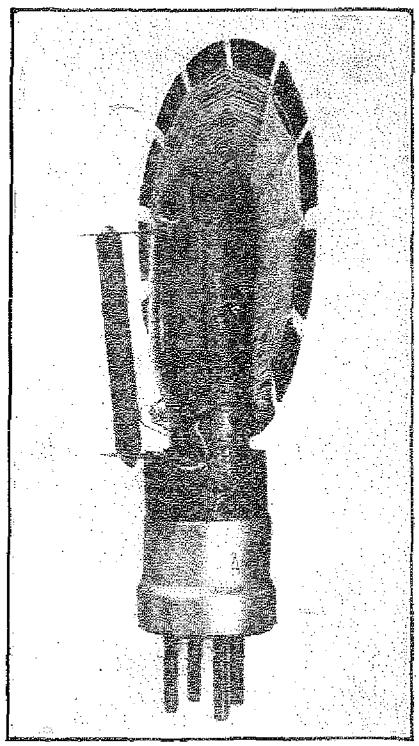

The stem of a match when impregnated with Indian ink makes a good grid leak.

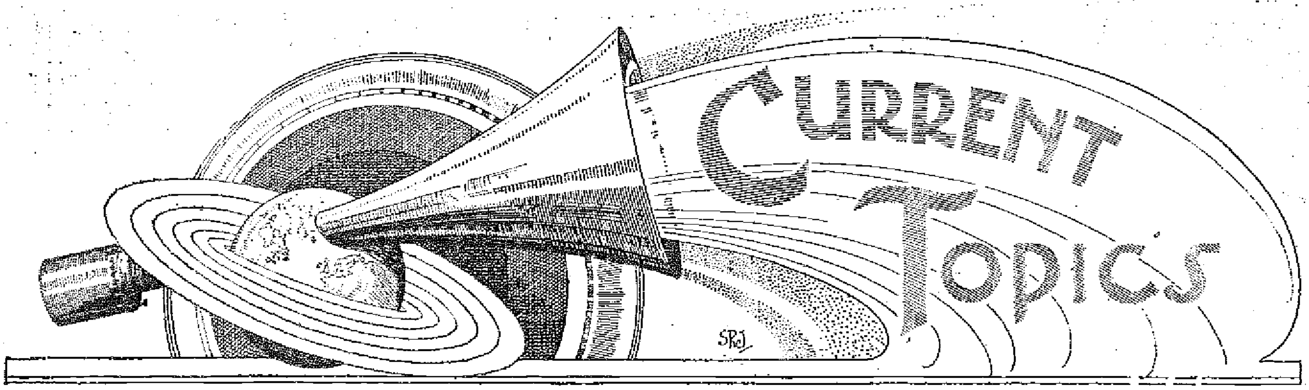
Contact is made by tightly binding the ends with copper wire and soldering.—E J. L.

CONVERTING H.F. TRANSFORMER COUPLING TO TUNED ANODE.

The accompanying illustration shows a useful component which can easily be made up from the base of an old valve. After breaking away the glass a piece of hard wood is tightly fitted into the valve cap, and the upper part cut away in the manner shown. A card inductance, which, for broadcasting wavelengths, may be wound with 75 turns of No. 38 D.C.C. wire, is secured to one side, the connecting wires being brought down to the base and soldered to two of the pins. Space is available on the other side of the support for attaching the grid condenser and leak.

In order that this unit may replace the usual type plug-in transformer, it is necessary to connect the winding of the coil across the pins which formerly were connected to the valve filament. The grid condenser is connected between one end of the coil and the grid pin, whilst the 2-megohm grid leak is joined between the grid and plate pins.—J. E. M.


The base of an old valve can be usefully employed to support the components forming a tuned anode unit.



Events of the Week in Brief Review.

Licence Troubles in Belgium.

Belgian amateur transmitters are protesting against a Government proposal to tax low power transmitters at a minimum annual rate of 300 francs. They draw attention to the fact that their French comrades have only to pay 100 francs for the same period.

Mill Hill Signals Reach India.

A report has been received at the Mill Hill School Amateur Station (2SZ) from Mr. G. W. G. Benzie (2BG), of Udorband Cachar, India, to the effect that he has picked up signals from 2SZ calling U9XBG, at steady and easily readable strength, on a three-valve (2-v-o) receiver.

Freedom for French Amateurs.

Wireless clubs in the South-West of France are forming a federation for the protection of their interests. A conference is to be held to secure a continuance of the amateur freedom conferred in the decree of November 23, 1923, and a firm stand will be made against proposals of a Government monopoly.

Up-to-date Dublin.

The Dublin Municipal School has opened a department for the training of wireless operators. The school equipment includes a $1\frac{1}{2}$ k.w. transmitting and receiving installation.

Japanese Ship Wireless Compulsory.

Probably owing to the recent loss of the "Massuyama Maru," which foundered with fifty passengers on board, the Japanese Government has decided to introduce a Bill making wireless a compulsory adjunct of every vessel above a certain size.

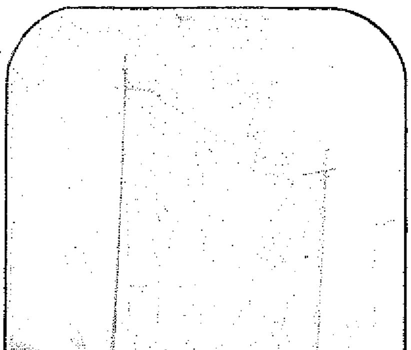
Second Radio World's Fair.

Arrangements are already in hand in connection with the Second Radio World's Fair, to take place in New York city next autumn. That it will outshine last year's event, held in the Madison Square Garden, is confidently predicted. Three hundred and twenty-five prominent manufacturers will exhibit, including representatives of fourteen different foreign countries.

A sensation of the exhibition will be a wireless refrigerator which any housewife can manipulate. The organisers announce that there will be "a dozen other startling discoveries."

Australian Professionals Unite.

Australia has formed an "Institution of Radio Engineers" to protect and advance the interests of the profession in the smallest continent. The institution will also endeavour to further wireless research.



SAFETY AT SEA. One of the wireless-equipped lifeboats of the R.M.S. "Orbita," undergoing her tests at Liverpool. Note the D.F. frame in the bow.

Geneva as a Wireless Centre.

In consequence of the success of the International Wireless Exposition at Geneva last autumn a similar event will be held in the same city from September 23rd to October 4th of this year. As before, the Exposition will be staged in the Electoral Palace, and will include, in addition to wireless, special exhibits marking the advances in science and art during the past year.

Several conferences and receptions will be held, which will be attended by delegations from radio societies from all parts of the world.

Two-way Communication with Argentine.

For the first time amateur two-way working between Great Britain and the Argentine was accomplished by Mr. E. J. Simmonds (2OD), of Gerrard's Cross, Bucks, and Mr. Carlos Braggio, senr. (Argentine CB8) on February 1st.

Of late Mr. Braggio has been persistently attempting such a feat, and his signals have been heard in this country by Mr. C. W. Goyder (2SZ), of Mill Hill, Mr. J. Ridley, of Blackheath, Mr. J. Gordon Ritchie, of Glasgow, and others. On February 1st, at 7.25 a.m., Mr. Simmonds picked up strong signals from CB8 on a wavelength of 68 metres, and in spite of heavy atmospherics 2OD's signals were reported as very strong.

In the course of communication the following interesting messages were passed by CB8:—

1. To the Radio Society of Great Britain. On occasion of first two-way, the Radio Club of Argentine sends greetings to their British Brothers. (Signed) C. Braggio, CB8.

2. To *The Times*, London: With the first communication between British and Argentine amateurs *La Nacion* sends greetings to *The Times*. (Signed) Braggio, CB8.

CB8 added that he also heard G 2OD, G 2SZ, and G 5LF on Sunday, January 25th.

Wireless for Ships' Lifeboats.

Two of the motor-driven lifeboats of the R.M.S. "Orbita" have been equipped with the latest type of Marconi apparatus for ships' boats. The installation comprises a transmitter and a receiver embodying a direction finder. The normal transmitting range is at least sixty nautical miles when the receiver is using a crystal detector, and much greater, of course, in the case of a valve set.

The directional frame can be seen in the photograph on this page.

Unwelcome Regulations in Switzerland.

Wireless clubs in Switzerland are viewing with some concern the Government stipulation that no amateur transmitting station may exceed a power of 50 watts. It is felt that such a restriction will seriously hamper international amateur work, and it is understood that representations will be made to the authorities with a view to securing more favourable treatment

The various sections of the Swiss Radio Club are busily encouraging the erection of amateur stations and the fostering of a wider public interest in radio.

A Listeners' Association.

An association has been formed in Belgium bearing the title "The Friends of Wireless," states a Continental correspondent. This association announces as its objects the building and subsidising of broadcasting stations in Belgium, and the guarding of private interests against any State control of broadcasting. The "Friends" will also seek to obtain the best facilities for sending and receiving, and will demand from the Government a remission of the present tax on aerials. In a word, the new organisation will do all in its power to further the advancement and popularisation of broadcasting in the interests of the Belgian people.

Wireless Journal in Esperanto.

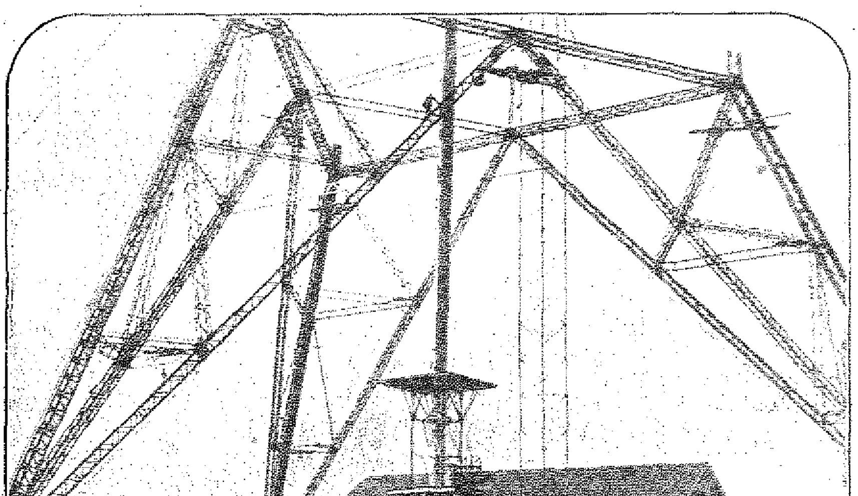
"The Hungarian Radio Review," which is stated to be the only wireless periodical in Hungary, is to be printed in Esperanto only. The publishers, in pointing out that interpreters of Esperanto are to be found in every country, announce that they have adopted Esperanto in view of the fact that this *neutral* language is predestined to perform a very important part in wireless of the future.

RETIRED. Mr. Frank J. Brown, C.B., assistant secretary of the G.P.O., whose career has been closely associated with official wireless development.

Important Retirement.

Saturday, January 31st, saw the retirement from active service, in consequence of the age limit, of Mr. Frank James Brown, C.B., C.B.E., M.A., assistant-secretary of the General Post Office.

Mr. Brown's career as a Civil servant has been marked with more interest than usually attaches to his profession, for in his official duties he has been actively associated with the successive development of telephones, cables, wireless telegraphy, and broadcasting. In connection with the last named, it will be remembered that Mr. Brown occupied a seat on the Advisory Broadcasting Board formed in 1923 to consider the problems arising after the first few months of broadcasting in this country.



MONSTER WIRELESS MAST. Erecting the 830-feet mast at Koenigswusterhausen, which, it is stated, will be the world's largest wireless station. One of the transmitting houses is seen in the background.

Amateur Links Texas and Germany.

For fifteen minutes on Sunday, January 24th, Mr. C. W. Goyder (2SZ), of Mill Hill, worked with the U.S. amateur 5UK, o. New Orleans Louisiana. At 7 a.m., following upon this communication, Mr. Goyder carried on a two-way conversation with 5DW, of Greenville, Texas, from whom he received a message for retransmission to Germany.

Both the American stations reported strong signals from 2SZ.

Major H. Lefroy.

In the reference in our last issue to the appointment of Major H. Lefroy as a director of Marconi's Wireless Telegraph Company, Ltd., we regret that this gentleman was erroneously identified with Lt.-Col. H. P. T. Lefroy, D.S.O., M.C., of the Air Ministry.

Radio Society of Great Britain.

An informal meeting of the Society will be held at the Institution of Electrical Engineers, Savoy Place, W.C.2, at 6 o'clock this evening (Wednesday), when Mr. L. F. Fogarty will give a talk on "Tantalum Rectifiers."

Talk by Captain P.P. Eckersley.

A meeting of the Eastern Metropolitan Group of Affiliated Societies will be held at 8 p.m., at the headquarters of the Hampstead and St. Pancras Radio Society at Crogsland Road, N.W., on February 18th, when Captain P. P. Eckersley will give a technical talk. The chair will be taken by Captain Ian Fraser, M.P.

Death of Dr. Heaviside.

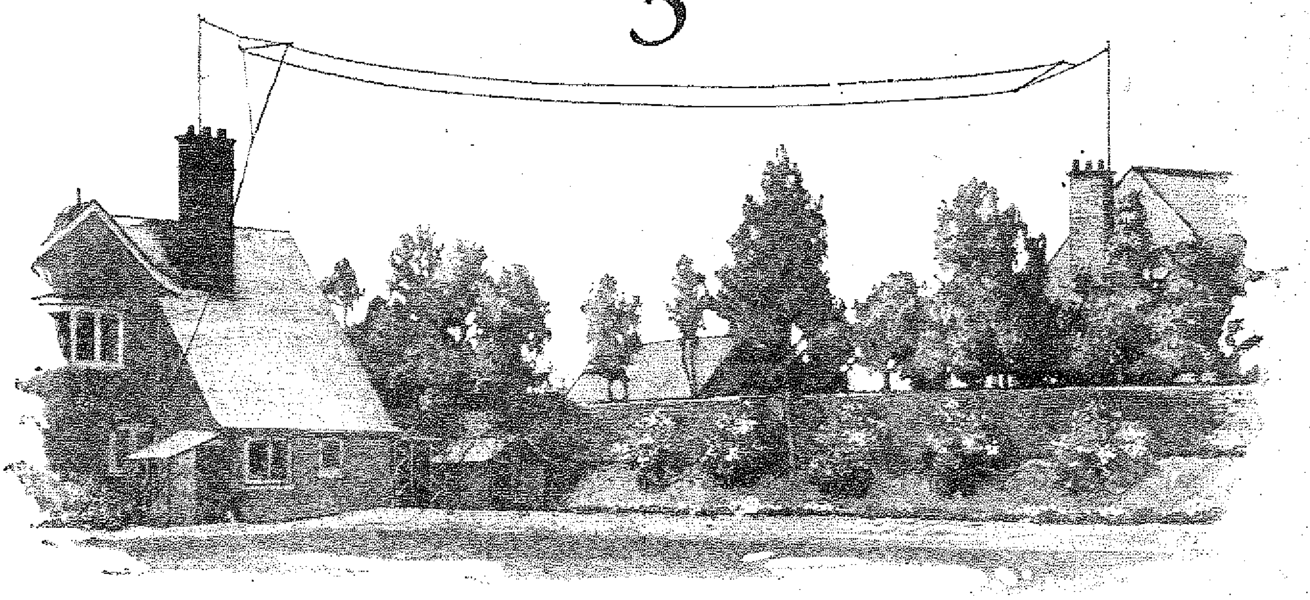
With the death of Dr. Oliver Heaviside, F.R.S., at Torquay on February 4th, the science of wireless has lost one of its original thinkers.

The name of Dr. Heaviside is primarily associated with the theory, propounded by himself, of the existence of a permanently ionised layer in the upper atmosphere capable of deflecting electro-magnetic waves and thus permitting wireless communication round the earth. Many reasons have been adduced in support of the "Heaviside Layer" Theory, which would seem to fulfil all the conditions encountered in practical experience.

Born in London on May 13th, 1850, Mr. Heaviside was engaged in telegraph work for a few years, but after 1874 he lived in retirement studying Clerk Maxwell's theory and applying it to telegraphic and wireless problems.

Elected a Fellow of the Royal Society in 1891, he was also Faraday Medallist of the Institution of Electrical Engineers and Hon. Ph.D. of Göttingen University.

Concerning Aerials



A Talk on Points to Observe in Aerial Erection.

By R. D. BANGAY.

I SOMETIMES wonder how many receiving sets could be made and bought out of the time and money needlessly expended on aerials. I should not like to hazard a definite guess, but I am sure that the figures, if they could be ascertained, would surprise most people. Assuming that we have limited facilities in the way of valves, the efficiency or otherwise of an aerial may make all the difference between strong signals which can be listened to with comfort and weak signals which require one's concentrated attention to hear, but the necessary efficiency can usually be obtained in a very simple way. The principal features that matter in any receiving aerial are efficiency, appearance and safety, and it is with due regard to these points that the following notes are compiled.

What Form Shall the Aerial Take?

The first point to consider is the actual form of the aerial. In the matter of length, one has usually not a great deal of choice. The Post Office regulations stipulate that the size of receiving aerials must not be more than 100ft., and this is a convenient size to work to for broadcast reception. This length is measured along the wire itself from the point where it enters the building to the insulated end or ends. We say " or ends " because the aerial may fork into two or more wires at some point along its length, as for example in a T aerial. The measurement is then taken to one or other of its extremities. (See Figs. 1 and 2.)

For all ordinary receiving purposes, an aerial wire 100ft. long is ample, and no advantage is gained by going beyond this length. In fact, it may quite easily be a disadvantage to do so. The reason for this is that the longer the aerial wire, the longer is its natural wave length. If this is much greater than the wave length to be received, it is difficult to compensate for the discrepancy in the aerial tuning circuit of the receiver. To do so it is necessary to use a very small condenser in series with the aerial, which is difficult to adjust accurately and introduces a considerable amount of high frequency resistance with a corresponding loss of signal strength. The natural wavelength of a single-wire 100ft. aerial will vary from place to place, but is approximately 150 metres.

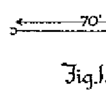


Fig. 1.

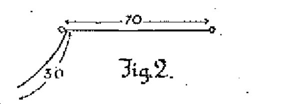


Fig. 2.

If the wavelength to be received is about 300 or 400 metres, the difference is just about the right amount to allow for the tuning inductance and coupling coils of the receiver (a single-circuit receiver requires a considerable amount of inductance to obtain efficient rectification) so that the aerial condenser can be short-circuited and the losses in it avoided. This is more important in the case of a crystal receiver than with a valve, because in the latter case the losses in the aerial can be made good to a large extent by the use of reaction.

As regards the shape of the aerial, there is a great deal of variety, but undoubtedly in the large majority of cases the single-wire aerial is by far the most convenient and, for ordinary purposes of broadcast reception, is every bit as efficient as the multi-wire aerial provided approxi-

Concerning Aerials.—

mately 100ft. length of wire can be employed. It is a popular fallacy to think that multi-wire aerials have greater receiving properties than a single-wire aerial. This supposition is not correct.

The Effect of Multiple Wires.

The object of increasing the number of wires in the aerial is merely to increase its capacity and decrease its inductance. This may or may not affect the natural wavelength of the aerial according to whether the additional wires branch at some point along the aerial or right from the point where it is connected to the receiver, but it does make a difference to the tuning. The wavelength of the aerial circuit, or of any tuned circuit for that matter, is proportional to the square root of both the inductance and the capacity. It follows, therefore, that if the aerial has a large capacity, a given amount of tuning inductance connected in series with it will increase the wavelength of the circuit more than if the capacity is small. In other words, we require less tuning inductance to tune a large-capacity aerial from, say, 150 metres to 400 metres than we require to produce the same change with a small-capacity aerial.

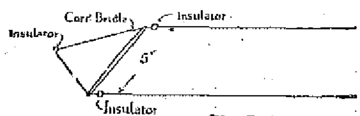


Fig.3

As already pointed out, a single-wire 100ft. aerial has just about the right capacity to allow for the inductance of the receiver coils when receiving wavelengths of about 300-400 metres. Therefore, if the greater part of the reception is to be carried out on or about these wavelengths, and if the full-length aerial can be erected, no possible advantage can be gained by multiplying the number of wires. On the other hand, if the greatest efficiency of reception is wanted on the very long wavelengths, or if there is only sufficient room to erect a very short aerial, then it may pay to use two or more wires for the aerial, because it enables one to reduce the losses in the inductance coils, which may be considerable if very large values of inductances are needed. It is doubtful, however, whether an experienced observer would be able to detect much improvement in signal strength between a single-wire aerial say 60ft. long and a multi-wire aerial of the same length if the receiver were tuned to a 400-metre wave.

Importance of Symmetry.

In case some readers, for one reason or another, wish to use a multi-wire aerial, it may be worth mentioning one or two points in that connection. In the first place, the aerial should be perfectly symmetrical; that is to say, the length and height from the ground of each branch should be as nearly as possible the same as the others. This applies chiefly to "T" aerials or "umbrella" aerials (see Fig. 1). In the second place, where two or more wires are run parallel to one another, as in a twin aerial, with the object of increasing the capacity, they should be kept as far apart as possible by means of spreaders, otherwise there will be no appreciable increase in the capacity of the aerial. A twin wire aerial as shown in Fig. 3 with 5ft. spreaders will have a considerably greater capacity than a four-wire "sausage" aerial of the same length with 1ft. hoops, as shown in Fig. 4. The farther apart the several wires, the greater the increase in capacity per wire. The addition of a third wire in the aerial illustrated in Fig. 3 suspended between the existing pair would make practically no difference to its capacity. For this reason a simple T aerial, as shown in Fig. 1, has a greater capacity than the twin aerial shown in Fig. 3, because in the former the two wires are separated to the greatest possible extent.

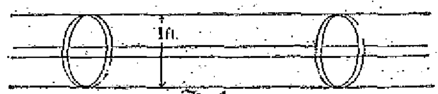


Fig.4

The next point to consider is the height of the aerial, and it is here that there is the greatest scope for ingenuity and applied intelligence, because the receiving property of an aerial increases in direct proportion to its average height—all other things being equal, of course. Let it be clearly understood that it is the average height that counts, and not the maximum height. The average height is found by taking the height at a large number of equidistant points along the aerial, adding them together and dividing the result by the number of measurements taken. If we apply this rule to a perfectly vertical aerial 100ft. long, it is easy to see that the average height is only 50ft., although its maximum height is 100ft. Or to take the other extreme, the average height of a perfectly horizontal aerial 100ft. long and, say, 1ft. from the ground is practically the same as the maximum height, namely, 1ft. But let us take a more practical example. Suppose the aerial is 100ft. long and rises more or less vertically to a height of 30ft., and then slopes downwards to, say, 20ft., as shown in Fig. 5. The easiest way to arrive at the average height of such an aerial is to take it in sections. The average height of the first 30ft., which constitutes the down lead, is obviously $\frac{30}{2}=15$, and the average height of the last 70ft. is $\frac{20+30}{2}=25$. So that we have 30ft. of wire 15ft. high and 70ft. of wire 25ft. high; therefore the average height of the whole 100ft. is $\frac{(30\times15)+(70\times25)}{100}=22$ft.

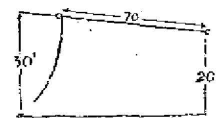


Fig.5

Supporting the Aerial.

The next question that arises is how to support the aerial. The aerial itself is quite the cheapest part of a receiving set, but it frequently happens that more money is spent on erecting it than on all the rest of the equipment put together. It is worth while, therefore, to study the question rather carefully. I do not propose to go into details of the construction of the mast or pole. Almost any kind of mast is unsightly, and the higher it is the more unsightly and expensive does it become, so that if we can do without one so much the better. The house itself can generally be made to answer the purpose of one support, but unless the house is a very large one, sufficient length of aerial cannot easily be obtained by merely running the wire up to one chimney stack and then across to another If your neighbour across the road has

Concerning Aerials.—

no objection, you might be able to get permission to attach the far end of your aerial to his chimney. You will probably not be successful in the ordinary way, but if your friend happens to be a wireless enthusiast himself and if his house is at a convenient distance, you might very well persuade him to join forces to a common end by joining the extremities of your respective aerials together as shown in Fig. 6. Such an arrangement has obvious advantages to both parties.

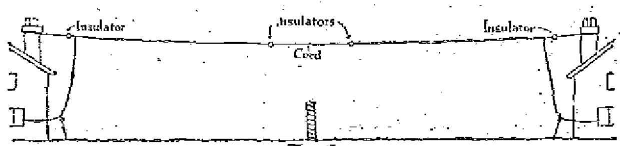


Fig. 6.

When attaching the aerial to the house, be careful to secure it to something really solid. Avoid gutter brackets or gutter pipes unless these are extremely firmly fixed, otherwise you will sooner or later have a heavy bill to pay for repairs. Probably the best method is to encircle a chimney stack with a piece of stout wire as shown in Fig. 7 and attach the aerial insulator to this by means of a length of cord or wire long enough to allow the down lead to fall well clear at least 4 or 5 feet away from the walls of the house. At the same time this cord can be made to act as a mechanical "fuse" which will break at a pre-determined tension to save the chimney stack from being pulled over should any accidental strain be put upon it.

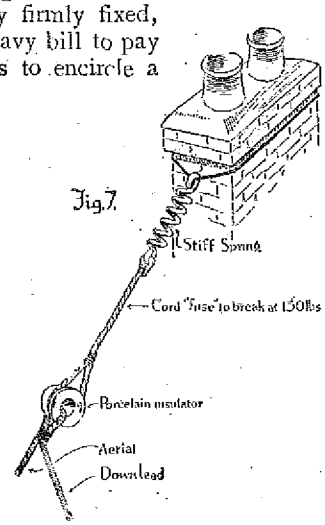


Fig. 7.

It is impossible to give an exact figure for the horizontal pull which a chimney stack will stand, as so much depends upon its height, shape and how it is built. Assuming it is reasonably well built and about 8ft. high, it should be capable of *withstanding* a pull of at least 400lb. longways or 200lb. broadways. Therefore always arrange for the pull to be in the direction of its greatest dimension if possible.

If the fuse is tested to break at a pull of, say, 150 lb., you know that no greater strain than this can be applied to the masonry, and it should therefore be perfectly safe. This precaution is particularly important if the far end of the aerial is attached *to a tree,* because in a heavy gale the top of the tree may sway several feet, and unless sufficient slack has been allowed for something has got to break. Some aerial wires will stand a very considerable pull before breaking, and it is quite easy for a chimney stack to be pulled over in this way. A stiff spring between the fuse and the attachment to the chimney will be a great benefit in saving the chimney from jars which might eventually loosen the brickwork.

When a Mast becomes Necessary.

If no tree is available, and if neighbours are not obliging, then there is no alternative but to erect your own support in the back garden. Before committing yourself to any serious delay in this respect, it is worth considering the following point. Suppose your point of attachment to the chimney is 30ft. from the ground, as illustrated in Fig. 8, and suppose you erect a mast 30ft. high to support the far end of the aerial, then the average height of the aerial will be $\frac{(15\times30)+(30\times70)}{100}=$ 25ft. 6in. If, instead of erecting a 30ft. mast, you set up a *post* 10ft. high about 200ft. from the house, as indicated by the broken lines in Fig. 8, it will be observed that only 3ft. will be lost in the average height of the aerial, but a considerable saving in expenditure will be effected, besides avoiding the unsightly appearance of a tall mast. In both cases the aerial itself is 100ft. long, and in the second case the extra distance between supports is spanned by a light wire which is insulated from the aerial in the usual way.

Remember that Rope May Shrink.

Always avoid long lengths of hemp or manila rope. This *contracts* by a very considerable amount when wet, and if an aerial is pulled *taut* in dry weather and then left, as soon as it rains something will break. The size of the wire employed is not an important matter from the receiving point of view, but for the sake of appearance it should be as small as possible consistent with mechanical strength. It is doubtful whether any reduction in signal strength would be noticeable if a single No. 28 gauge wire were employed. In fact, I know of someone who always uses an aerial consisting of a single No. 38 gauge wire suspended by black thread which acts as an insulator. Probably if his signals were compared with those from an ordinary aerial they would show a slight disadvantage, but it is doubtful whether more than 10 per cent. efficiency is lost. The arrangement has the advantage of offering practically no resistance to wind and weather, and the aerial is practically invisible. I would therefore recommend this suggestion to those who have difficulty in persuading their landlords to permit an aerial. This, however, is rather an extreme case. For ordinary purposes a stranded wire consisting of seven strands of about No. 28 gauge phosphor bronze

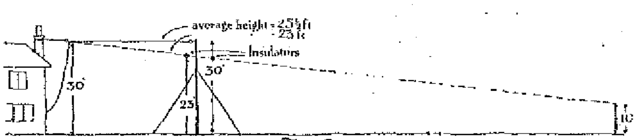
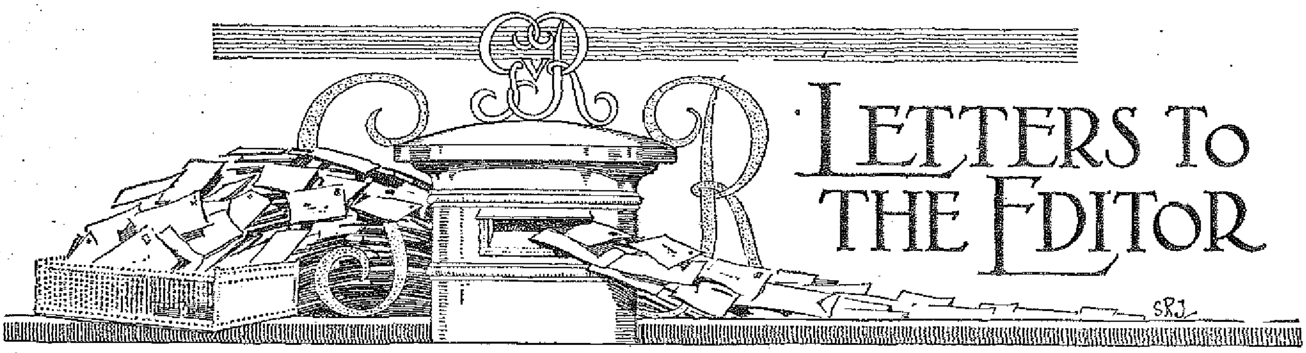


Fig. 8.

wire is recommended. Such a wire is flexible, inconspicuous and of ample strength. As regards insulation, very small porcelain insulators are the best. So long as they offer a clear inch of surface between the aerial wire and any support, the insulation is ample. Larger insulators are unnecessarily clumsy. A single insulator should be used at each point of support.



The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," 139-140, Fleet Street, E.C.4, and must be accompanied by the writer's name and address.

LISTEN FOR CB8.

Sir,—I should be grateful if you would announce that my father, from station R-DA8 (ex CB8), Buenos Aires, is calling me now every night from 12 to 12.15 G.M.T. on a wave of about one metre shorter than KDKA's short wave transmission.

Although I have a very bad aerial, I have succeeded in hearing him very loud and steady, one of the messages being "Advise *Wireless World* that I am on this wave."

CB8 uses 200 watts CW with a slight ripple. His wave is very steady.

Will all amateurs who succeed in receiving CB8 please let me know at the address given below. J. C. BRAGGIO.

Chancellors Hall,
Edgbaston, Birmingham.

EXPERIMENTS DURING THE ECLIPSE.

Sir,—The following particulars of a test I carried out during the eclipse period from 3 to 4.30 p.m. may be of interest to your readers

The test was carried out on an ordinary crystal set, using a Western relay with a small mirror to note the difference with regard to input current, if any, during this period.

At 3 p.m. the deflection from the zero line of the spot of light was 19 mm.; at 3.15 p.m., 20 mm.; at 3.30 p.m., 22 mm.; and at 3.58, 24 mm. I had one pair of 'phones in series with the relay, and there was a very appreciable difference in the volume of sound.

I may say that the deflection of 24 mm. is not generally attained until about 7.30 p.m. on ordinary days.

Further, by 4.15 p.m. the maximum deflection had dropped back to 22 mm., although, of course, as the B.B.C. changed their programme at 4 pm., it is possible their power output may have been slightly altered. FRANK P. LINDLEY.

Northwood, Middlesex.

BROADCASTING AND EDUCATION.

Sir,—With reference to your Editorial on the above subject in the current number of your periodical, it may interest you to know what has been done in the matter of wireless reception of the school transmissions from London in the South Wigston (Boys) Intermediate School, near Leicester. Sanction for the experiment was obtained from the school managers last September, and a start was made with the lectures on "Music" every Monday afternoon. Such was the success of the "experiment" that the only two prizes offered at the examination in December were won by boys from this school, which is 95 miles from 2LO. Three different sets were borrowed and used at different times, each giving quite satisfactory results on four valves. One, or two, loud speakers were used, the latter not to give increased volume, but to obtain a better distribution of sound, so that as many as 90 boys have heard at one time.

At a meeting of the school managers held this week, one of the managers has reported "Complete satisfaction at the manner in which wireless was being utilised as a means of education at the South Wigston Boys' School," and said that "the inspectors had had a practical demonstration during the day, and were completely satisfied with the results." Lectures are still being received as a regular part of the school work once or twice a week.

We cannot understand the attitude of the London County Council (doubtless the important educational body referred to), and would respectfully suggest that it is just that little bit of "active support" far more than actual financial assistance that is required to enable schools in the London area to achieve far more than we have been able to do at this distance, and without "simultaneous."

We should welcome reports from other schools, and I, personally, would be willing to try advising any school that is not getting the results that it would like, and might expect, to obtain. F. S. POOLE, M.R.C.S., L.R.C.P.

South Wigston,
Nr. Leicester.

THE OSCILLATION NUISANCE

Sir,—I was greatly interested in reading your article in the current issue of *The Wireless World and Radio Review* upon the subject, "Can the Oscillation Nuisance be Remedied?"

Wireless amateurs in this district have been finding interference from this cause more on the increase rather than decrease, which prompted the undermentioned society to formulate some plan to eliminate, as far as possible, this unsatisfactory state of things.

It was felt that a great deal of the trouble was caused by persons building and operating sets who were unacquainted with the true *modus operandi* of reaction, and with little thought of the annoyance caused to others by injudicious handling.

The plan adopted by the society was as follows: A small sub-committee of experienced wireless experimenters was formed to deal solely with the matter. Intimation was given in the local Press that any person having a receiving set who was in doubt as to whether his installation was oscillating could, by making application to this committee, receive advice, and in many instances arrange a personal visit for the purpose of a brief practical demonstration upon avoiding it in his own set. Of course, everything was treated in a strictly confidential and most friendly manner.

Whilst the scheme has not yet had time to prove conclusively its worth, results go to prove that in this way useful work can be accomplished, not only in doing something to lessen interference somewhat, but in coming into personal contact with potential members of the local society, which should also be a step in the right direction.

It is felt that every society can do some good by steady application to the subject, more so if in the vicinity of a B.B.C. station, whose co-operation in this matter is most valuable.

L. LESLIE SIMS.
Borough of Tynemouth Radio and Scientific Society.

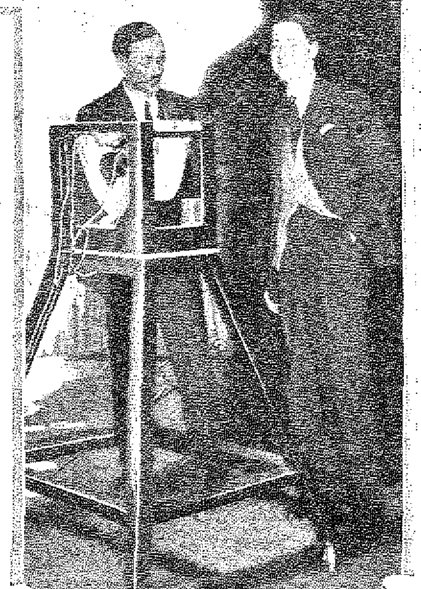
Bedford Street, North Shields.

[This is obviously a good method for extending the activities of a local society. The difficulty would appear to be in the drafting of suitable instructions.

Many other interesting letters have been received on the subject of oscillation and will appear in our next issue.—ED.]

BROADCAST BREVITIES.

NEWS FROM THE STATIONS.



Savoy Bands heard across the Sahara.

There seems to be something in the ether conducive to long distance broadcasting just now, because scarcely a day passes but someone writes to the B.B.C. telling of reception in far distant areas.

The latest report is from the Gold Coast. Someone in the town of Nsawam has picked up the Savoy Bands. Atmospherics are usually very bad, but on this occasion reception was perfect.

oooo

Native Wireless.

The present writer has been in Nsawam, and it seems to him little short of marvellous that anything from London should have reached that lonely but not unattractive region on the other side of the Sahara.

The natives of West Africa have long had an excellent system of wireless telegraphy of their own, which is very much quicker than the official telegraph service, which is liable to interruption every time a bush cow rubs itself against a telegraph pole. They can carry news by drumbeat at great speed. The writer has known of news being conveyed four hundred miles in a little over half-an-hour by this method.

oooo

India Enjoys 5XX.

Mr. A. C. Owen, stationed at Rawalpindi (India), writes: "At present I am working on the W.T. Station. Our call is 8RP. On our station we read Chelmsford every evening. We always have the footer results early on Sunday morning or late on Saturday night."

oooo

Special Concerts for India?

The B.B.C. have frequently had reports of reception in India, but this is the first intimation of anyone receiving Chelmsford regularly. If this goes on, the B.B.C. will have to arrange special concerts for India. It would seem as if a touch of broadcasting were going to make the whole Empire kin.

oooo

What Durban Thinks.

A Durban correspondent writes: "The way Bournemouth comes in is wonderful. Last Saturday it was received with such strength that by adding a single valve amplifier it was possible to work a loud speaker so that several who were present could hear at times as plainly as Cape Town is received here.

"I was at the time using the three-valve dual, and at a quarter to twelve I tried for Bournemouth, and was astonished to pick up such a powerful carrier, which I thought could be no other than Cape Town working a late night. I soon found I was listening to Bournemouth, and to a musical dialogue broadcast from there. At four minutes to twelve we heard a chorus sung by male and female voices with such purity that the piece could have been recognised by anyone familiar with the tune."

This correspondent gives other particulars which make it evident that he had been listening to "Patricia."

oooo

Best Provincial Station.

Next to Chelmsford, Bournemouth seems to have as great a range as any of the B.B.C. stations. Bournemouth is probably the best provincial station of the B.B.C., because the transmitter is built on ground belonging to the company. It has been heard several times at distances of a thousand miles on a crystal.

oooo

Bournemouth Concert at Sea.

Another wonderful record for Bournemouth already referred to was when it was picked up on a crystal detector at 1,100 miles on a ship bound for Port Said. The aerial used was a single wire type, and the receiver inductively coupled with a carborundum crystal using a potentiometer.

oooo

Why KDKA Can Reach Australia.

It seems that our old friend KDKA has been heard in Australia, and the Australians are wondering why the B.B.C. cannot do likewise. The B.B.C. have quite enough to do reaching all the blind spots of Great Britain without troubling about Australia. There is no doubt that it is the 63 metre wavelength of KDKA that is responsible for this record transmission, and the B.B.C. of course, officially, cannot get down so low as that.

oooo

Will the B.B.C. Do It?

However, now that all the main stations and the relay stations are going, we may expect that the activities of the B.B.C. engineers will be turned in the direction of greater experimenting with short wavelengths, so that we may hope to do something with Australia before many moons are over. The Australians are simply crazy to hear a message from the Old Country.

oooo

Broadcast Plays.

By the time this appears in print the B.B.C. will have held their second meeting with the theatrical managers, but it will be surprising if an agreement is reached. It is said that some of the theatrical managers want fabulous sums for broadcasting, which the B.B.C. simply could not look at.

The recent meetings between the two interests have not been brought about because of any change of attitude on the part of the theatre managers generally.

oooo

Division in the Theatre Ranks.

The undoubted success which has attended the broadcasting of selected pieces has rent the theatrical societies in twain—those who approve of broadcasting, and those who do not.

Those who do not approve are afraid that the shows which are broadcast will benefit at the expense of those which do not.

The meetings with the B.B.C. are more for the purpose of getting unity amongst themselves than to arrive at any terms about broadcasting.

It is quite possible that the B.B.C. will get all the theatrical productions they wish if they will only have patience.

oooo

Trouble in "Auld Reekie."

The B.B.C. are having a very hectic time of it just now with Edinburgh.

Edinburgh people want London programmes, and the essence of their complaint is that they are getting rather too much from Glasgow.

As a matter of fact, with Chelmsford and at least four nights a week from London, they are getting quite as much as ever the B.B.C. promised them, but that does not seem to satisfy them.

Edinburgh and Glasgow Problem.

There is a section of the listening public in Edinburgh which under no circumstances wishes to have anything artistic or musical from Glasgow.

Surely localism and parochialism of this nature is a little bit irrelevant in the realms of the ether.

Just as we are perfecting international broadcasting and looking forward to the time when all countries will instruct and entertain each other, it seems particularly inappropriate for Edinburgh to demand that its ether waves must come in a specified direction.

After all is said and done, if a programme is good, what does it matter where it comes from? And there are frequently concerts from Glasgow which are as good as anything from London.

oooo

A Solution?

Perhaps the B.B.C. could get over the difficulty by sending their Glasgow programme up to London, and then letting a London announcer give the items while it was sent back to Edinburgh.

It is gratifying to note, however, that the complaints with regard to the quality of the Edinburgh transmissions have now to a large extent ceased.

oooo

More Power from 2EH.

Whatever the B.B.C. have done, there is no getting away from the fact that the power of 2EH seems to have materially increased of late.

It is interesting to note that the Edinburgh wavelength has been increased to 465 metres.

FUTURE FEATURES.

Sunday, February 15th.	
London and 5XX (3 p.m.)	Star Ballad Concert. S.B. to other Stations.
Bournemouth (3 p.m.)	Russian Symphony Concert.
Newcastle and 5XX (8.30 p.m.)	Newcastle Bach Choir. Address by the Very Rev. The Dean of Durham.
Manchester (3 p.m.)	Sonata Recital—Solos and Songs.
Glasgow (9 p.m.)	Recital of 16th Century Church Music.
Liverpool (9 p.m.)	Operatic Evening by British National Opera Company.
Monday, February 16th.	
Newcastle	Music and Comedy: A Scene from "The School for Scandal."
Tuesday, February 17th.	
5XX	Operatic Programme.
London	Musical Comedy Excerpts. S.B. to other Stations.
Belfast	Belfast Postmen's 13th Concert.
Wednesday, February 18th.	
London and 5XX	"From the Mystic East."
Manchester	Operatic Evening.
Thursday, February 19th.	
Bournemouth	Musical Appreciation: A Survey of Music from the Earliest Times to the Present.
Glasgow	Spanish Scenes.
Friday, February 20th.	
London and 5XX	Speeches from the Civil Service Dinner. S.B. to other Stations.
Birmingham	Speech by Rt. Hon. The Earl of Birkenhead, K.C., at Chamber of Commerce Banquet.
Saturday, February 21st.	
London	Band of H.M. Scots Guards.
Manchester	Pantomime: "Cinderella."
Aberdeen	A One-Act Farce: "The Cure."

The B.B.C. at Rugger.

The B.B.C. Rugby Football Club are elated because they have pulled off their first Rugby match.

Dan Godfrey is the leading light in the new venture, although "light" is scarcely the adjective to apply to "Dan of the Great Diameter," as a futurist poet somewhat rudely described him recently.

oooo

A Sports Club, Too.

Future fixtures are with the teams of the London Scottish and Westcombe Park.

The B.B.C. are also endeavouring to find a ground for a sports club, so they evidently imagine that they are going to be a permanent institution in the country.

oooo

Waiting for a Thaw.

The B.B.C. have promised us one or two "stunts," and one wonders what has come over them.

For instance, there was the Niagara "stunt," and the explanation of the delay there is that the Falls are partially frozen just now, and we shall need to wait for a thaw before the mighty rush of waters can be heard.

oooo

Waiting for a Frost.

Then there was the wild fowl "stunt"—broadcasting the cries of wild birds from some place on the East Coast.

It is understood that the B.B.C. naturalist is on the spot just now, only in contra-distinction to the Niagara people, he is not waiting for a thaw, but waiting for a frost. It seems that the birds only sing to the best advantage under conditions of arctic winter.

If this is correct, then it is quite possible that we may have to wait until midsummer before the cries of the birds can be heard.

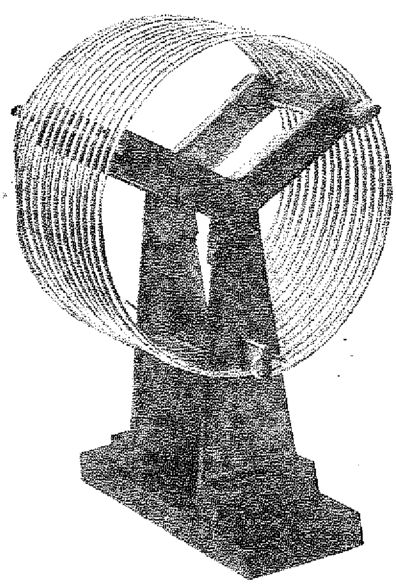
A TEAM THAT HAS NEVER LOST A GAME. Members of the B.B.C. Rugby Football Club, who are elated at having "pulled off" their first match. From left to right they are Messrs. Broadbent, Newsom, West, Frost, Godfrey, Bishop, Palmer, Hamilton and Murray.

A SHORT WAVE RECEIVER.

PART I.

The set described in this article has been designed for the amateur interested in short wave work. It has a detector and one stage of L.F., and with the tuning coil shown here will tune over 45–130 metres. This instalment deals with the construction of the coils.

By W. JAMES.



The closed circuit coil which is of tinned copper wire wound on a wooden framework.

ONE of the most sensitive arrangements for amplifying weak signals is a regenerative valve detector, working into a note magnifier. It can be proved experimentally :—

(1) That a valve detector with critically adjusted reaction will give a response in the telephones, however weak the signal which reaches the tuner. There is *no* limit to the sensitivity of a regenerative detector other than that due to the critical reaction coupling required.

(2) For maximum response or signal strength, provision should be made for an extremely fine control of reaction, and, further, the circuit should be designed in such a manner that it has the lowest possible high-frequency resistance.

Critical Tuning.

By following out the connections of the receiver given in Fig. 1, it will be seen that a tuned circuit is connected to the grid of the detector valve. One end of this circuit is joined to the grid condenser and leak and the other end to a potentiometer. Coupled to the closed circuit is the aerial coil and the reaction coil. Both couplings are variable.

We can, therefore, make adjustments which will result in best detector action and give us a critical degree of reaction by adjusting the filament resistance, the potentiometer, the anode voltage, the reaction coil, and the aerial coil.

The degree of rectification depends, of course, on the value of the filament current, the anode voltage, and the normal grid potential. These may be roughly fixed from a knowledge of the operating characteristics of the detector valve, and then final critical adjustments made for best results while listening for signals.

Perhaps the most important of these three controls is that of the potentiometer. An adjustment of the potentiometer changes slightly the grid bias which, in turn, has an effect on the degree of coupling of the reaction coil required to reduce the effective resistance of the secondary circuit to approximately zero.

It is, I think, very convenient to provide a variable coupling between the aerial and secondary circuits. In the first place, the amount of reaction required to put the receiver in a sensitive condition for the reception of telephony, or to make it oscillate for heterodyning continuous wave signals, depends on the effective resistance of the secondary circuit. When the aerial is fairly tightly coupled to the secondary circuit, the effective resistance is higher than when the aerial is loosely coupled. Hence, if the set is just oscillating when the aerial is only loosely coupled, the set will stop oscillating when the coupling is tightened.

Secondly, by employing a variable coupling, we are able to make much more critical adjustments.

The number of adjustments available do not make tuning-in a difficult process. Searching is done by adjusting the tuning condenser with one hand and the reaction coil with the other. When a signal is heard, final adjustments may be made with the potentiometer and the coupling of the aerial coil. It will be quite clear that it is far easier to strengthen a weak signal by comparatively coarse settings of several adjustments than by two extremely delicate adjustments

Low Loss Circuits.

When building a set for the reception of short wavelength signals, it is important to remember what enormous

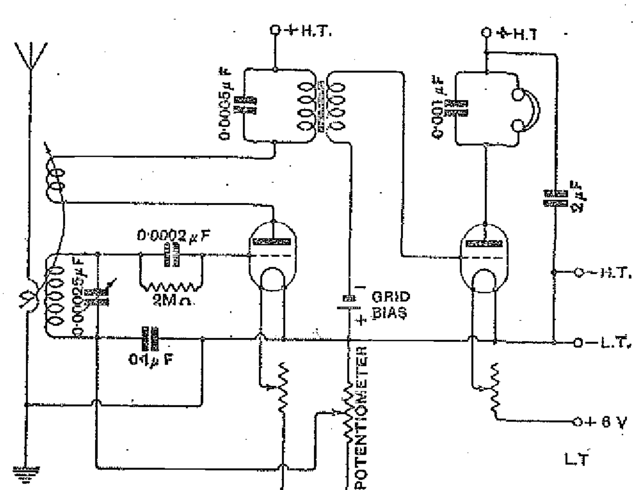


Fig. 1.—Schematic connections of the set.

A Short Wave Receiver.—

frequencies one is dealing with—for the losses of coils and condensers increases with the frequency. The frequency range of this set, for instance, is 2,300,000 to 6,660,000 cycles, which compares with approximately 600,000 to 1,000,000 cycles for the broadcast band.

It should also be remembered that reaction does not completely compensate for the losses of the coils and condensers connected in the circuit. That is, the signal strength obtainable from a set having inefficient coils and condensers will not be so great as from a set having good coils and condensers, the degree of reaction being critically adjusted in both cases.

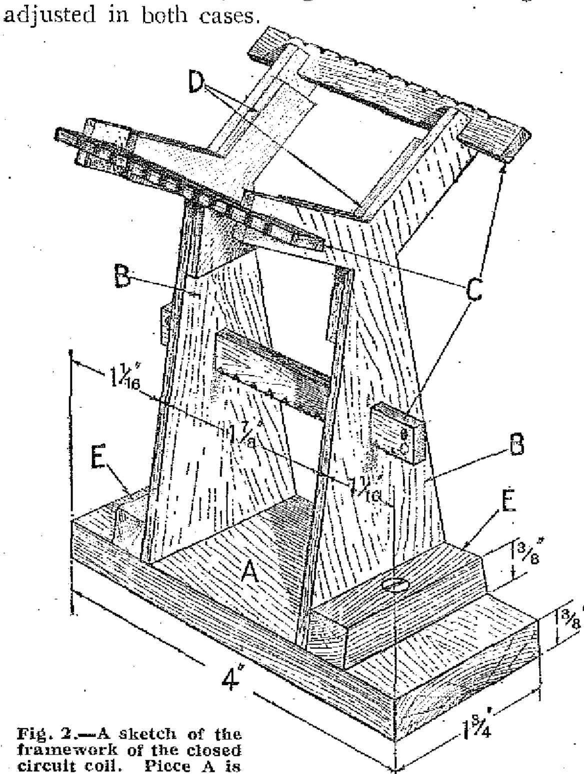


Fig. 2.—A sketch of the framework of the closed circuit coil. Piece A is the wooden base; pieces B are drawn in detail in fig. 3; pieces C are given in detail in fig. 5; pieces D are to strengthen the former, and pieces E are blocks of wood to which are screwed the upright pieces.

Therefore, it is of the utmost importance that well-designed coils and condensers be used. It is well known that for short wave work the tuning coils should be wound of fairly thick wire, have the turns spaced, and have a minimum amount of solid material in their construction. We should, therefore, use as nearly as possible a coil whose only insulation is air. One would not use, for instance, a coil consisting of a number of turns of insulated wire wound on a former of cardboard or ebonite. Bare solid wire should be used, and the turns spaced and supported with the minimum amount of material.

A coil of this description is not difficult to make, as may be seen from the photograph (of the closed circuit coil of this set) at the head of this article. When such a small amount of insulating material is used in the coil, there is probably nothing to choose between ebonite and wood, except that wood is easier to handle and the pieces may be stuck together so that no metal screws are required in the construction.

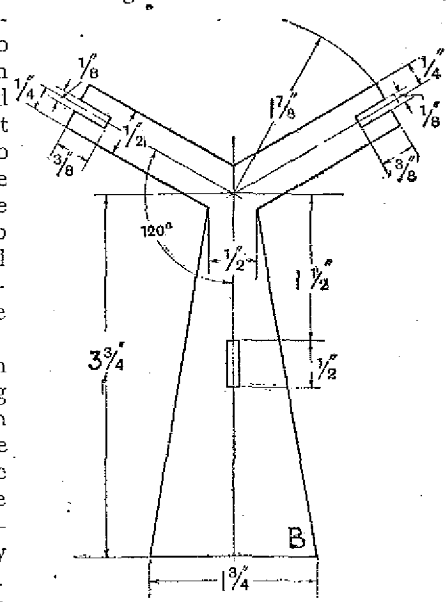


Fig. 3.—Details of the pieces marked B in fig. 2. These are of hardwood, 1/8th in. thick.

Dealing with the remaining factors which should receive attention, we may say at once that it is not advisable to employ a tapped coil. Apart from the fact that dead ends have a more marked bad effect on short waves than on the broadcast wavelengths, it would seem that the provision of tappings is undesirable for two reasons.

In the first place the wires running from the coil to the points at which the taps are connected increases the self-capacity of the coil, and, secondly, if the taps are taken to contacts mounted in ebonite, we introduce dielectric losses. Sometimes when a tapped coil is employed the set will not oscillate over its tuning range because of the losses introduced by the tappings and the dead-ends.

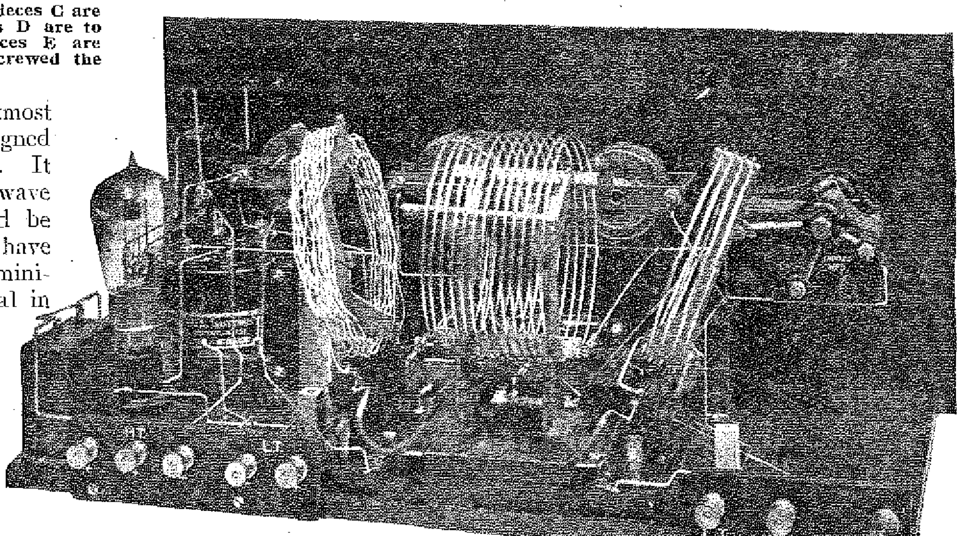


Fig. 4.—A view of the back of the set, showing the aerial coil (right), closed circuit coil (centre), and reaction coil (left).

A Short Wave Receiver.—

A special feature of this set is that the closed circuit coil may be removed from the set and another having a different number of turns put in its place.

Another thing which should receive attention is the position of the coil with respect to other components. It would not do, of course, to mount the coils close to the panel, the tuning condenser, or transformer, as the losses of the coils are increased when they are situated close to such parts. So far as possible, a clear space of several inches should be left round the tuning coils, and the components arranged in such a manner that they are not in the field of the coils.

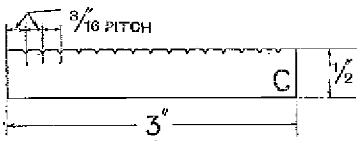


Fig. 5.—Details of the pieces marked C in fig. 2. These are of hardwood 1/8 in. thick, but may be of ebonite.

Valves.

With regard to the valves to be employed in a short wave set, we need to pay particular attention to the one employed in the detector stage. This valve should preferably be of the modern type, having a high ratio of amplification factor to impedance, but it should also be of low self-capacity. Probably the best valve available is of the V24 type; in this set I use a D.E.V., which requires a filament current of 0.25 ampere at 3 volts and an anode voltage of 15 to 30. This type of valve, when mounted in its special holder, has a capacity which is considerably below that of valves of the ordinary four pin type.

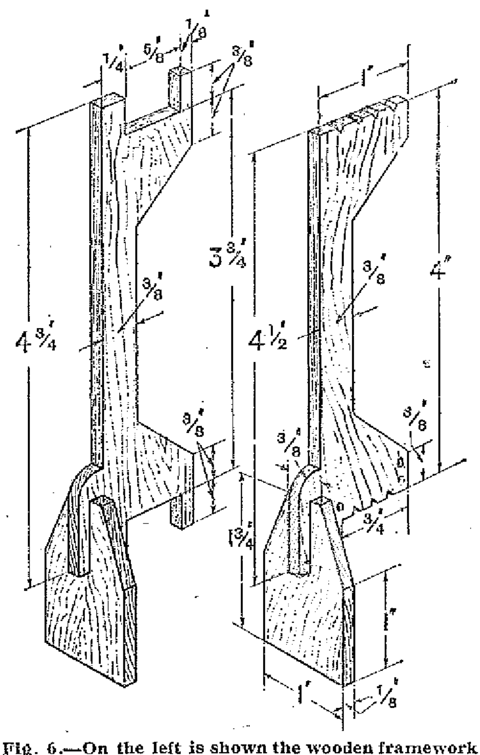


Fig. 6.—On the left is shown the wooden framework for supporting the reaction coil and on the right, the framework for the aerial coil. These pieces are secured to the movable portion of the coil-holders.

For the L.F. stage we require a valve to work from a transformer into telephones, and I use a valve of the D.E.5 class, which takes a filament current of 0.25 ampere at 6 volts and an anode voltage of about 90—the grid bias being 3 volts.

Construction of the Coils.

The closed circuit coil consists of a number of turns of tinned copper wire wound on a former of skeleton construction. A photograph of the coil appears at the head of this article, and constructional details are given in Figs. 2, 3, and 5.

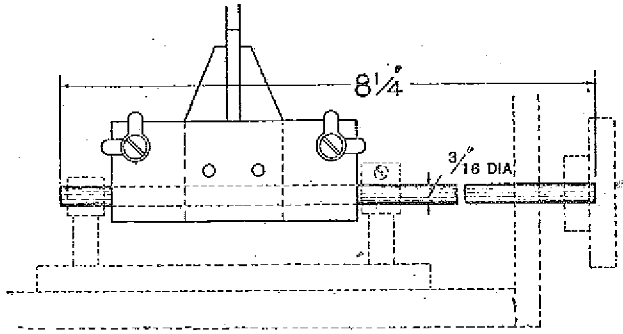


Fig. 7.—Layout of the movable coil holder for the reaction and aerial coils. Details of the base are given in Fig. 8, and of the movable pins in Fig. 9. The movable portion has a spindle passing through it which runs in two brass pillars as indicated. A knob is attached to the end of the spindle which passes through the panel.

The former may be divided into three parts: First, the base (Fig. 2), which is of hardwood measuring 4in. × $1\frac{3}{4}$in. × $\frac{3}{8}$in.; second, the two Y pieces of $\frac{1}{8}$in. hardwood with strengthening pieces shaped as indicated in Fig. 3; and third, the three notched strips, which, in the coil illustrated, is of $\frac{1}{8}$in. wood, but may, of course, be ebonite if preferred (Fig. 5). The strips are glued to the Y pieces, which in turn are screwed to the base. It will be noticed that the ends of the strips project beyond the Y pieces. This was done in order that similar formers may be employed for coils having a different number of turns, the notched strips being extended if necessary. For the wavelength range of 45-130 metres the coil may have thirteen turns, like the one illustrated here; up to twenty turns may be wound on this former (provided the strips are lengthened), with a pitch of $\frac{3}{16}$in., without any change being made to the aerial or reaction coils.

Number 16 tinned copper wire is employed. A length is tightly wound on a tube $3\frac{1}{2}$in. in diameter. This is then taken off the former and "worked" on the skeleton former. Leave the ends about half an inch long.

The design is such that a coil may be taken out of the set and another put in its place in a few moments. Therefore, instead of the ends of the coil being soldered to the circuit wires, a small terminal is soldered to them, and the ends of the coil fixed in the terminals.

The reaction coil is a basket-weave coil having twelve turns of No. 20 D.C.C., wound on a former consisting of fifteen pegs fixed on the circumference of a circle 4in. diameter, and may be seen in Fig. 4. This coil is supported in a wooden framework, and the framework is screwed to the movable portion of a coil holder as indicated in Fig. 7.

The coil holder is home made, and consists of a base of ebonite (Fig. 8) measuring 4in. × $1\frac{1}{4}$in. × $\frac{3}{8}$in., carrying two brass pillars, which serve as bearings for the

A Short Wave Receiver.—

spindle of the movable part of the holder. A brass rod, $\frac{3}{16}$-in. diameter, is passed right through the movable portion, shown in detail in Fig. 9, and carries a knob on the end which passes through the panel.

To construct the reaction coil and holder, therefore, prepare the ebonite base (Fig. 8), the movable piece of

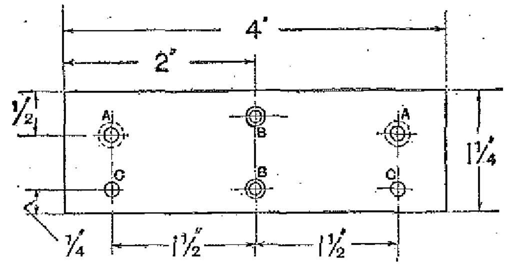
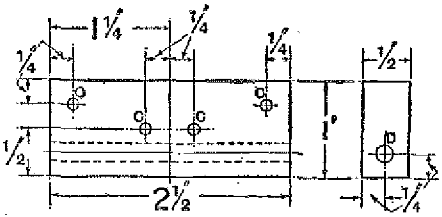


Fig. 8.—The ebonite base of the coil holder. Holes A are to take the pillars which support the movable portion, and should be drilled accordingly; holes B are for fixing screws, etc., for No. 4 B.A. screws. These screws hold connecting tags which are connected by flexible wires to the tags on the movable portion.

ebonite (Fig. 9), and mount them with the spindle as indicated in Fig. 7. Then make the wooden frame shown on the left of Fig. 6, and screw this piece to the movable piece as shown in Fig. 7. The reaction coil is slipped over the ends of the wooden frame, and its ends soldered to tags secured by screws to the movable piece

Fig. 9.—Dimensions of the movable part of the coil holder. Holes C are for No. 4 B.A. screws and hole D, which passes right through the length of the pins is drilled to the diameter of the spindle—3/16 in.



of the holder. The reaction coil is the left-hand coil in Fig. 4.

The aerial coil has four turns of No. 16 tinned copper wire mounted on a wooden framework. The wooden framework is secured to the movable part of a holder, which is constructed in exactly the same way as the holder for the reaction coil.

A sketch of the wooden frame for the aerial coil appears on the right-hand side of Fig. 6. It will be seen that the top and bottom edges are notched to take the turns of the coil. The ends of the coil pass through holes in the bottom of the vertical piece. This coil is the right-hand coil in Fig. 4.

(*To be concluded.*)

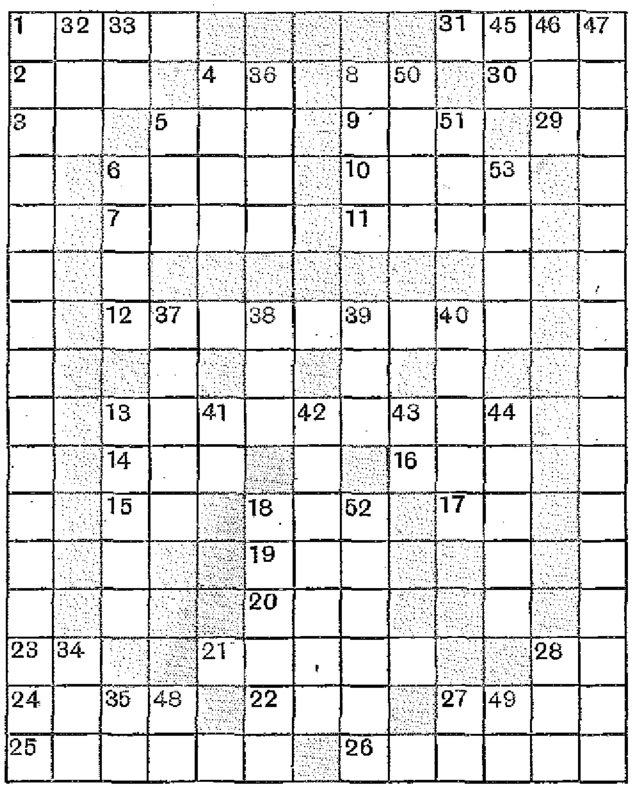
WIRELESS CROSS-WORD PUZZLE.

No apology seems necessary in presenting our readers with a Cross-Word Puzzle. In the example given, no word or abbreviation has been included which cannot take its place in wireless parlance. A numbered square marks the beginning of a word proceeding both horizontally and vertically, the word being ended by a dark square or the edge of the puzzle.

A prize of Two Guineas will be awarded to the sender of the correct solution which is accompanied by the most suitable new cross-word puzzle. A second prize of One Guinea will be awarded to the sender of the next best attempt. Consolation prizes to the value of Half a Guinea each will be presented to senders of *any other cross-word puzzles published in The Wireless World.* In all cases payment will be made after publication.

The merits of each puzzle submitted will be considered in relation to the appropriateness of the terms it contains.

N.B.—Solutions of the above, together with new puzzles, should be addressed: "Cross-Word," c/o The Editor, *The Wireless World*, 139, Fleet Street, London, E.C.4. and must reach this office not later than the first post on Wednesday, February 18th, 1925.

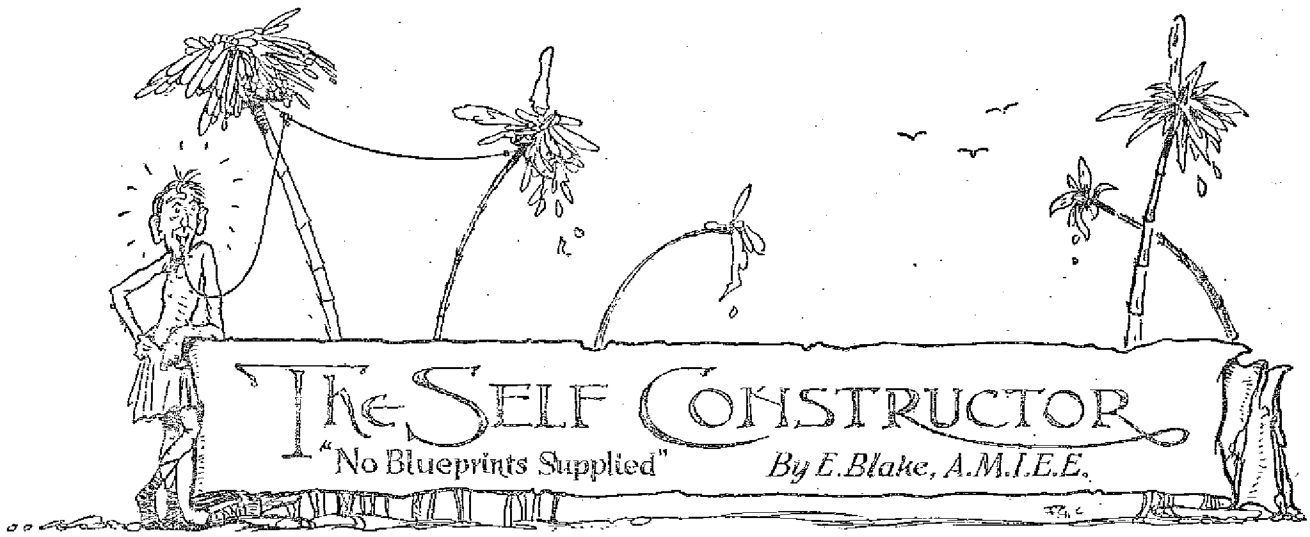


ACROSS.

1. Contains most of the hams.
2. Often used with a log.
3. Has the last word.
4. Call sign of Nantes.
5. Distinction owned by several wireless scientists.
6. Mount for set.
7. An integral part.
8. Type of copper wire.
9. Messages in the affirmative.
10. Volume X density.
11. A problem in broadcasting studios.
12. An old word with a new meaning.
13. The aim of the transmitter.
14. Secondary battery (abbreviation).
15. Negative terminal.
16. Not an amateur (colloq.).
17. A tapped coil.
18. Auxiliary telephone switch.
19. May be said of good broadcasting.
20. Unofficial break sign (Morse).
21. Contained in veracious news bulletins.
22. Controls the wavelength.
23. Special note.
24. Rare gas.
25. A Continent with great wireless possibilities
26. Important element.
27. A wireless beginner.
28. Break sign (Morse).
29. Terminals seen on most sets.
30. Important electrical body.
31. Enrols all British amateurs.

DOWN.

1. Without definite time period.
4. An international radio union.
5. Unpleasant wireless term.
6. *Part of a valve.*
8. Should contain a broadcast receiver.
13. Depends on atmospheric conditions.
18. Six commas (Morse).
27. A famous "Section."
28. Continental broadcasting station.
32. *Type of valve (reverse).*
33. Silent Service (uses Wireless).
34. Military force making extensive use of radio.
35. Either.
36. What every amateur must have.
37. To cause a nuisance, sometimes.
38. Sometimes employs a slider.
39. *Animal reputed to provide wireless component.*
40. Sometimes causes a disaster.
41. Generally needs smoothing.
42. What the "Wireless World" does.
43. Connects to the plate.
44. Produced by poor transformers.
45. *Connects with negative L.T.*
46. Letter of the alphabet (as pronounced in telephony).
47. A new radio development.
48. Metallic element used in wireless construction.
49. Stands for annual wireless publication.
50. *Canadian broadcasting station.*
51. s.s. "Curvello."
52. Polite name for a wireless bugbear.
53. Kind of valve.



An Episode of Costa Rica.

LAST year I went to Costa Rica on business. I did not find the coast so rich as to be worthy of its name, though it was well endowed with man-eating insects and patriotic Scotch-Germans who manifested high coefficients of absorption.

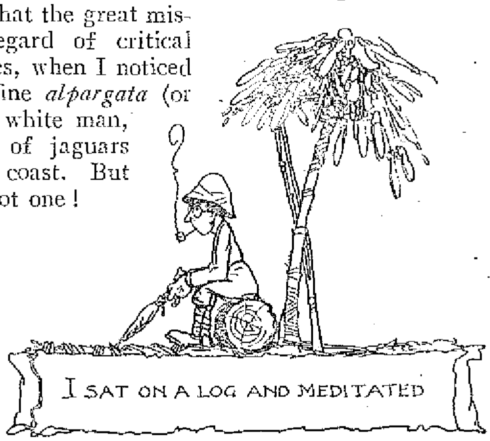
A few hours before the mail-boat sailed I rambled out of Santa Dolorosa into a sort of tuppenny, half-tame jungle, and there, amidst the clashing palm-fronds, the cries of the *tcha-tchas*, or Costa Rican sparrows, and the sickly scents of the local match factory, I sat on a log and meditated.

I had just reached the conclusion that the great mistake of my life was a wilful disregard of critical values in the application of grid biases, when I noticed a man step from the shelter of a fine *alpargata* (or Costa Rican boot-tree). He was a white man, not one of the yellow-necked sons of jaguars indigenous to the back blocks of the coast. But —oh, dearie me! Not a stitch! Not one!

Queer Antics.

What amused me more was his behaviour. I had seen classical dancers, sword-swallowers, and wireless operators trying to receive the unreceivable, but this man was a combination of the three. First he would caper about like a French wine-waiter busy between toasts; then he would stop, hold himself erect, shut his eyes, and gape like a giant carp, and then he would hold his breath till his neck swelled and his eyeballs well-nigh came out on to his cheekbones to see what the evolution was.

I enjoyed this for some minutes, meanwhile snooping about this way and that in the hope of seeing his keeper arrive. And then he spotted me. I declare he became normal on the instant. For he hastily dodged behind the boot-tree and reappeared toffed up in an emergency petticoat constructed from a copy of *La Libertad*, and shambled over to where I sat. I made room for him on the log and we chummed up. Here follows his story.


I SAT ON A LOG AND MEDITATED

Dodging Atmospherics.

"As you have seen me playing the goat, I ought to say at once that, far from being one of these 'back-to-nature' birds, I am just plain John Wadd, late of Hoxton. Five years ago I was a master-goldbeater with a turn for scientific hobbies. If the old dad hadn't died too soon I'd ha' been through Cambridge, but I had a good education. Up to a point. I was very hot on wireless, and had a receiving station which was the last word in science. It did everything except shut down automatically when the Leafield arc started up. But then, of course, it didn't need to. By the way, there's a Praying Mantis on your collar. My set, as I was saying, was the eel's eyebrows. The aerial was designed to dodge every known species of 'atmospheric,' the 'earth' took a professional miner seven hours to plant, and the safety switch embodied every dictum enunciated by the Instute of Insurance.

"The set itself was a marvel. It conformed to every theory, included every device known to popular journalism, and was pivoted at 13.392° clockwise to the angle of the earth's axis in relation to the—but we need not go into that. I may say, anyway, that I used to correct the angle with a doo-hickey specially designed by the Astronomer Royal.

"But somehow I felt discontented. True, my signals were strong. Once I nearly scalped a prominent divine by turning on Arlington while he was listening-in with me. And, of course, you know it was I that blew down the War Memorial at Hoxton with a badly tuned selection

The Self-Constructor.—

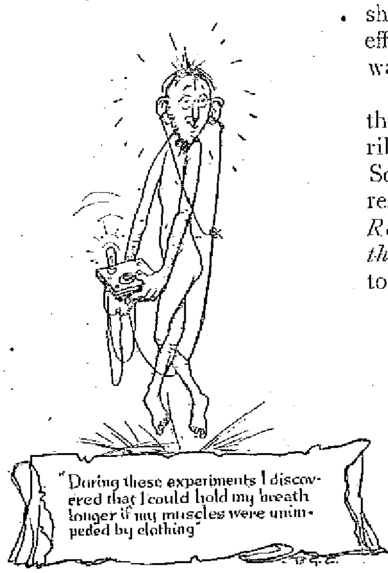
of signals from Lyons. It was not until I heard the strength and quality of the reception obtained by a neighbour's child with nothing more than a crystal detector made from domestic flotsam that I realised I was all wrong.

Working Backwards.

"'Simplicity, John, is the secret,' I said to myself. 'Work backwards and find rock bottom.' A bit mixed, but you get the idea. Excuse me! This is my time to eat my second banana."

(*Interval for mastication.*)

"In three months I had reduced my necessities to an aerial, a crystal, a pair of telephones, and an 'earth.' But I was not satisfied. How did I tune? Easy! I varied the fundamental wavelength of my aerial by means of a drum full of wire which unwound or was wound up and cut out by a switch. That switch nearly broke my spirit. It was so complicated!



"Then I dispensed with the 'earth.' I used to hold the earth wire in my mouth and stand in a muddy patch in the garden. Next I scrapped the outside aerial in favour of a contractile frame. Later on I learned to do without accurate tuning by contenting myself with weaker signals. So I had to build a sound-proof room for reception.

"One day a professional operator told me that in the early days of wireless he had often to hold his breath in order to hear faint signals. I adopted the practice and found it of immense service. Then he told me that shutting the eyes undoubtedly had the effect of sharpening the sense of hearing. He was right, for I gave it a trial.

"During these experiments I discovered that I could hold my breath longer if my rib muscles were unimpeded by clothing. So I stripped to the waist and got excellent results. Then the great idea assailed me. *Reduce to the lowest proportions and only the human factor will be left!* I had clearly to become a human receiver!

"I've wandered a goodish bit and have been arrested nineteen times for not wearing duds, and it was not until I got here that I could experiment in peace. But these bananas——!

"I'm hoping to use my body as an aerial and to stop my heart beating while I hold my breath. Sometimes I fancy I can hear signals from Panama, over the way, but—but excuse me! This is my time to practise heart-stopping. Very decent of you to have listened."

When I began to write this narrative I thought it was a moral story. Now I have forgotten what the moral is and am inclined to think it is only a Horrible Warning.

I'm not playing at wireless just now. Something safe and sane like White Mice or Cross Words seems to be indicated.

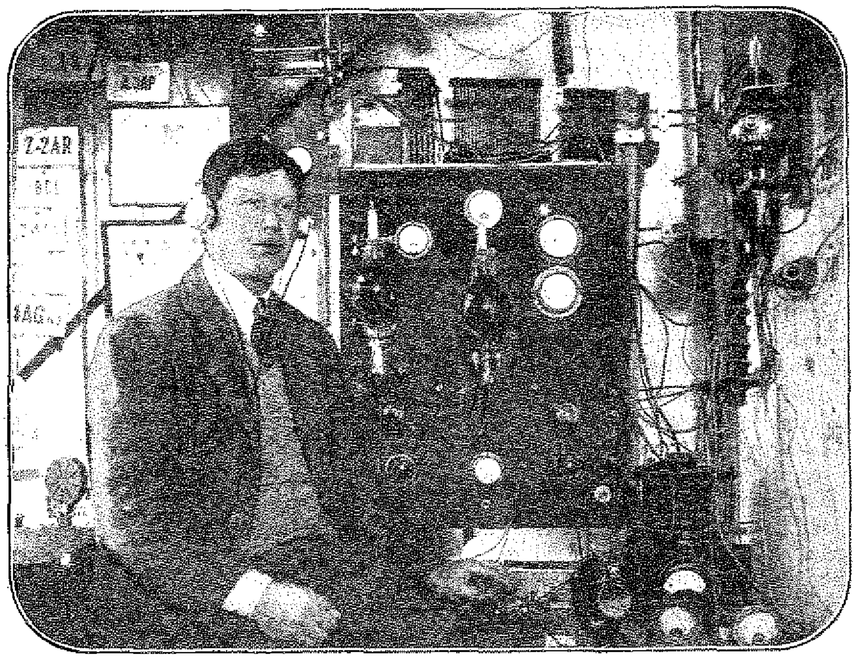
AMATEUR ACHIEVEMENT.

Another Feather in the Cap of 2NM.

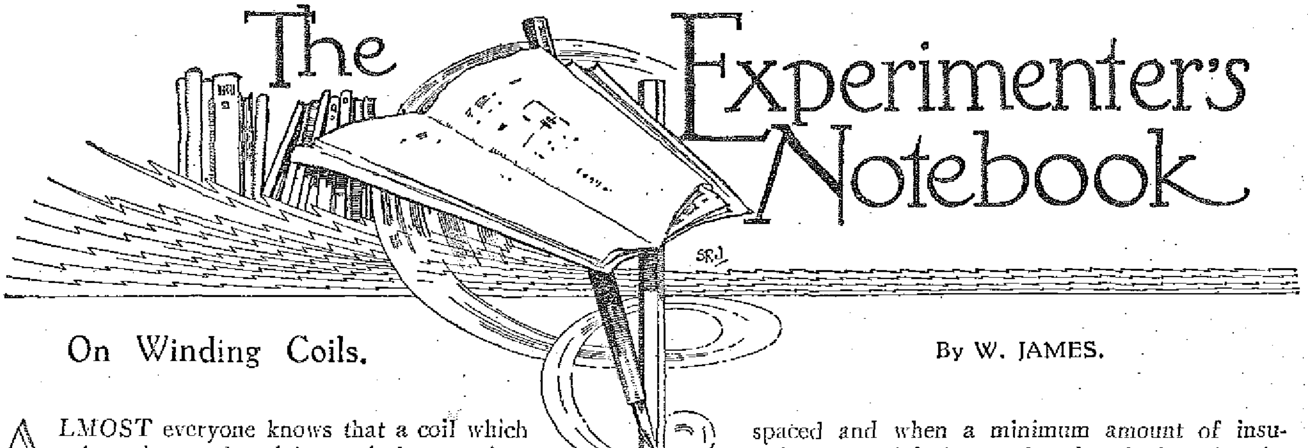
Mr. Gerald Marcuse (2NM) is probably one of the best known of British amateurs on account of his many successes in long-distance communication.

In addition to having worked with almost monotonous regularity with New Zealand and Australian amateurs, Mr. Marcuse has recently added to his laurels by maintaining two-way communication with SA-WJS, a portable station attached to the Rice Expedition now exploring the Amazon.

It is believed that the transmitter used by the Rice Expedition is only of 100 watts power, and that a petrol engine generator unit is the source of power. Under these circumstances reception with a two-valve receiver is yet another proof of the efficiency of short waves.



Mr. Marcuse with his transmitting apparatus.



The Experimenter's Notebook

On Winding Coils.

By W. JAMES.

ALMOST everyone knows that a coil which is to be employed in a wireless receiver with good results cannot be wound anyhow. It would not be productive of good results, for instance, to use a coil which is damp or has poor insulation, or one consisting of a number of turns of wire wound at random—just as one might wind an odd length of string. Such a coil, of course, would enable us to tune in a signal provided it had a suitable number of turns, but the signal would not be heard with the same intensity as when a well-designed coil is employed, neither would one expect the tuning to be sharp. Tuning would probably be flat, rendering it difficult to tune out the local broadcast station and bring in a more distant station with clarity and volume.

Coils for wireless purposes are therefore specially constructed with the object of giving maximum signal strength coupled with good selectivity.

Briefly, the desirable features of a coil are (1) low self-capacity, and (2) low high-frequency resistance.

(1) In general it may be said that a coil will have a low value of self-capacity when the turns of the coil are spaced and when a minimum amount of insulating material is employed—whether in the form of wrappings round the wire itself, or in the former employed to carry the turns of the coil.

(2) The high-frequency resistance of a coil may be kept at a reasonably low value by giving the coil a suitable shape, by using the minimum amount of insulating material in its construction, and by using a suitable size of wire. The best size of wire depends largely on the frequency of the oscillations to be carried by the coil, and also on the shape of the coil. For instance, the best gauge of wire for a well-spaced single-layer coil is not necessarily the best size to employ when the coil is wound basket-weave or duolateral fashion.

Basket Coils.

The basket type of coil is a favourite with amateurs, because of the ease with which they may be prepared at home, and because the efficiency of a well-made coil of this type is as high—if not a little higher—than that of other multilayer coils. One would not suggest that coils

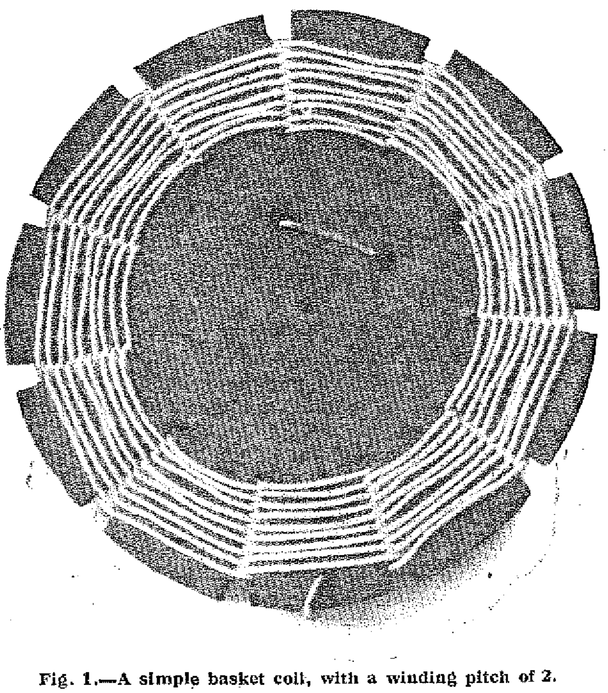


Fig. 1.—A simple basket coil, with a winding pitch of 2.

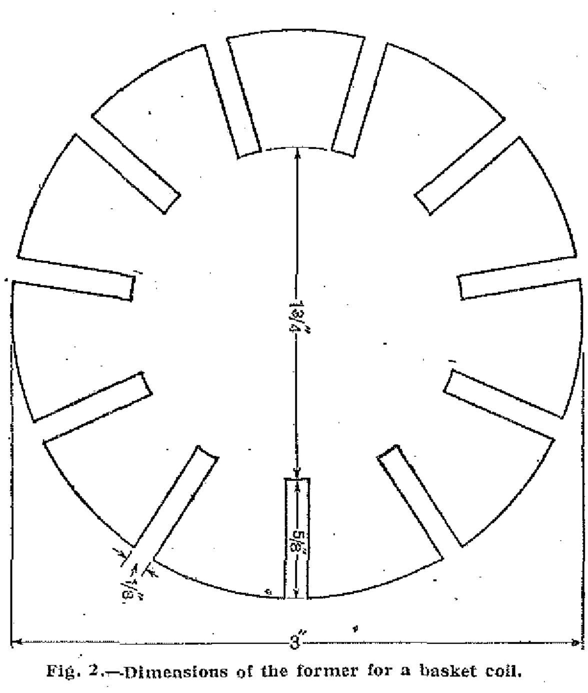


Fig. 2.—Dimensions of the former for a basket coil.

The Experimenter's Notebook.—

wound basket fashion have a higher efficiency than good single-layer coils, but they *are* easily made, occupy but little space, are suitable for use in any tuned circuit, and may be wound in a number of interesting ways.

The ordinary type of basket coil, with which all readers are probably familiar, is illustrated in Fig. 1. This coil has a prepared cardboard former of the dimensions given in Fig. 2. Its outside diameter is 3in., and there are eleven slots, each ⅝in. long and ⅛in. wide; the inside diameter is therefore 1¾in.

A fairly stiff cardboard is employed for this purpose; the projecting pieces will probably break off while the wire is being put on if the cardboard is too thin.

After the cardboard has been slotted, it is immersed in a bath of paraffin wax. This is not only to drive out the moisture in the cardboard, but to ensure that moisture shall not be absorbed during the life of the coil.

Relative Dimensions.

The relative dimensions of the former should be noted; the slots are one-third of the inside diameter in length.

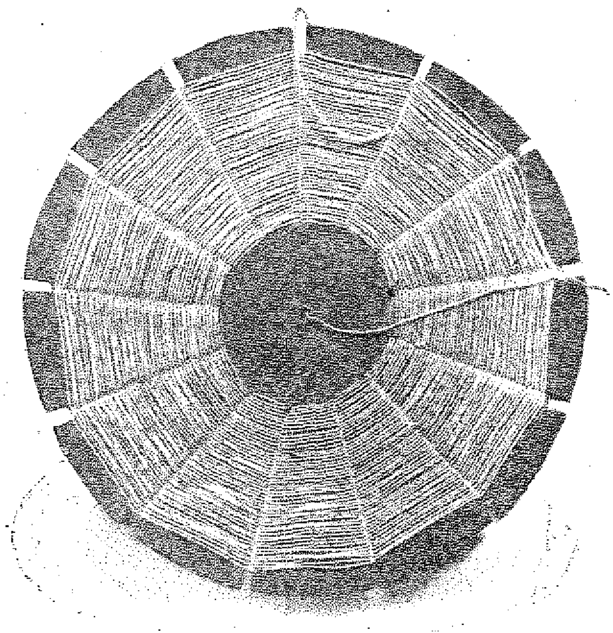


Fig. 3.—A badly proportioned basket coil. The winding is too deep compared with the diameter.

This is a good proportion, which (for broadcast wavelengths) results in the coil having a lower effective resistance for a given inductance than when the slots are relatively longer.

A badly proportioned coil is illustrated in Fig. 3. The inner turns of this coil are of small diameter, and therefore have only a small inductance compared with those on the outer edge. They do, however, add considerably to the effective resistance of the coil, and are therefore undesirable. A further objection is that it is difficult to wind such a coil without breaking off the projecting pieces of the former. In spite of these disadvantages, coils similar to this are to be purchased and are frequently used by amateurs. A coil having lower losses for a given inductance can be constructed on a former of the relative dimensions shown in Figs. 1 and 2.

Winding Basket Coils.

The simplest form of winding is that illustrated in Figs. 1 and 4. Fig. 4 represents an edge view of the former, which is supposed laid out flat to show the slots. To wind the first turn of the coil, fasten one end of the wire by passing it through two holes in the former and lay the wire through one slot, along the back of a pro-

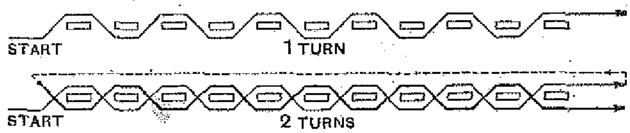


Fig. 4.—Winding of a simple basket coil having a pitch of 2.

jecting piece to the next slot, through this slot to the front of the former, along the projecting piece to the next slot, through this slot to the back of the former, and so on as indicated in Fig. 4, until one turn is wound. There is now one wire in each slot, and one wire along the front of one projecting piece, the back of the next, and so on round the former.

Proceed with the winding by putting on the second turn as indicated in Fig. 4. We have then a wire on the front and back of every projection, and two wires in each slot.

The coil is finished by winding as many turns as desired, and securing the end turn by tying it with thread, or by passing it through holes in the former.

As the wire appears on the face of the former after every second slot, the pitch of this winding is two. The number of turns in the coil is therefore equal to twice the number of wires counted on one face.

Reasons for the Special Winding.

The reasons for the special arrangement of the turns can be understood now that the construction has been described. In the first place, the turns are separated by the thickness of the former, except where they cross in the slots. Secondly, the layers are spaced a distance equal to the thickness of the wire. Hence the self-capacity of the coil is much less than it would be were the turns wound touching. However, the wires still touch where they cross in the slots. But the length of the wires touching can be made very small by employing narrow slots. The angle of crossing is then large.

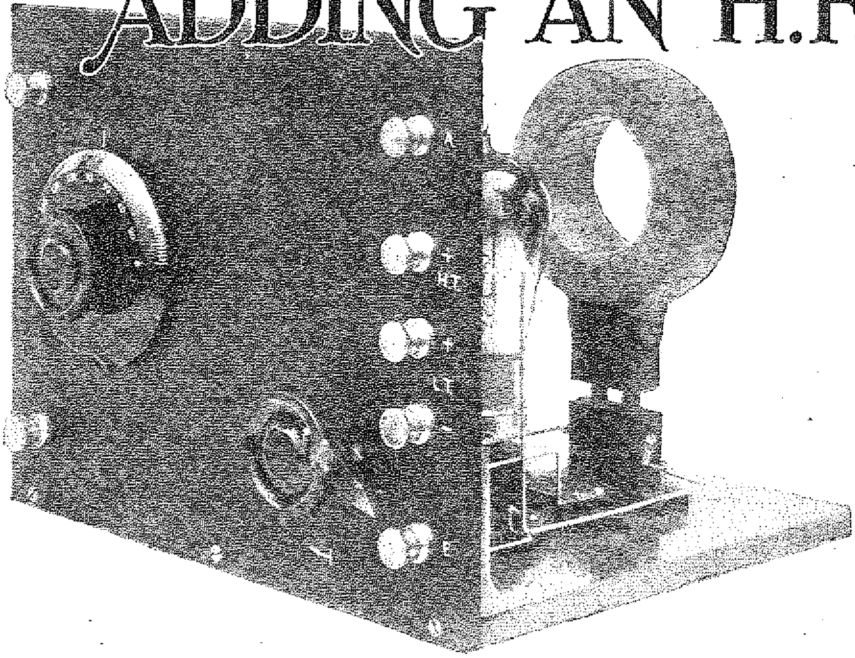
The inductance of a basket coil can be found from the formula :—

$L = \pi^2 d^2 n^2 lk \div 1{,}000$, where
L = the inductance of the coil in microhenries,
$\pi = 3.14$ and $\pi^2 = 9.86$,
d = the mean diameter of the coil in centimetres,
n = the number of turns per centimetre,
l = the length (or depth) of the winding in centimetres,
k = Nagaoka's factor, which may be obtained from a wireless book.[1] The value of k depends on the ratio of the diameter and the length.

An examination of this formula shows that the inductance increases with the *square* of the diameter of the coil, and also with the *square* of the number of turns.

[1] For instance, "Tuning Coils and Methods of Tuning," by W. James (2s. 6d. nett).

ADDING AN H.F. STAGE



It is usually necessary to rebuild a Receiver almost completely when adding a stage of High Frequency Amplification. The Unit described here, however, may be added to an existing Set with the same ease as a Note Magnifier.

By R. HARRISON.

It is quite an easy matter to add a note magnifier to a crystal or valve receiver. One simply connects the telephone terminals of the set to the input terminals of the amplifier, and transfers the telephones or loud-speaker to the output terminals. A high frequency amplifier, however, must be connected between the aerial and the receiver. The amplifier to be added must therefore either contain a tuner for tuning the aerial, or be connected between the tuner of the existing receiver and the first valve (or the crystal). Obviously, it is preferable so to design the apparatus that it may be joined in circuit simply by connecting it to the aerial and earth terminals of the existing set.

The unit described here is designed on these lines, the tuner of the existing set being employed as the coupling of the high frequency amplifier. The diagram of Fig. 1 shows the connections of the H.F. unit. A plug-in coil and a variable condenser are employed to tune the aerial circuit. One end of the circuit is connected to the grid of the H.F. valve, and the other end to a terminal marked "To earth terminal of set." This terminal is joined to the earth terminal of the existing set, which in the majority of receivers is connected to L.T. negative. If the existing set has its earth terminal connected to L.T. negative, the earth connection on the H.F. unit could be permanently joined to the L.T. negative, and the terminal marked "To earth terminal of set" dispensed with. In some sets, however, the earth is connected to L.T. positive. It is therefore better to wire the H.F. unit exactly as indicated, when it may be added to any set, regardless of how the earth and the L.T. battery are joined.

In the anode circuit of the H.F. unit is an untuned choke coil, which may be of the usual plug-in type. The size of this coil is not critical. A No. 300 Igranic coil has been found to give good results, although a coil of another type, having an equivalent inductance, may of course be employed. A fixed condenser is placed between the anode of the valve and the terminal marked "To aerial terminal of set," and carries the high frequency currents to the tuner on the existing set. The value of this condenser is not critical. It may have a value of 0.002 microfarad. One of the objects of this condenser is to prevent the flow of steady current from the H.T. battery, and it is therefore important that it should be a good one. If leakage occurs, the normal voltage of the grid of the detector valve may be altered and thus

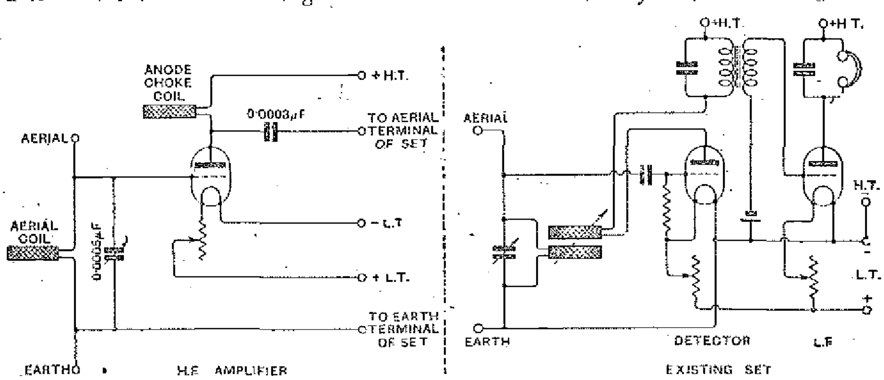


Fig. 1.—The connections of the H.F. unit, and those of a typical set having a detector and note magnifier. To connect the H.F. unit to the set connect the terminals marked "To aerial terminal of set" and "aerial"; "To earth terminal of set" and "earth"; H.T.+, to the H.T. battery, and connect the L.T. terminals to the filament battery. The aerial and earth should be joined to the respective terminals of the H.F. unit.

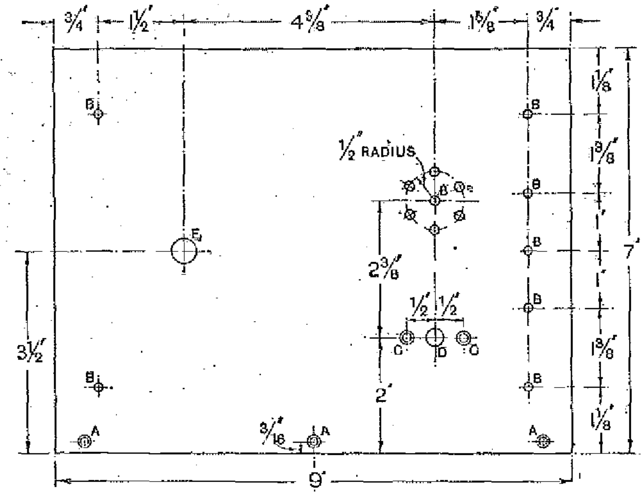


Fig. 2.—Drawing of the ebonite panel, showing the position and size of the holes. A = ⅛" dia. and countersunk for No. 4 wood screws; B = 9/32" dia.; C = 5/32" dia., and countersunk for No. 4 B.A. screws; D = 9/32" dia.; E = 7/16" dia.

the signal strength may be very appreciably reduced. It will be seen from Fig. 1 that the aerial circuit of the existing set is now used to tune the anode of the H.F. valve. When the two circuits are in tune, amplified high frequency currents will be applied to the grid of the detector valve. To tune to a given wavelength, the condenser of the existing set will have to be set to a higher reading than when the H.F. unit is not employed, owing to the fact that the circuit has not now the capacity of the aerial across it.

In those sets where regeneration is used, such as in the set connected as in Fig. 1, it will be found necessary to employ a somewhat smaller reaction coil than usual. It is not, however, necessary to reverse the connections to the reaction coil when adding the H.F. unit, as is usually the case when one stage of H.F. is added. This is, of course, a real advantage.

When it is desired to obtain regeneration with the H.F. unit attached to a simple crystal set, the tuning coil of the crystal set may be coupled to the aerial coil of the H.F. unit.

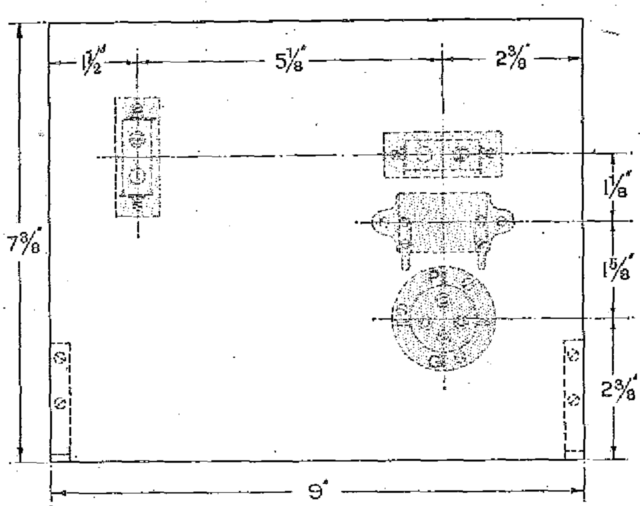


Fig. 3.—Layout of the parts on the base board.

Construction.

The appearance of the unit may be seen from the photographs, and Figs. 2 and 3 give the layout of the panel and the base.

The parts required for the unit are as follow:—

1 Ormond filament resistance.
1 Burndept valve holder (batten type).
2 Plug-in coil holders.
1 Igranic plug-in coil, No. 50, for the broadcast wavelength.

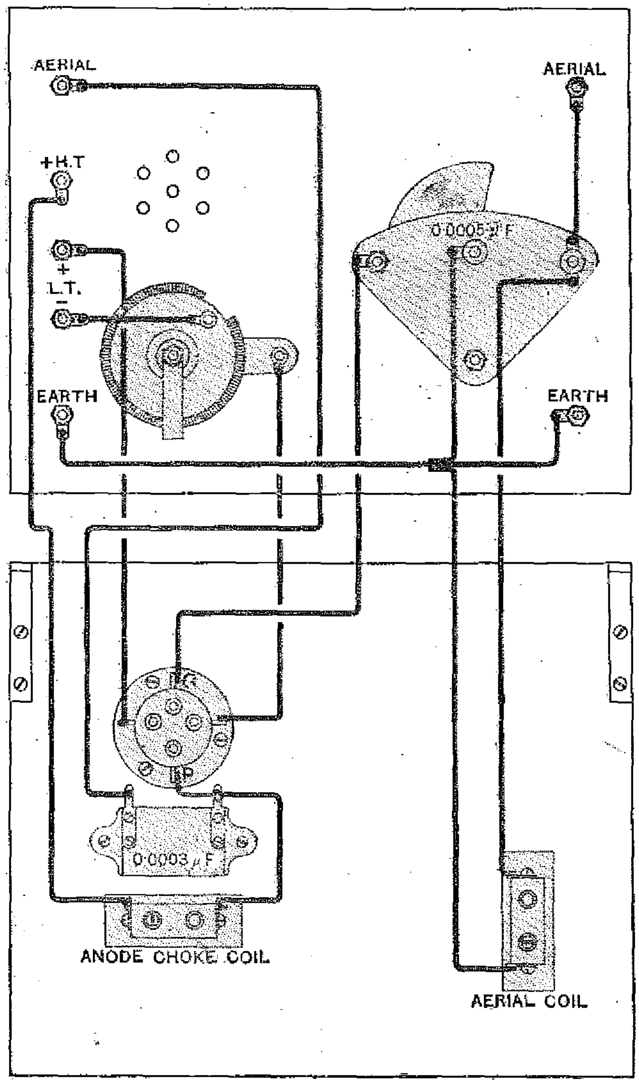


Fig. 4.—The wiring connections of the unit.

1 Igranic plug-in coil, No. 300, for the anode choke.
1 Dubilier fixed condenser, capacity 0.002 microfarad.
1 Jackson Bros. variable condenser, capacity 0.0005 microfarad.
7 Terminals.
1 Piece of mahogany for the base, measuring 9in. × 7⅜in. × ⅜in.
1 Ebonite panel measuring 9in. × 7in. × ¼in.

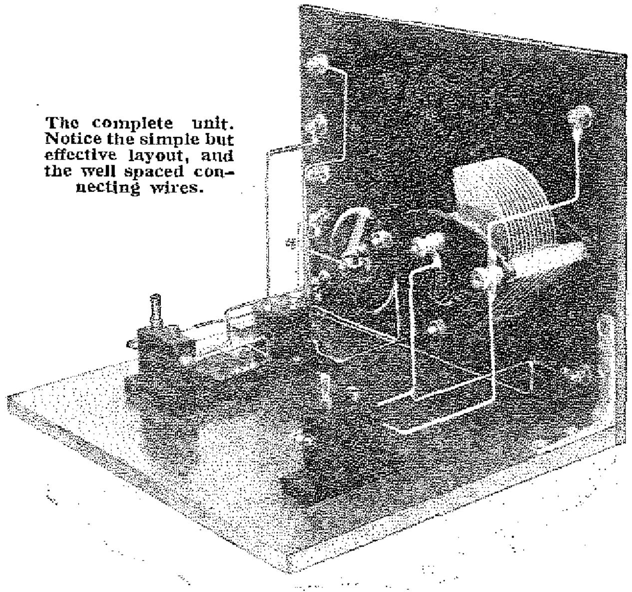
A few screws, and a length of No. 16 tinned copper connecting wire.

Adding an H.F. Stage.—

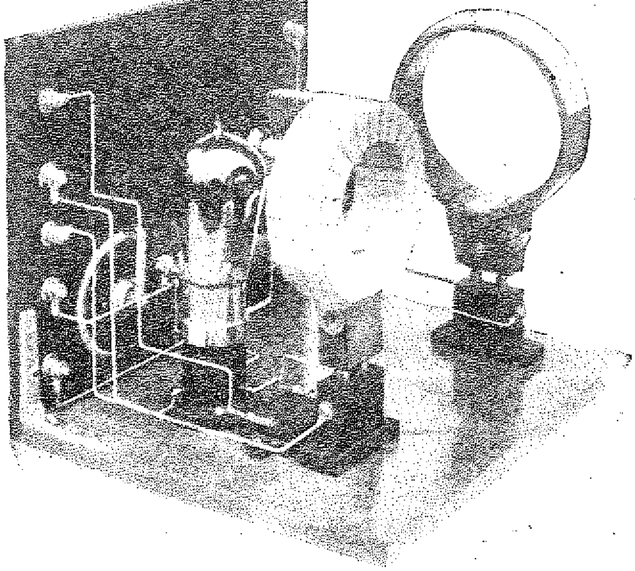
It will be seen that mounted on the panel are a variable condenser, a filament resistance, and the terminals. Mounted on the wooden base is the valve holder, the fixed condenser, and two plug-in coil holders. The position of these parts is clearly shown.

It will be observed that the coil holders are mounted at right angles, in order that there should be no interaction between the coils mounted in them.

The panel and base are held at right angles by two small brackets, and by wood screws passed through the lower edge of the ebonite panel into the edge of the base.



The complete unit. Notice the simple but effective layout, and the well spaced connecting wires.



A view of the H.F. unit. The coil by the side of the valve is the anode choke; the smaller coil is the aerial tuning inductance.

Fig. 4 gives the wiring connections which are few and easily wired. Tinned copper wire should be employed, and the lengths carefully bent to shape, in order that the wiring shall be well spaced.

The method of connecting the unit to a valve receiver is indicated in Fig. 1. To connect the unit to a crystal receiver, the aerial and earth terminals of the set are joined to the terminals marked "To aerial terminal of set," and "To earth terminal of set." The H.T. and L.T. batteries are, of course, connected to the terminals as indicated by the lettering.

AN INTRODUCTION TO WIRELESS

THE wireless beginner, however great and numerous his difficulties, cannot to-day complain that he is uncared for and forgotten. There is no shortage of teachers, and in spite of its continuous and varied development, the number of elementary books on the subject has grown to such an extent as to make original treatment a matter of difficulty. It is all the more to Mr. Risdon's credit, therefore, that he has succeeded in producing a volume* which not only covers the ground very comprehensively, but in a manner calculated to interest both the beginner and the rather more advanced reader. This, in itself is an original achievement.

The book has the valuable support of Dr. J. A. Fleming, F.R.S., who contributes an admirable introduction in the form of a general survey of wireless development up to the present day.

Mr. Risdon's earlier chapters, which are devoted to the needs of the beginner, discuss the ether theory, elementary principles of electricity and magnetism, and the phenomena of electric currents. The chapter on the discovery of the electron, however, will probably interest all readers, being based on an interview between the author and Sir Joseph Thomson, in which the latter gives an absorbing account of his early experiments with cathode tubes culminating in the advancement of the electron theory. The pages following deal with the generation and detection of electro-magnetic waves, the principles of the valve, and the arrangements of receiving circuits. High and low frequency amplification are next elucidated, after which the reader is introduced to wireless in practice. Space forbids reference to all the wireless activities touched upon, but among the most interesting chapters we may mention those dealing with beam transmission, short wave telegraphy, wireless time signals, television and *telepathy*. In regard to the last-named, Mr. Risdon goes so far as to say that there is no technical reason why the extent of one's varying emotions should not be wirelessed to the ends of the earth. May we hope that this is an exaggeration?

The only palpable loophole for criticism in Mr. Risdon's book is a certain irrelevancy in the arrangement of chapters, which do not all follow a logical sequence.

The book can be recommended to those who are seeking a pleasantly written and well-illustrated introduction to a subject upon which no one can afford to remain in ignorance.

E. C. T.

*"Wireless." By P. J. Risdon, F.R.S.A., with an introduction by J. A. Fleming, M.A., D.Sc., F.R.S. (London: Ward, Lock & Co. Ltd., Salisbury Square, E.C.4. 432 pages. Profusely illustrated. Price, cloth, 6s. net.)

NEWS from the CLUBS

Secretaries of Local Clubs are invited to send in for publication club news of general interest. All photographs published will be paid for.

Manchester Radio and Scientific Society.

A lecture in the form of a reply to an imaginary question: "What is a condenser?" was given on January 28th by Mr. Philip R. Coursey, B.Sc., F.Inst.P. The audience thoroughly enjoyed Mr. Coursey's skilful answer to a question which is not so simple as appears at first sight.

Applications for membership of the Society should be addressed to the hon. secretary, Mr. Geo. C. Murphy, of Meadow View, The Cliff, Hr. Broughton, Manchester.

Kentish Town and District Wireless Society.

A feature of this Society is that no *subscriptions are levied for membership.* Practical classes are held and lectures are given every Monday evening from 7.45 to 9.45 at the L.C.C. Men's Institute, Carlton Road. The hon. secretary is Mr. Frank Phillipot.

Northampton and District Amateur Radio Society.

"Weather and Wireless" was the title of a fascinating lecture given before the Society on January 19th by Mr. H. L. Lewis. The speaker said that we were so accustomed to hearing daily weather forecasts broadcast that we ought to know something of how these forecasts were obtained. A knowledge of the atmosphere was first necessary. Mr. Lewis dealt interestingly with the shell of air surrounding the earth. Depressions, cyclones, and anti-cyclones were next dealt with, and the lecturer exhibited many maps illustrating typical pressure distributions over Europe and the Atlantic.

The Society has accepted with much regret the resignation of Mr. S. H. Barber from the post of vice-chairman. The position is now filled by Mr. R. G. Turner.

New Society for Hampton, Middlesex.

An endeavour is being made to form a new radio society at Hampton, Middlesex, and it will be appreciated if all those interested in the proposition will kindly communicate with Mr. G. Douglas Ash, of Maristow, Wensleydale Road, Hampton.

North Middlesex Wireless Club.

On January 21st Mr. A. S. Manders delivered an instructive lecture on "A Low-loss Tuner." Dealing with the ever-present question of efficiency, Mr. Manders outlined the heads under which losses generally occur. He laid stress on the paramount importance of a low resistance aerial and earth system. The principal topic of the paper was, however, the construction of low-loss inductance coils. In the lecturer's opinion too much importance cannot be attached in short wave work to the question of resistance and self capacity, and he explained with the actual coils as ocular demonstration how he had reduced these undesirable factors to a minimum. Mr. Manders uses an unusually heavy gauge wire (16 S.W.G.), and prefers it to be double cotton-covered for the sake of the extra spacing afforded.

The ordinary plug and socket coil holders came in for some unfavourable criticism, being described as "splendid fixed condensers" and therefore undesirable additions to the self capacities of the coils.

Applications for membership should be addressed to the hon. secretary, Mr. H. A. Green, 100, Pellatt Grove, Wood Green, N.22.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 11th.

Manchester Radio Scientific Society.—Lecture: "Cutting Out Manchester." By Mr. J. A. Peters.

Streatham Radio Society.—Annual dinner.

Radio Research Society, Peckham.—Lectures: "Distortion." "Resistance in Wireless Circuits."

THURSDAY, FEBRUARY 12th.

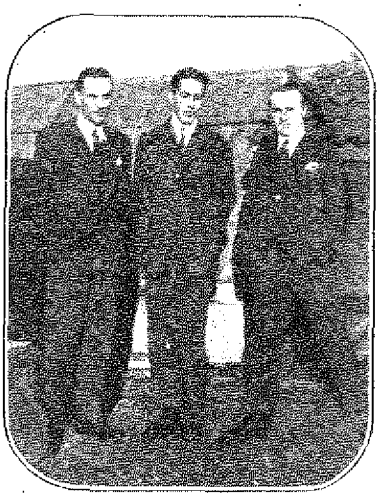
Luton Wireless Society.—At 8 p.m. At the Hitchin Road Boys' School. Experiment and demonstration for beginners.

FRIDAY, FEBRUARY 13th.

Sheffield and District Wireless Society.—At 7.30 p.m. At the Department of Applied Science, St. George's Square. Lecture: "Capacity." By Mr. S. R. Pritchett.

MONDAY, FEBRUARY 16th.

Dorking and District Radio Society.—At 7.45 p.m. Members' evening with apparatus.



Italy, Denmark and Britain. An interesting snap showing (left to right): Mr. Giulio Salom (Italian 1MT), Mr. Cohet (Danish 7EC), and Mr. J. E. Partridge (G2KF). The photo was taken at 2KF during a recent visit of the Continentals to this country.

TRANSMITTING NOTES.

The past week has been remarkable for the signal strength of the American and Canadian amateurs. In fact, at times it has been painful to keep the 'phones on the head while listening to the American 1st district transmitters. Curiously enough, these signals increase in strength after sunrise, and 4SA (Porto Rico) came in at tremendous strength on two valves at 9 a.m. on Sunday, February 1st.

The number of Americans and Canadians operating on the 70-85 metres band is so great that it is literally impossible to pick them out. 20D was wise in listening on 65 metres, for he managed to pick up our friend in Buenos Aires, Senor Braggio (CB8), whose patience in battling with electric storms has at last been rewarded.

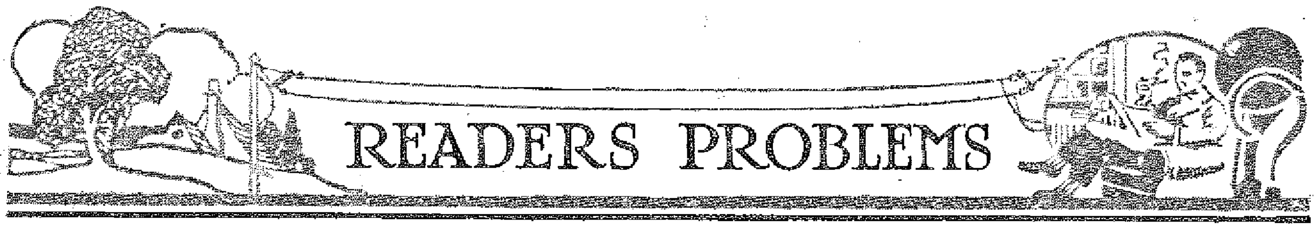
Next week it is hoped to publish the cost in connection with the projected trip to Paris in the spring for the International Amateur Conference, and the writer will be glad to hear from more amateurs who intend to join the party. It is expected that about 60 American and Canadian amateurs will be coming over to England after the Paris event, and an opportunity is given us to entertain them in the true British spirit. Being a poor society, however, we have decided to open a subscription list. An appeal is therefore made for support of this fund. No amount will be too small or too large.

An endeavour is also being made to arrange a convention in London following the Paris event, and we hope that all amateurs interested will join in.

The T. and R. Committee is now drawing up a scheme for keeping in touch with the various districts in England, and we hope in a day or two to circulate the new traffic arrangements to all members.

All communications relating to the above points should be addressed to

GERALD MARCUSE (2NM),
Hon. Secretary, T. and R. Section,
Radio Society of Great Britain,
53, Victoria Street, S.W.1.

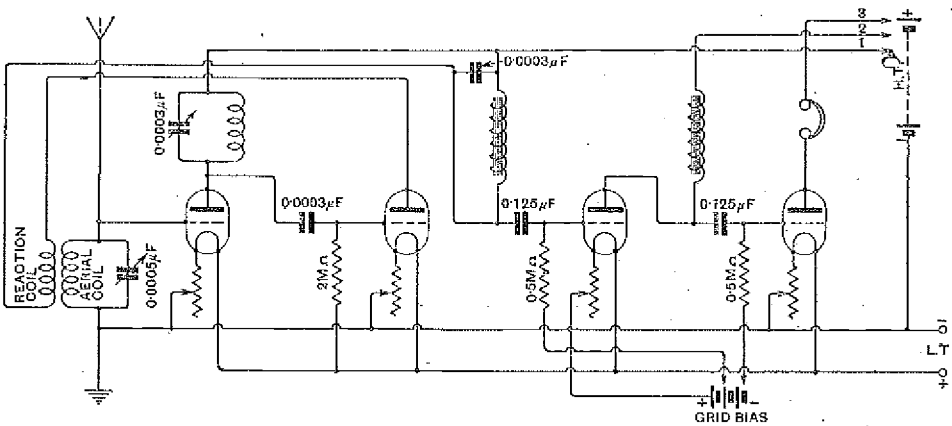


Readers Desiring to Consult the "Wireless World" Information Dept. should make use of the Coupon to be found in the Advertisement Pages.

A Choke-Coupled Four-Valve Set.

A READER living seventy miles from the nearest main B.B.C. station has written to ask us what, in our opinion, is the best all-round set he can construct to fulfil his requirements, which are as follows :—The set must be capable of giving full loud-speaker strength on at least one of the B.B.C. stations and in addition attention must be paid to the quality of reproduction. He specifies also that the set must be sufficiently selective to enable him to separate the various stations, but must at the same time be simple to operate.

We give below a diagram of a receiver which, if carefully constructed, should fulfil all our correspondent's requirements. The conventional form of H.F. and detector circuit is given, since in our opinion this will best meet our reader's conditions of sensitivity, selectivity, and ease of control. Choke coupling is the method we have adopted in the L.F. amplifier, since we have found that this gives a marked increase of tonal purity over transformer coupling, whilst at the same time it does not call for any increase in the H.T. battery value.



Connections of a four-valve receiver with one H.F. valve detector and two L.F. stages. The H.F. stage is tuned anode coupled, and the L.F. stages are choke coupled.

We recommend that, for maximum purity, the value of the coupling condensers be not less than that which we have assigned to them. Attention is also drawn to the grid leaks, which should not be of higher value than is indicated. The chokes require to have a very high impedance, and they should be wound to have an inductance value of 100 henries or more. A transformer with its primary and secondary connected in series does very well in this position. If the impedance is too small the higher musical frequencies will be accentuated at the expense of those lower in the scale, a form of distortion which is also noticeable if the coupling condensers are made too small.

o o o o

The Position of the Aerial Downlead.

IN a letter which we have received from a correspondent he asks whether it is absolutely essential that the downlead of a T type aerial be taken from the exact centre.

In order to obtain the best results from an aerial of this description, it is essential to take the downlead from the electrical centre, otherwise the fundamental wavelength of each of the two horizontal arms will be unequal, with the result that the whole aerial system will tend to oscillate at two separate frequencies simultaneously, and flat tuning will result. In the case of an aerial erected between two posts in an open field, the electrical centre of the horizontal portion will be coincident with the geometrical centre, but with aerials erected in the vicinity of buildings, tall trees or similar objects, the electrical centre will in many cases be considerably displaced. It is therefore necessary when erecting an aerial of this description to experiment considerably with temporary aerials before the position of the downlead of the permanent aerial is decided upon. Similarly, when erecting parallel wire aerials, care must be taken that the electrical constants of each wire are similar. In the case of aerials erected well clear of surrounding objects, this can easily be effected by making the two wires of equal dimensions, but often when an aerial of this type is erected with one wire nearer to a wall or other object than the other, the electrical constants of the two wires will differ although they are of equal dimensions. The single-wire inverted L type of aerial gives good results for ordinary short and medium wave reception.

o o o o

Charging Accumulators from D.C. Mains.

MANY readers have written to us seeking advice as to the best method of charging their accumulators from the house electricity supply.

In the case of houses whose supply is A.C. some form of rectifier will, of course, be necessary. When the supply is D.C., however, the matter is greatly simplified, all that is necessary being that a resistance of suitable value, according to the charging rate of the accumulator and the voltage of the mains, be inserted in series with the mains and the accumulator. Assuming the accumulator to be of the 30 ampère-hour type, it will have a charging rate of about 2.5 amps., and at this rate will take at least 14-15 hours to charge fully. In order to obtain a current of 2.5 amps. from the usual 240-volt mains it is necessary to use about ten 60 watt lamps in parallel. A more convenient method is to use an electric heater whose current consumption is approximately 2.5 amps. A point frequently overlooked, however, by the average householder desirous of utilising his mains in this way is the cost of charging in this manner. Assuming that the cost of electric current is 7d. per unit, it is quite obvious that the cost of charging will be nearly 5s., which is, of course, prohibitive.

A second method is to place the accumulator in series with the mains at the meter so that all current supplied to the lights of the house passes through the accumulator. The charging process then costs nothing, the power consumed being paid for by a scarcely perceptible dimming of the lamps of the house. This process is, however, very slow except in

Readers' Problems.—

houses where many lights are used. In the average small household it would take about thirty continuous hours' charging, or, allowing six hours per day, it would be five days before the accumulator was ready for use again. In places using a large number of lights this method is, of course, ideal. In houses using electric apparatus for cooking or heating the problem solves itself, as the current supplied for this purpose is only charged up at about 25 per cent. of the cost of current for lighting purposes.

In certain instances it may be desirable to install a small motor generator of the type specially designed for accumulator charging. Such machines do not require skilled attention, and may be safely left on during the night.

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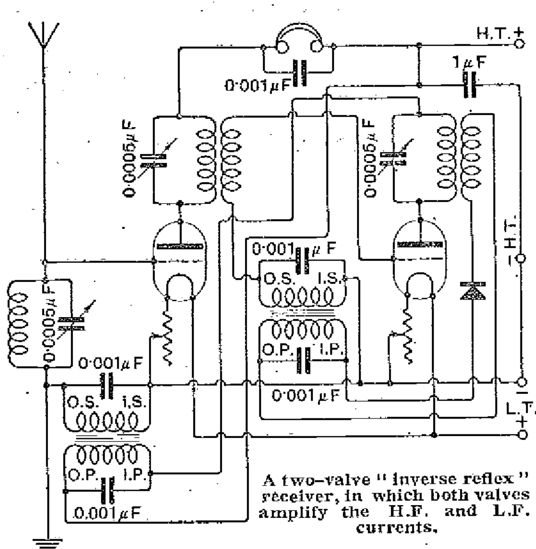
A Reflex Circuit in which both Valves Act in a Dual Capacity.

A READER asks what is meant by the inverse method of reflexing valves, and what are its advantages, if any.

In ordinary two-valve reflex sets, when both valves are used as dual amplifiers, it is customary to amplify at high frequency by means of the usual cascade connection, and then, after rectification by a crystal, to pass the received signals back to the beginning of the amplifier once more, and through both valves at low frequency in the same order as when they passed through at high frequency.



A two-valve "inverse reflex" receiver, in which both valves amplify the H.F. and L.F. currents.

In inverse reflex or inverse duplex circuits (as they are frequently called), however, the low frequency pulses travel through the amplifier in the reverse direction to the high frequency impulses. That is to say, they are first amplified at low frequency by the second valve, and then passed on to the first, the telephones being in the anode circuit of the first valve. In this way the load on the valves is more evenly distributed. The second valve which handles the largest amount of H.F. now handles the lowest amount of L.F., whilst in the first valve things are similarly reversed.

This circuit has had a great vogue in America, it being claimed that it is far more stable and easily controlled than the ordinary form of reflex circuit. The most popular of these circuits is known as the "Grimes Inverse Duplex," but there have been many variants of this.

We give below a two-valve crystal circuit embodying the inverse principle.

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Wood as an Insulator.

FROM time to time we receive enquiries regarding the suitability or otherwise of wood instead of ebonite for receiving set panels.

Wooden panels for receiving sets will be found to be quite efficient when certain precautions are taken. Provided a hard wood is used, such as oak or mahogany, and that it is well dried, no leakage effects will occur. Indeed, provided that it is very carefully dried, it will usually be found, if actual tests are made with a "megger," that the insulation of the wood is superior to many grades of ebonite that are on the market. Great care, however, must be taken to avoid the use of soft wood, such as satin wood, whose specific resistance is very low and when hard wood is used it should be carefully dried. Many amateurs make the mistake of heating the wood for a comparatively short period in front of a fire. The only effect of this is to raise the outside of the wood to a very high temperature, and in many cases to scorch it, and the moisture in the interior is scarcely affected. The correct method is to bake the wood over a prolonged period in an oven of moderate temperature. It can then, whilst still warm, be dipped into molten paraffin wax. If these precautions are observed, no fear need be entertained in using wood in place of ebonite.

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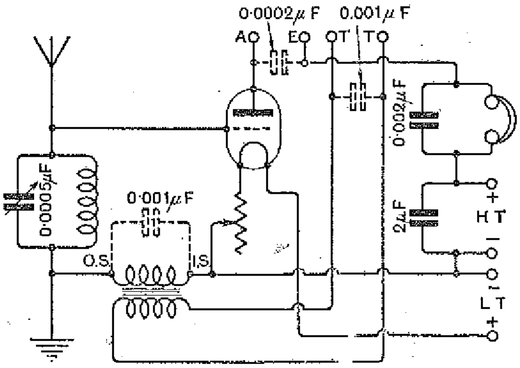
A Dual Amplifier for Adding to Crystal Receivers.

A READER living within easy crystal range of both 2LO and the high-power station (5XX), and hitherto able to receive either station at will, asks us to suggest suitable apparatus for adding to his crystal set, in order to obtain better results.

The simplest apparatus which it is possible to add to an existing crystal set is a transformer-coupled one valve amplifier, which will have the effect of considerably increasing signal strength, and will add slightly to the range of the set. If we amplify at high frequency before rectification by the crystal, we shall increase range very considerably, but the volume will still leave much to be desired, and an L.F. should be added also. We can, however, avoid the use of two valves by constructing a dual unit in accordance with the diagram given below. It is now only necessary to couple the aerial and earth terminals of our crystal set in the correct position in the anode circuit of the valve, the telephone terminals of the crystal set going to the primary of the L.F. transformer in the dual unit. We connect terminals A and E to the aerial and earth terminals of the crystal set, and terminals TT to the



A single-valve dual unit which may be added to a crystal receiver to give H.F. and L.F. amplification.

telephone terminals. It will be seen that the tuner of the crystal set now acts as the tuned anode circuit of the valve. The aerial coil of the dual unit is of the plug-in type, and so the wavelength range obtainable is entirely governed by the tuning constants of the crystal set. No alteration is needed in the crystal set unless (as is very unlikely) it is fitted with a *series* tuning condenser, when it will be necessary to connect this condenser in parallel with the coil.

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Bye-pass Condensers on Long Wavelengths.

WHEN designing a receiver employing one of the usual type of "straight" circuits, it is customary to shunt the primary of the first transformer with a fixed condenser of about .001 µF capacity. The purpose of this is to bye-pass the H.F. component of the current flowing in the anode circuit of the detector valve, and it will be found very beneficial in securing a smoother control of reaction, and will tend to increase the stability of the set. The capacity usually recommended is quite suitable for all ordinary wavelengths, but when attempting to receive long-wave Morse on 5,000 metres or more it will be found that this value is not nearly large enough to bye-pass the H.F. currents, and it is necessary to increase the capacity of this condenser very considerably. When the correct value is used a marked increase in stability will be observed.

The Wireless World AND RADIO REVIEW

No. 288. WEDNESDAY, FEBRUARY 18TH, 1925. VOL. XVI. No. 2.

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Editorial Offices: 139-40, FLEET STREET, LONDON, E.C.4 - Telephone: City 4011 (3 lines).
Advertising and Publishing Offices: DORSET HOUSE, TUDOR STREET, LONDON, E.C.4. - Telephone: City 2847 (13 lines).
Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street. Telegrams: "Cyclist, Coventry." Telephone: 10 Coventry.
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MANCHESTER: 199, Deansgate. Telegrams: "Iliffe, Manchester." Telephone: 8970 and 8971 City.

Subscription Rates: Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries abroad, £1 3s. 10d. per annum.

RESPONSIBILITY FOR WIRELESS CONTROL.

FOR many years now the responsibility for the control of wireless in this country has been vested in the Post Office. The Post Office has accepted the responsibility, and, having done so, has placed itself in the position of having to show either that it is competent to carry out the duties so imposed, or else to acknowledge that its administrative efforts in this direction have failed.

The Post Office has had a free hand with the advice of experts in every branch of the subject at its disposal in addition to a permanent technical staff. Apart from these facilities, the Post Office can also, at any time, set in motion the necessary machinery for appointing a special Parliamentary Committee to assist or advise on particular points. No such Committee has been appointed, and one is therefore encouraged to believe that the Post Office feels satisfied with the way in which it has controlled and regulated wireless in this country. The Post Office may like to adopt this complacent attitude, but it is doubtful whether the public, and in particular those sections of the public which make use of wireless, are equally satisfied with the state of affairs to-day.

Just recently we drew attention in this journal to the growing disturbance resulting from oscillation by receiving sets, and we mentioned that in our opinion the Post Office authorities, although they had made a bold bid to control the evil in the early days of broadcasting, had now given up the attempt. A feeble regulation still states that receivers must not be used in such a way as to cause interference through re-radiation, but the absence of any definite effort on the part of the authorities to see that this regulation is enforced is glaring evidence of their inability to solve the problem.

After broadcasting had been in operation in this country for a short while, various problems presented themselves for solution, and a committee was set up to enquire into the matter and recommend remedies.

We feel constrained to ask how it is that the present problem, which is fast becoming a menace to the broadcasting enterprise as a whole, is allowed to go on without any steps being taken to meet the situation, except what are virtually unofficial endeavours made by the Broadcasting Company itself assisted by the purely voluntary co-operation of the wireless societies.

Has the Post Office, in spite of the fact that it is the responsible authority which should deal with the matter, definitely given up the task, and, if so, how is it that it escapes the public criticism which would have been launched at any other Government Department which had failed to cope with responsibilities entrusted to it?

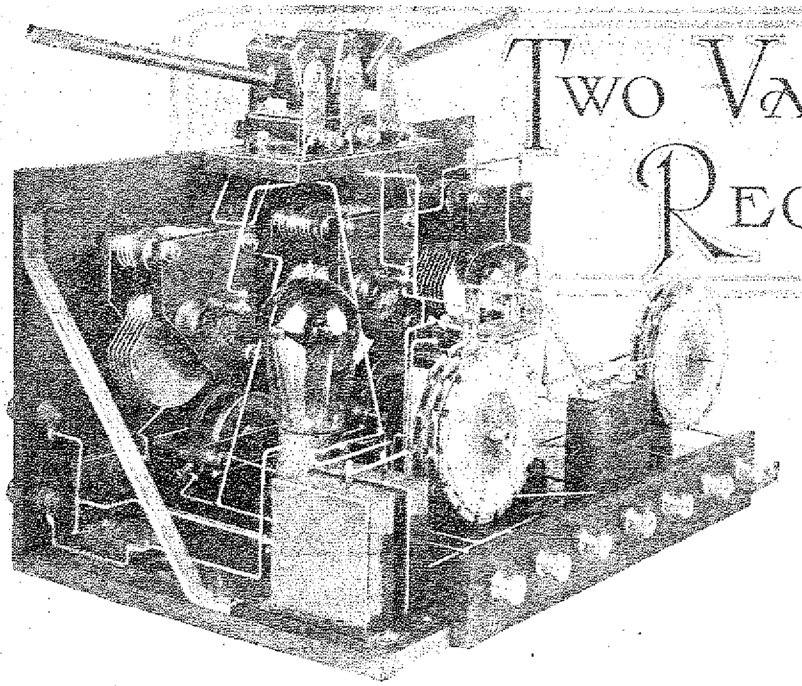
It is to be hoped that as soon as possible the proposals for new legislation which it is understood will shortly come before the House will receive wide publicity and that no effort may be spared to obtain a full discussion on the matter and the assistance of technical opinion, with the object of re-establishing the whole question of the control of wireless on a satisfactory and permanent basis.

THE AMATEUR'S POSITION.

IT is becoming increasingly difficult for the amateur to hold his own against the criticism launched at his activities by other wireless interests which are not inclined to concede to him a place in the ether.

It must not be forgotten that the mere fact of building a receiver is an indication of an interest in wireless which will result in the acquisition of technical knowledge in a very short time. On the other hand, those who buy complete sets usually have no interest in wireless beyond the reception of programmes, and consequently may continually cause interference by allowing their receivers to oscillate without even recognising that they are producing any disturbance.

This is only one of the directions in which those who wish to curtail the privileges of the amateur can make an attack, which, however unfair, may yet do much harm to the position of the amateur unless the unfairness is exposed.



Two Valve Reflex Receiver.

The set described here is particularly recommended because it is easy to operate, is selective, and gives good volume. With the help of the large coloured wiring diagram, which has been printed on a separate sheet and inserted in the magazine, the reader should find wiring a pleasant task.

By W. JAMES.

Introduction.

IN this receiver we employ two valves; the first amplifies the high-frequency currents received by the aerial, the second rectifies or detects them, and the resulting low-frequency currents pass through the first valve and are magnified.

The underlying principle is illustrated in Fig. 1, which will serve to give a picture of the process. We see that the H.F. currents (represented by a full line) are applied to the first valve; there they are amplified, and pass to the second valve—the detector. Out of the detector we get the low-frequency or speech currents (represented by a broken line), which pass back to the first valve, are strengthened, and then actuate the telephones.

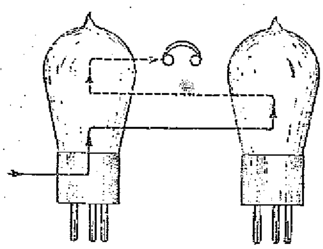


Fig. 1.—The reflex principle.

Reflex receivers are not new—probably as many commercial reflex sets are in use by the public to-day as sets constructed on any other principle. Not all "home constructors" favour reflex sets, however; a good deal of publicity, perhaps, unfortunately, has been given to sets of this class, with results not altogether satisfactory. The lucky ones have secured the results to be expected of reflex sets, and are enthusiastic over them, but there are others who were less fortunate.

One can have every confidence in reflex sets, provided they are properly designed. The satisfactory results which are obtained with this set may be repeated by anyone who carefully follows the instructions regarding the components employed, and the connections.

The experienced amateur will no doubt be able to obtain the proper results by employing parts he has by him, provided he is prepared to do a little experimenting.

The Circuit.

The action of the set may be fully explained by the theoretical diagram of Fig. 2. We have first the aerial circuit. This contains a tuning condenser C_1 in series, and another tuning condenser C_2 in parallel with the plug-in aerial coil. By employing two condensers in this way we can do two things—first, control the selectivity, and, second, control the volume.

When the series condenser C_1 is set at a low value,

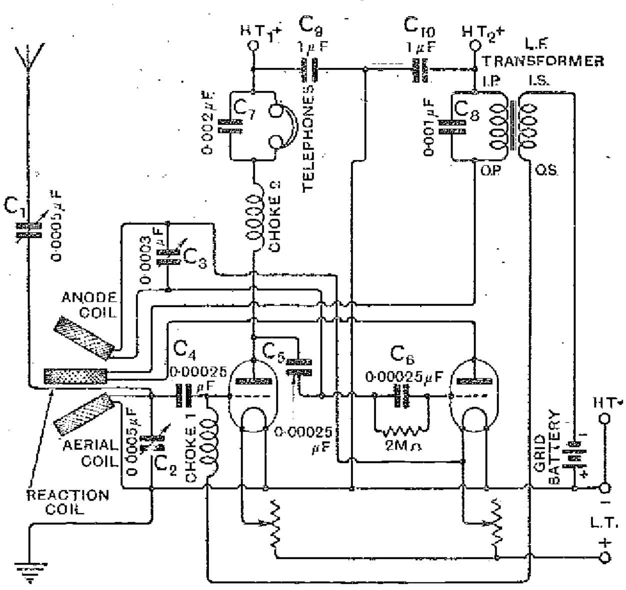


Fig. 2.—Theoretical diagram of connections.

Two Valve Reflex Receiver.—

condenser C_2 must be set at a higher value than normal to tune in a given station. If the capacity of C_1 is increased, that of C_2 must be reduced, and so on. Now the selectivity of the set depends largely on the value of these two condensers; when C_1 is made small and C_2 large, we have maximum selectivity, but the strength of the signal is less than when other adjustments are made. By increasing the capacity of C_1 and reducing that of C_2, so that the aerial is still tuned to the station we wish to receive, the volume is increased and the set is not so selective.

whose secondary is connected to the filament through a grid battery, *and to the grid of the first valve* through Choke 1.

A three-coil holder is employed to accommodate the aerial, reaction, and anode coils. The reaction coil is the centre one; hence we can react on the aerial and anode circuits, and so improve the selectivity.

Too much reaction, of course, results in poor quality and instability, but there is no need to make adjustments which result in these ill effects. The signal strength can be materially increased without any noticeable falling off in the quality.

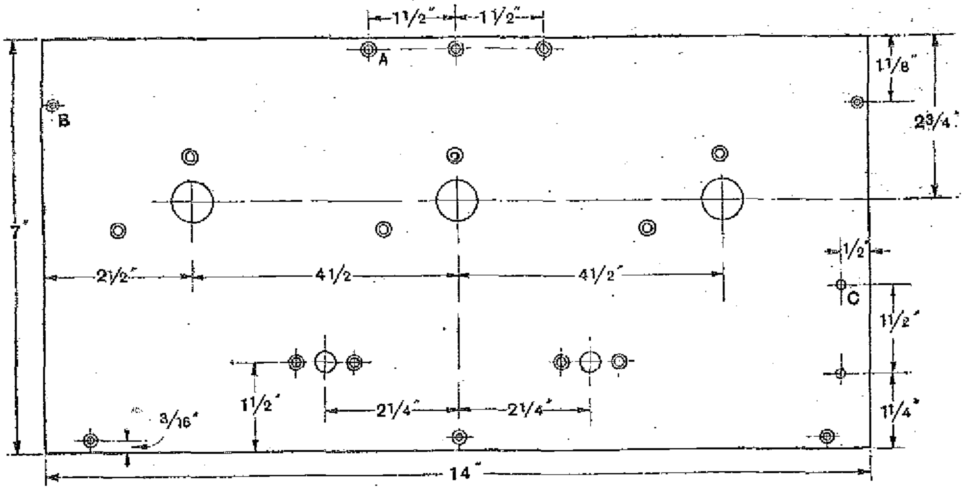


Fig. 3.—Drilling details of ebonite front panel. A = drill $\frac{3}{16}$ in. and countersink. B = drill $\frac{1}{8}$ in. and countersink. C = drill $\frac{5}{32}$ in.

Arrangement of the Set.

The accompanying photographs show the pleasing appearance of the set and the *neat arrangement* of the panel. As may be seen, the set is of the enclosed type—the valves and all the parts, excepting the tuning coils, being inside the containing cabinet; the telephones are connected to a pair of terminals on the front panel, and the batteries, aerial, and earth to terminals which project through the back of the cabinet. The whole set may be removed from the cabinet.

On the ebonite front panel are the three tuning condensers, the filament resistances for the two valves and the telephone terminals; the three-coil holder is fixed to a piece of ebonite screwed to the top of the panel.

Attached to the bottom of the front panel is a baseboard which carries the remainder of the components, including the terminal strip.

Hence, by properly using these two tuning condensers we can control the selectivity and the volume. For best selectivity, make C_1 small and C_2 large; this weakens the signal. For maximum signal strength, increase C_1 and reduce C_2; this reduces the selectivity.

The aerial circuit is connected to the first valve through a fixed condenser (C_4). This condenser is used to prevent the aerial coil short-circuiting the valve to the speech currents which actuate the grid of this valve through *Choke 1*.

In the anode circuit we have *Choke 2* and the telephones, and the anode current passes from the H.T. battery through these to the valve. Connected between the anode of the valve and the grid condenser and leak (C_6, 2 M Ω) is a fixed condenser C_5, while the tuned anode circuit proper is connected between the filament and the junction of C_5 C_6.

The remainder of the circuit is straightforward. There is, besides the reaction coil, a low-frequency transformer in the anode circuit of the detector,

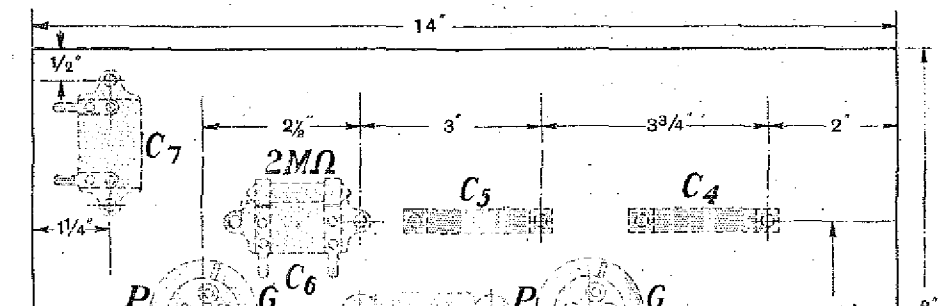


Fig. 4.—Arrangement of parts on the base.

Two Valve Reflex Receiver.—

Construction of the Set.

The Front Panel.—The front panel is of ebonite, measuring 14in. × 7in. × ¼in., and, if the reader is employing components similar to the author's, can be marked out and drilled according to the drawing of Fig. 3. Drilling templates of the tuning condensers and filament resistances are supplied by the manufacturers and are of great assistance.

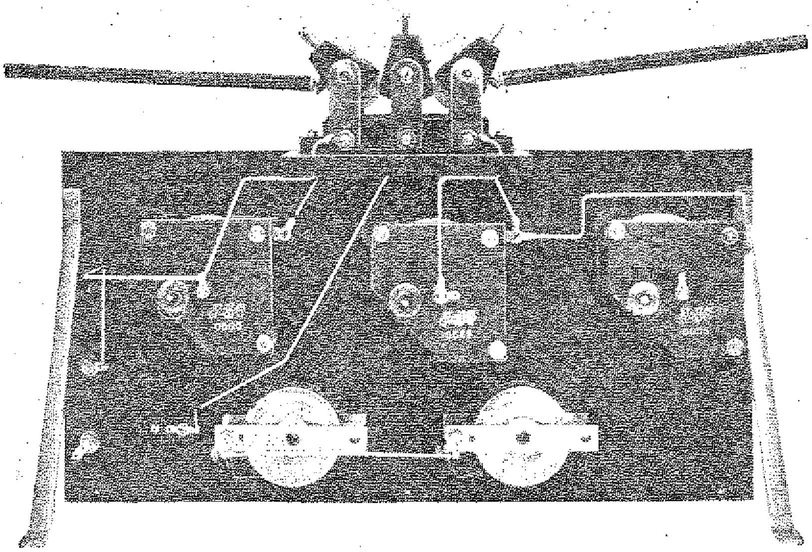


Fig. 5.—View of the back of the panel showing the components partly wired.

Mark the position of the holes with a scriber rather than with a pencil—it is easy to do accurate work when a scriber, straight-edge, and square are used. Then carefully enlarge the points where holes are to be made with a small drill.

Having drilled the panel, matt the surface (if this has not already been done) by carefully rubbing it with a medium grade of emery paper and a little oil. Finally, mount the components on the panel and see to the action of the condensers and filament resistances. A view of the back of the panel with some of the connecting wires in place appears as Fig. 5.

The Coil Holder.—The three-coil holder is fixed to a piece of ebonite measuring 4¼in. × 2¾in. × ⅜in., and a ⅛in. hole is drilled below each of the terminals of the coil holder for the connecting wires to pass through. Three screws are passed through the top side of the panel and screw into threaded holes in the edge of this piece of ebonite. No. 4 BA screws, ⅝in. long, are used, therefore three holes ⅜in. long are drilled with a No. 32 drill and tapped 4 BA in the edge of the piece of ebonite. The position of these screws is indicated in the drawing of the panel, Fig. 3, and the position of the coil holder when fixed is shown by the photographs

The Base.—The base is a piece of mahogany, measuring 14in. × 8in. × ⅜in. On it the reader may fix at once the valve holders, fixed condensers, and transformers. Fig. 4 gives the position of these parts; they may be secured with ½in. No. 4 round head brass screws.

The grid battery is mounted on a small wooden stand cut to the shape of the battery and screwed in position.

The Chokes.—Two high-frequency choke coils are employed. These may be made by the reader or purchased.

Suitable chokes are supplied by the Metropolitan Vickers Electric Co., Ltd.; one of their chokes is illustrated in Fig. 9.

For the reader who prefers to make his own, particulars of two which are equally satisfactory are given. One of these, illustrated in Fig. 10, is of the type employed in certain Marconiphone receivers, and consists of a piece of ebonite tube or rod, 1in. in diameter and 3in. long, wound with about 2,500 turns of No. 44 D.S.C. copper wire. The wire is not wound on the tube anyhow, but is wound to form 6 piles or "heaps," each pile being ⅛in. long and having about 400 turns. An easy way to wind this type of choke is to mount a hand drill in a vice, and secure the length of ebonite rod to the chuck. By turning the handle the rod may be rotated at a fair speed and the wire quickly put on.

The chokes actually employed in this set consist of three basket coils arranged as in Figs. 7 and 8. The formers for the coils are cut from stout cardboard to the dimensions given in Fig. 7, and are wound full of No. 42 D.S.C. copper wire. The method of winding is described on page 66. Each choke has three coils spaced with circular pieces of wood or cardboard as indicated, and are mounted on a simple ebonite framework.

A short length of No. 4 BA screwed rod is passed

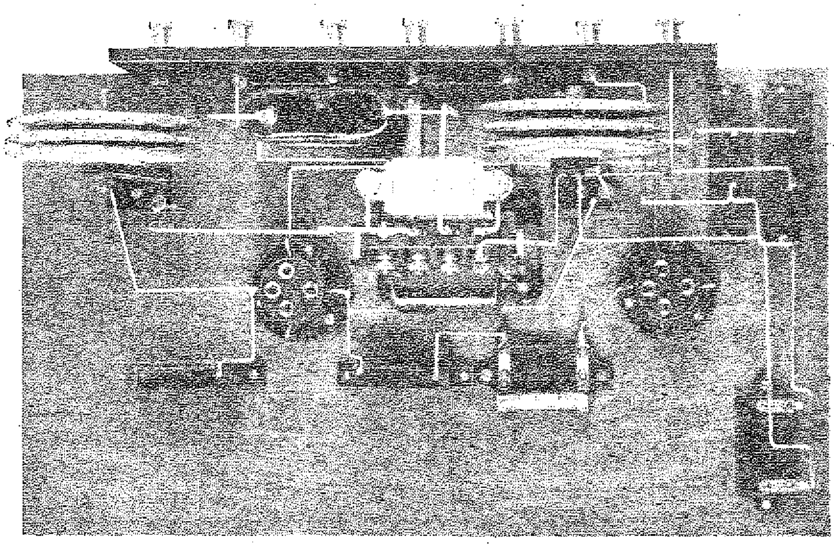


Fig. 6.—View of the base with the components partly wired.

Two Valve Reflex Receiver.—
through the centre of the coils, the spacing pieces, and the support, and a nut and washer put on each end to fix the coils.

The three coils of each choke are wound in the same direction and are put on and connected in series to form one continuous winding, running in one direction. To do this it is only necessary to put the three coils on the length of rod with the windings running in the same direction. Then the beginning of the first coil is soldered to one connecting tag, the end of this coil connected to

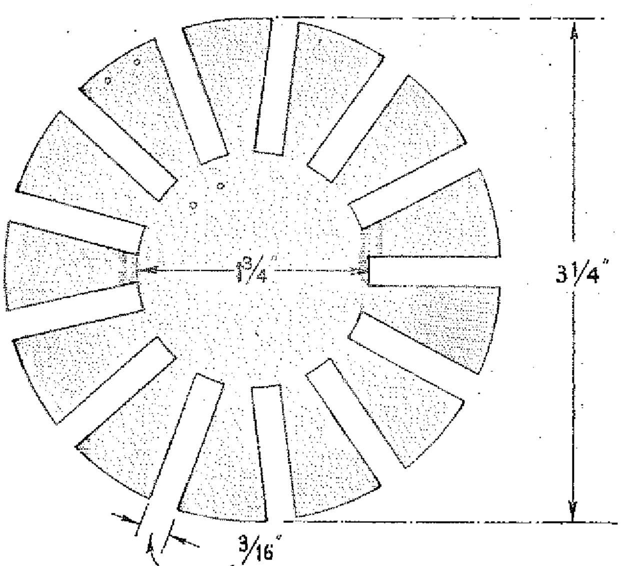


Fig. 7.—Drawing of the cardboard former of the basket coils which are used as H.F. chokes.

the beginning of the next, and finally the end of the third coil soldered to the second connecting tag.

There will be no difficulty in constructing these chokes if the photographs and the drawings of Figs. 6, 7, and 8 are followed.

The position of the chokes is indicated in Fig. 4 and in the coloured wiring diagram.

The Terminal Strip.

This consists of a piece of ebonite measuring 10¼in. × 1½in. × ¼in., with seven No. 4 B.A. terminals arranged as indicated in Fig. 11. The terminal strip is screwed to the back edge of the baseboard with ⅜in. No. 4 countersunk wood screws.

Fixing the Base and Panel.

The base is secured to the front panel by screws passing through the bottom edge of the panel into the edge of the base and by two brass brackets. Suitable brackets are easily made from brass strip, or may be purchased. These brackets are to be seen in the photographs of the back of the set.

Wiring.

The wiring of the receiver is shown on the sheet which will be found inserted in this copy of the magazine. This diagram has been specially prepared to make it very easy for the reader to follow the connections. Some of the wires are coloured red, others blue, and the remainder are blue and white.

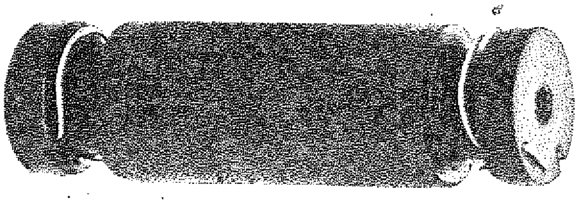


Fig. 9.—The H.F. choke supplied by Metropolitan Vickers, Ltd. Screw holes are provided at its ends for fixing.

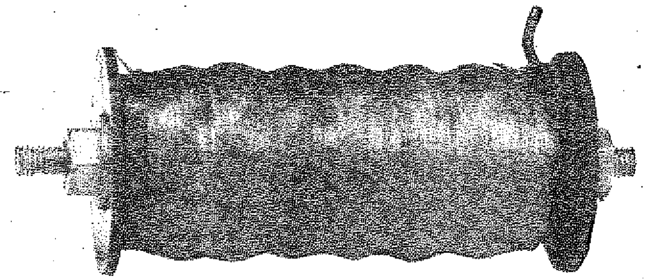


Fig. 10.—A H.F. choke such as employed in some Marconiphone receivers. The threaded rod and nuts are for fixing.

If the reader places the diagram with the coil holder at the top and looks at the back of the set, he will see that the coil holder, panel, baseboard, and terminal strip are drawn as they would appear if these parts were laid out flat.

Wiring is carried out with No. 16 tinned copper wire. A length is unwound from the reel as required, pulled until it is stiff, and then cut off.

It is best to wire in this order: First the panel, second the base, and finally to put in those wires which run between panel and base.

The panel is, therefore, removed from the baseboard, and as many of the wires as possible put on. Bend the

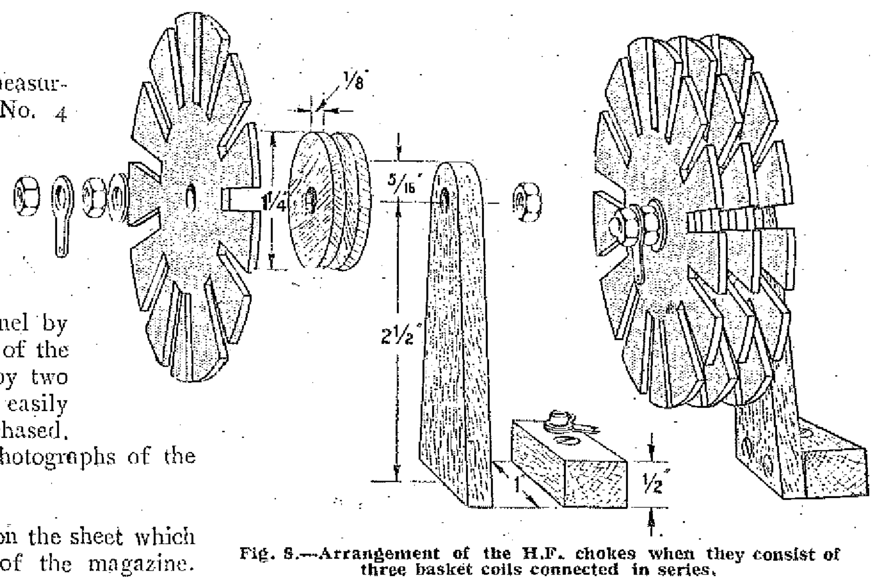
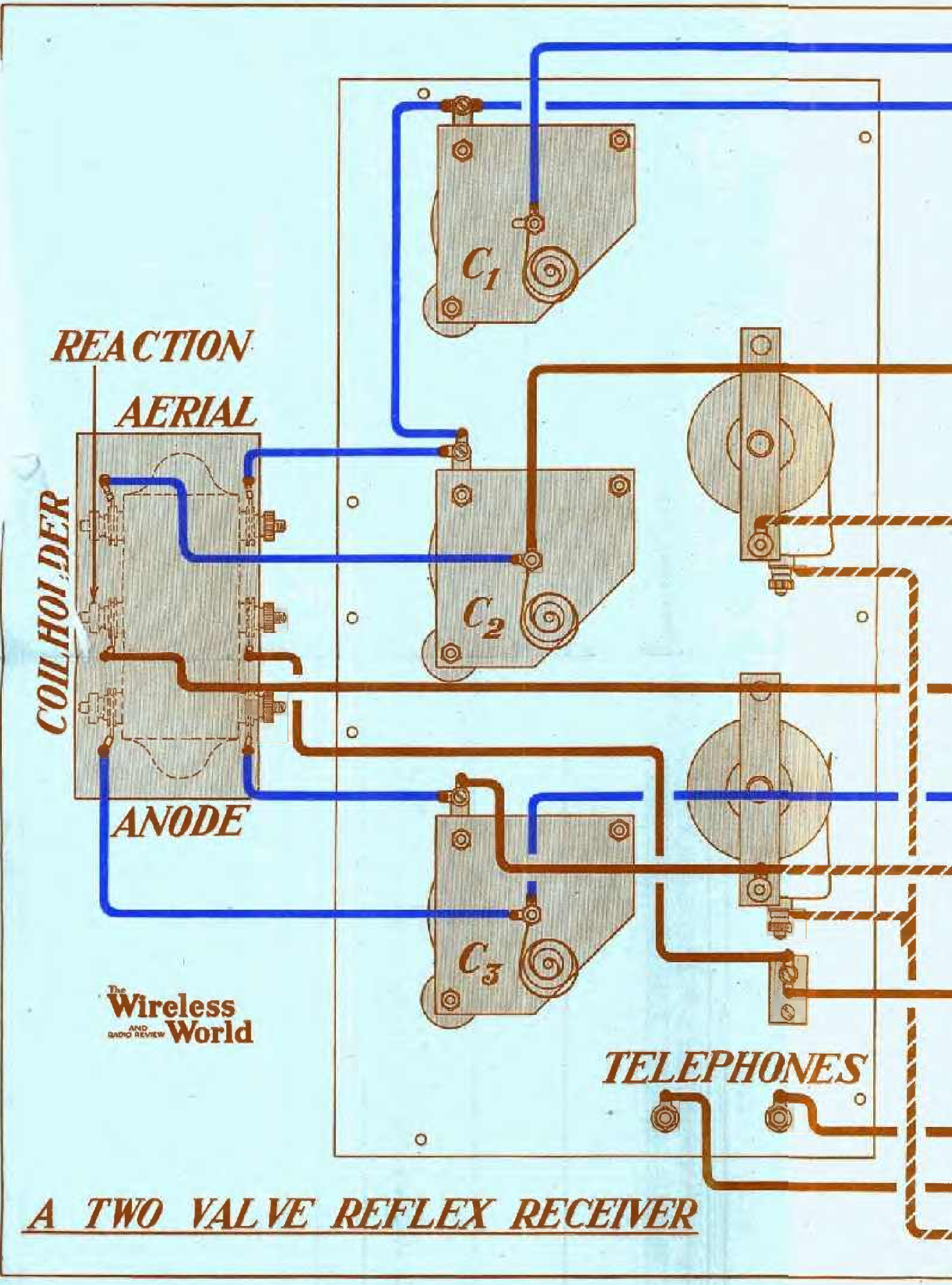
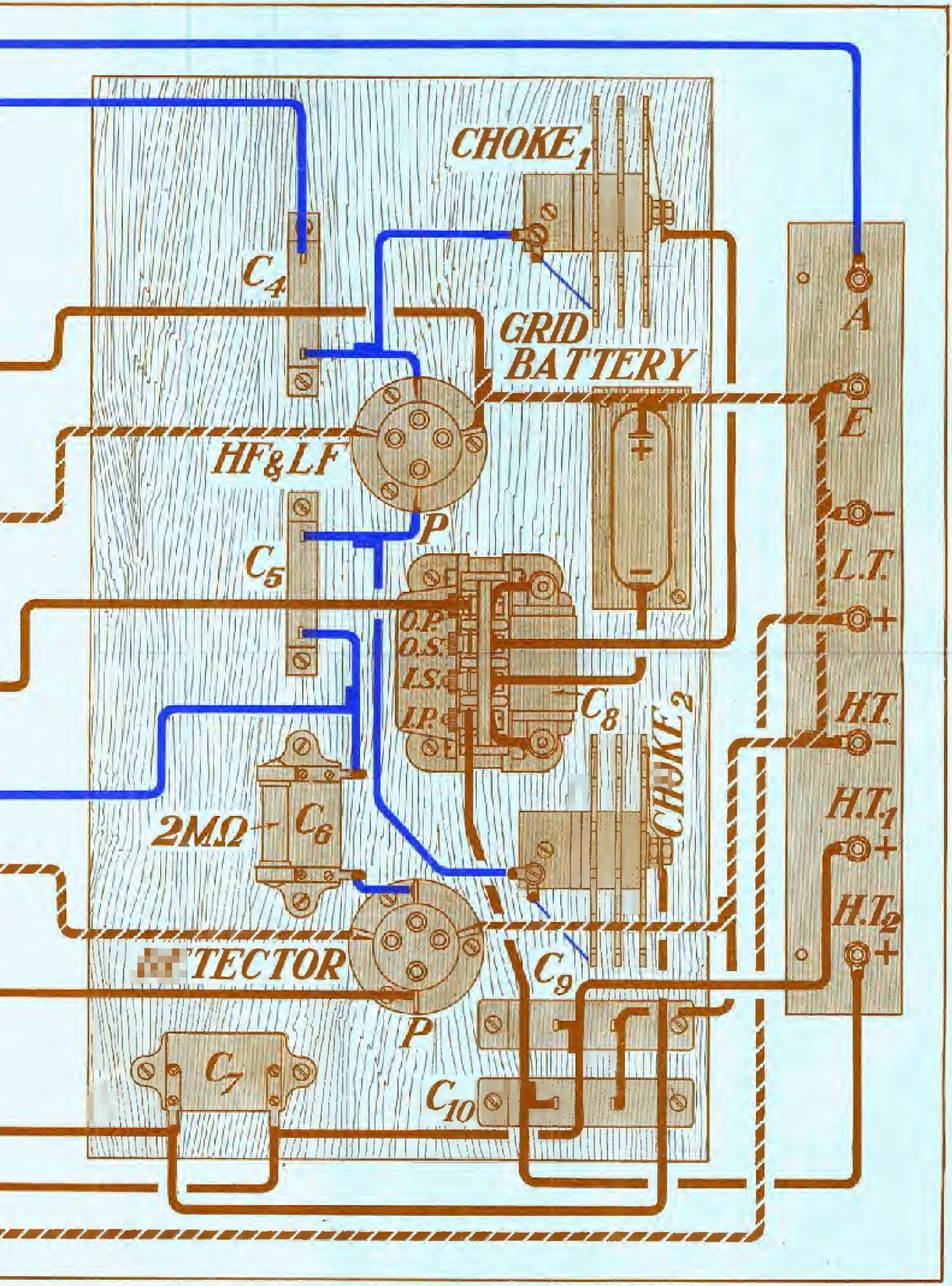


Fig. 8.—Arrangement of the H.F. chokes when they consist of three basket coils connected in series.



A TWO VALVE REFLEX RECEIVER



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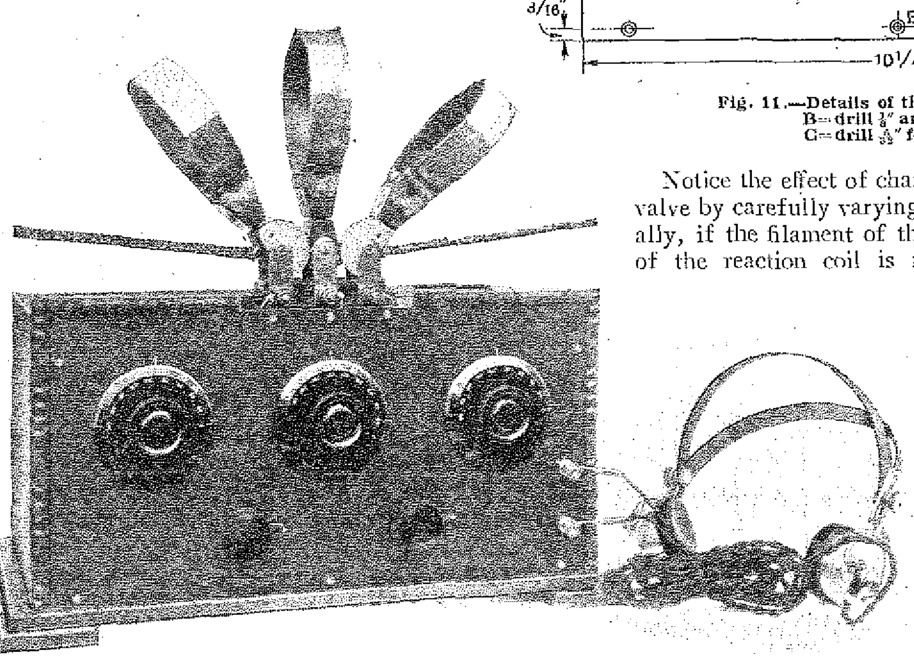
Two Valve Reflex Receiver.—

wires to shape, and carefully solder the connections. A view of the panel with its wiring is given in Fig. 5. Then wire the components fixed on the base, carefully marking the coloured diagram as the wires are put on. Fig. 6 shows the base with its wiring. Finally secure the panel and base, and finish off the wiring.

Special care should be given to the wires connected to the coil holder; if these are reversed, it will be found that instead of the signal strength being increased as the outer coils are brought nearer the reaction coil, the signals are weakened.



View of the complete Two Valve Reflex Receiver. In the coil holder, from left to right, are the aerial, reaction and anode coils. The first tuning condenser is in series with the aerial, the second across the aerial coil and the third across the anode coil.

Operating the Set.

Connect the aerial, earth, and the batteries. The correct value of filament and anode voltage will depend on the type of valve employed, and these values are stated by the manufacturers on the boxes containing the valves, or are printed on a separate slip. Do not forget that the first valve requires a higher anode voltage than the detector, because a grid battery is used.

For valves of the 60 milliampere class, a suitable H.T. voltage for the first valve (H.T.1) is about 70, and for the detector (H.T.2) about 30.

To receive the local broadcast, the aerial coil may be an Igranic honeycomb coil No. C2, the reaction coil a No. C2 or C3, and the anode coil a No. C3. For 5XX (1,600 metres) and other stations of approximately this wavelength we may use the following coils: aerial, No. 150; reaction, No. 100; anode, No. 200. The most suitable coils for the reception of other stations may be found from the manufacturers' tables.

When first using the receiver, put the outer coils in the three-coil holder as far away from the reaction (centre) coil as possible. Then, with the left-hand condenser (C_1), set all in—usually at 180°—adjust condensers C_2 and C_3. If the set has been properly made, several stations should be heard, but tune-in the local station first. Now try the effect of reaction. First move the *aerial coil nearer the reaction coil and notice the increase* in the strength of the signal. Then adjust the position of the anode coil so that the signal is heard with maximum intensity.

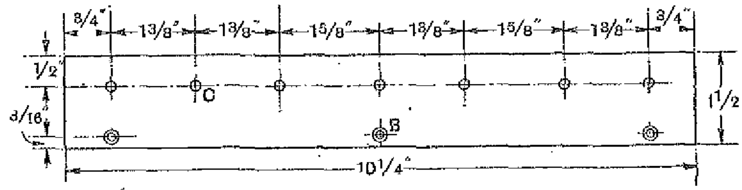


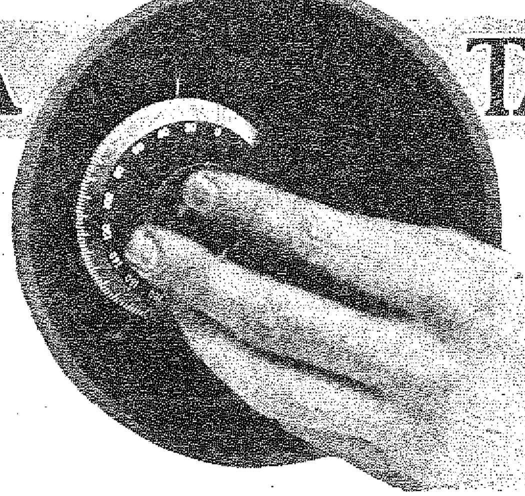
Fig. 11.—Details of the terminal strip.
B=drill 1/8" and countersink.
C=drill 5/32" for No. 4 BA terminals.

Notice the effect of changing the filament current of the valve by carefully varying the filament resistance. Generally, if the filament of the detector is dimmed, the effect of the reaction coil is reduced. The best results are secured by carefully setting the position of the coils, the filament resistances, and the tuning condensers. It is usually better to react on the anode coil, rather than on the aerial coil.

Finally, reduce the value of tuning condenser C_1, and retune the circuit by increasing C_2. It will be found that there is a setting for C_1 and C_2 which gives maximum signal strength when this is desired, or highest selectivity when one wishes to reduce interference.

PARTS REQUIRED FOR THE SET.

1 Ebonite panel, 14 in. × 7 in. × 1/4 in.
1 Piece of ebonite, 10 1/4 in. × 1 1/2 in. × 1/4 in.
1 Piece of mahogany, 14 in. × 8 in. × 3/8 in.
2 Tuning condensers, 0·0005 microfarad (E. J. S.).
1 Tuning condenser, 0·0003 microfarad (E. J. S.).
3 Fixed condensers, 0·00025 microfarad (Dubilier).
1 Fixed condenser, 0·002 microfarad (Dubilier).
1 Fixed condenser 0·001 microfarad (Igranic).
1 Grid leak, 2 megohms (Dubilier).
2 Fixed condensers, 1 microfarad (T.C.C.).
1 Intervalve transformer, ratio 1-3 (Igranic).
1 Three-coil holder (Igranic).
2 Valve holders, bal e i type (Burndept).
2 Filament resistances: 30 ohms for valves of the 60 milliampere class; 5 to 10 ohms for "R" type valves, and about 4 ohms for valves taking a filament current of 0·3 ampere, such as the D.E.R.
(The resistances in this set are 30 ohms, Igranic.)
1 Two-cell grid battery.
9 Terminals.
Materials for high-frequency chokes (see text).
Small quantity of No. 16 tinned copper wire for wiring.
1 Cabinet to suit.



A TALK ON TUNING

BY R. D. BANGAY

An Explanation of Tuning and Advice on What to Do to Improve the Selectivity of Your Receiver.

THE criterion of a good receiver lies not so much in the strength of signal it delivers, as in the relative strengths of the signal to which it is attuned and others of a slightly different wavelength. In other words, it is the *signal to interference ratio* which really counts, because any interference which filters through the tuned circuit of the receiver will be magnified in the same proportion as the real signal, and no amount of further magnification will improve matters. It is upon the tuned circuits of the receiver that we must depend for picking out the particular signal we wish to receive to the exclusion of all others.

In wireless telephony there are two ways of eliminating interference; one is by making use of the principles of "resonance," and the other by making use of the principles of "directional reception," and it is the former of these two methods that we propose to discuss in this article, and particularly to explain the important advantages gained by the use of a coupled circuit.

What is Resonance?

Resonance is the cumulative effect produced by a periodic force acting on a system so adjusted in frequency that the effect induced can attain the highest value. Before going any further, it may be as well to explain exactly what is meant by this definition.

In the case we are considering, the "periodic force" is the oscillatory electromotive force generated, in the first place, by the action of the electric waves on the aerial, and the "system" in which the cumulative effect is produced is the tuned circuit of the receiver.

By "cumulative effect" is meant the additive or final effect reached after the periodic force has been acting on the system for some time. For example, if a pendulum is given a series of equal pushes, it does not reach its maximum swing the first time, but gradually works up to it after perhaps twenty or thirty pushes, although the force exerted by each individual push is the same. The swinging pendulum gradually accumulates the energy imparted to it by each push, the only loss being the amount wasted in overcoming the friction of the pivots and the air resistance. Thus the amplitude of the swing gradually increases with each successive push given to it until the energy wasted during one swing is exactly equal to the energy given to it by each push. When that condition of balance is reached, the pendulum maintains a uniform amplitude of swing so long as the pushes are kept up. In the case of a wireless circuit the frequency of the force is so enormously high that the circuit gets ten or twenty pushes in a very small fraction of a second. Nevertheless, the process is the same, except that it occupies a very much shorter space of time.

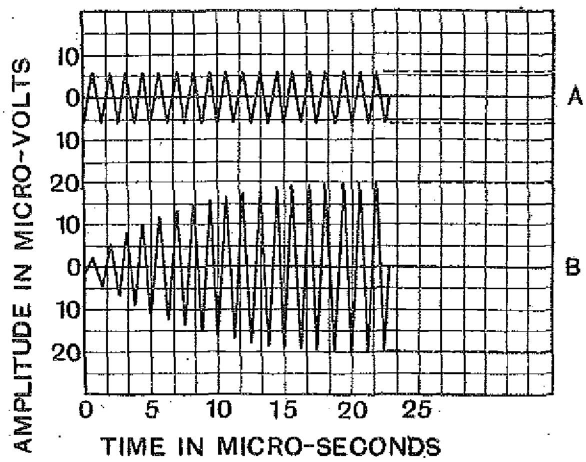


Fig. 1.—Explaining resonance

In Fig. 1 this effect is illustrated diagrammatically. The curve A represents a uniform periodic electric force such as that exerted on an aerial by an incoming train of waves which we will suppose is acting on a resonant circuit. The curve B shows the resulting electric oscillations built up in the circuit. For the sake of clearness, we have shown definite values of time and amplitude, although these are, of course, entirely hypothetical. Thus it will be seen that in the case illustrated the maximum amplitude reached by the oscillations is twenty micro-volts, and that this is approximately reached in twenty micro-seconds, or after fifteen periods of the applied force.

In the various resonance curves illustrated in Figs. 2, 3, and 5, the amplitude values plotted are the *maximum*

A Talk on Tuning.—
amplitudes reached for each adjustment of frequency, regardless of how long it takes to reach that value.

Resonance Curves.

The maximum effect is produced in any tuned circuit when the frequency of the applied force is exactly equal to the frequency of the tuned circuit. Any difference in these frequencies is accompanied by a falling off in the maximum amplitude of the currents induced in the circuit. This effect is best indicated by what is known as the

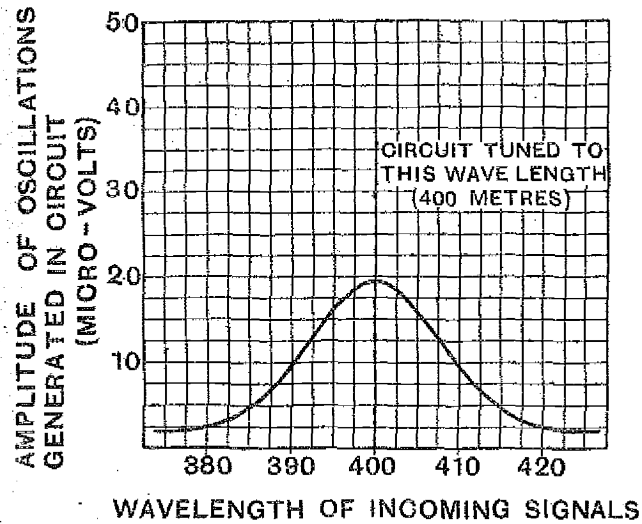


Fig. 2.—A resonance curve.

"resonance curve" of the circuit in question. Such a curve is plotted by fixing the frequency of the tuned circuit at some convenient value and measuring the strength or amplitude of the current induced in it by signals of different frequency, the actual intensity of the signal acting on the circuit being kept perfectly uniform at all frequencies.

A characteristic resonance curve is illustrated in Fig. 2, from which it will be seen that the strength of the effect induced in the tuned circuit rises rapidly as the frequency of the applied force—in this case the incoming signal—approaches the natural frequency of the tuned circuit, and reaches a maximum when the two frequencies are the same. In the case illustrated, the frequency of the tuned circuit was fixed at a value corresponding to a wavelength of 400 metres, and the frequency of the incoming signal was varied from a wavelength of 370 metres to 430 metres.

Damping.

Whatever the nature of the circuit, the curves will always take the general form indicated in Fig. 2, but the actual shape of the curve will depend upon the *damping* in the circuit. The less the damping, the more "peaky" will the curve become—that is to say, it will rise to a higher maximum value at the resonant point. And, conversely, the greater the damping in the circuit, the flatter will the curve become. Fig. 3 shows the effect on the resonance curve (of reducing the damping of the circuit). In order to facilitate comparison, we have drawn both curves on the same sheet. It will be seen that not only is a greater maximum amplitude reached by the current in the low resistance circuit due to a signal of equal strength, but what is far more important the difference in the *relative* values of signals in tune and out of tune is greater in the case of the sharply tuned circuit. For example, if we assume two equal signals acting on the circuit, the one having a wavelength of 400 metres to which the circuit is tuned, and the other a wavelength of, say, 390 metres, it will be seen from the curves that in the case of the low resistance circuit the effect of the two signals is in the ratio of 4 to 1.5, while in the more highly damped circuit the ratio is only 2 to 1.

Damping is caused by loss of energy in the circuit in question. These losses may be due to a number of causes such as the resistance losses in the aerial wire, earth connection, and in the copper coils of the inductance; dielectric losses in objects surrounding the aerial or in the insulation between the turns of the inductance and between the plates of the condenser and losses due to reradiation: this latter applies particularly in the case of the aerial system.

Coupled Circuits.

By careful design of the apparatus and choice of materials, these losses can be largely reduced, but many of them are more or less out of one's control, especially in the case of the aerial circuits. In practice, therefore, the aerial circuit has usually a much higher damping than a properly designed closed circuit, and in this respect the coupled circuit tuner has an advantage over the single circuit receiver, in which the only tuned circuit is the aerial circuit itself. But if we analyse the effect of using two tuned circuits coupled together in cascade as shown

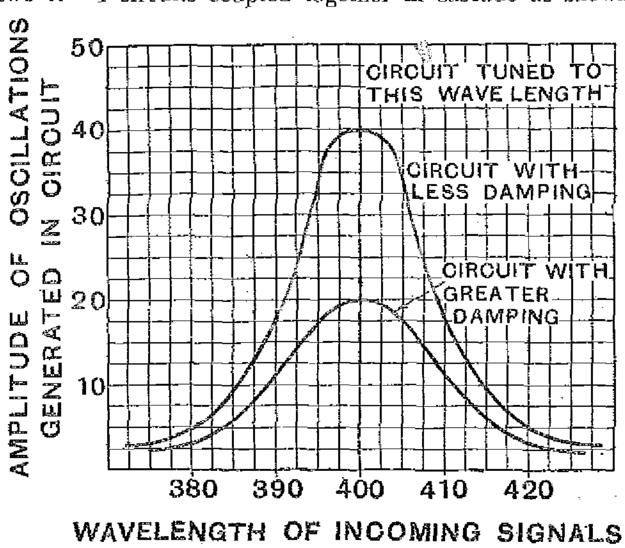


Fig. 3.—Resonance curves of two circuits, one having greater damping than the other.

in Fig. 4, we find that a far greater advantage is gained than might at first sight be expected.

For the sake of simplicity, we will assume that the two circuits have exactly the same damping, and that the flatter of the two curves in Fig. 3 represents the resonance curve of both circuits; also that they are both tuned to a wavelength of 400 metres.

As already explained, the curve represents the com-

LISSENIUM

Take away the roar!

The loud speaker which roars out with a raucous tone is not a pleasant thing to listen to.

Use a LISSEN CHOKE coupled amplifier, and it will take away the roar and bring in its place a pleasant tone and clear refined volume.

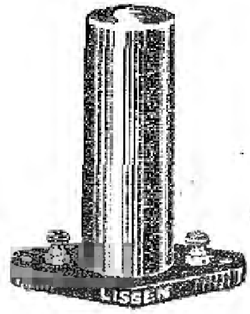
LISSEN CHOKE amplification is rapidly becoming popular. Amplifiers may consist of LISSEN CHOKES throughout, connected up as below, or a combined transformer (preferably use one of the LISSEN types) and LISSEN CHOKE amplifier can be evolved.

LISSEN CHOKE coupling of L.F. valves is a convenient way of obtaining pure sound without the disadvantage of using the high H.T. voltage necessary when resistance capacity coupling is employed.

How to connect:—

One terminal of the LISSEN CHOKE is connected to the plate of the preceding valve, the other terminal to the H.T. battery. A fixed condenser of ·01 capacity is connected between the plate of the preceding valve and the grid of the L.F. valve and a grid leak (preferably a LISSEN VARIABLE GRID LEAK) is connected between the grid of the L.F. valve and the L.T. negative. Grid cells should be introduced between the Grid Leak and L.T. negative if they are found necessary. Each succeeding stage is connected in the same manner.

Those who think there is room for improvement in their loud speaker reproduction should try the effect of a LISSEN CHOKE AMPLIFIER, one, two or more stages. Not quite so loud per stage as transformer coupled, but very pure.



Price 10/-

LISSEN MATCHED NEUTRALIZING TRANSFORMERS

The LISSEN MATCHED NEUTRALISING TRANSFORMERS described by Mr. W. H. R. Tingey in "Wireless Weekly" are now ready for delivery. The first range ready is the "A" range, which covers the Broadcasting Band. The Transformers should be ordered in a set of three, the separate coils making up the set being known as A1, A2, and A3. The letter identifies the wavelength range ("A" for the Broadcast Band) and the number the position in which the transformer is used in the receiver. Price per coil, **£1**—set of three for **£3.**

Other ranges will soon be ready.

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LISSEN Variable Grid Leak.. **2/6**

A Talk on Tuning.—
parative effect of signals of different frequencies, but of exactly the same intensity acting on the circuit. If the intensities are greater or less, then the effects will be proportionately greater or less. For example, it will be seen from the curve that the effect produced by a 400-metre signal is just twice that produced by an equally strong 390-metre signal; but if the intensity of the 390-metre signal acting on the circuit is twice that of the 400-metre signal, the effect of both signals on the circuit will be equal.

Let us suppose that two equal signals of unit strength are acting on the aerial circuit, one having a wavelength of 400 metres and the other a wavelength of, say, 384 metres. It will readily be seen by reference to the curve that the strength of the 400-metre oscillations in the aerial circuit will be 20, while that of the 384-metre oscillations will be 5.

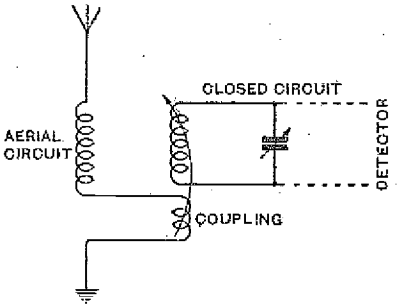


Fig. 4.—A coupled circuit.

The second tuned circuit or "closed" circuit does not, of course, receive any energy direct from the incoming wave, but only from the oscillations induced in the aerial circuit which act through the coupling coil. It follows, therefore, that the two signals acting on the closed circuit are no longer equal in strength as in the case of the aerial circuit, but that the 400-metre signal is five times as strong as the 384-metre signal. And since by virtue of the resonance in the closed circuit the effect produced by equal signals of 400 and 384 metres respectively is again in the ratio of 5 to 1, it follows that the effect of the five-times-as-strong 400-metre signal will be 25 times as great as that of the 384-metre signal in the closed circuit. Thus it will be seen that by using a coupled circuit, we have immensely increased the selectivity of the receiver.

The general effect can be more readily appreciated by taking a number of examples at different frequencies and plotting the results in the form of a new curve. The result is illustrated in Fig. 5, which shows the resonance curve of each circuit taken separately, and the overall effect of the two circuits coupled together in cascade.

In order to obtain the full advantage of the tuning possibilities in a coupled circuit, the coupling must be kept as loose as possible, otherwise the double-wave effect is produced which gives the resonance curve a double peak at two slightly different wavelengths, one on either side of the resonance point, instead of the single peak at the resonance point. As the coupling is increased these two peaks become more and more pronounced and further separated. The reason for this is that when two circuits are coupled inductively each tuned circuit has in effect two separate values of inductance, one due to the inductance of the circuit *plus* the mutual inductance between the two circuits, and the other due to the inductance of the circuit *minus* the mutual inductance between the two circuits.

Effect of Reaction.

It is sometimes claimed that the same sharpness of tuning can be obtained with a single circuit receiver by using reaction to make good the resistance losses in the circuit. This is not so. It is true that by the use of reaction the resonance curve of a tuned circuit can be made very much sharper, and the selectivity of the receiver thereby greatly increased, but reaction introduces other complex effects which it would be rather beyond the scope of this article to attempt to explain. The result of these effects, however, is, briefly, that the circuit does not behave in the same way towards incoming signals of different amplitudes; for example, if the amplitude of the interfering signal is considerably greater than that of the signal to which the receiver is tuned, an impulsing effect is produced which brings up the strength of the interfering signal disproportionately. Consequently, while the single circuit receiver with reaction might be quite effective in eliminating interfering signals of ordinary strength, it will fail adequately to suppress the very strong interference from a neighbouring station.

With the coupled circuit receiver it is, of course, equally possible to use reaction and thus obtain the additional advantages of the effect produced in this way; moreover, by coupling the reaction coil to the closed circuit instead of to the aerial circuit radiation from the aerial is largely avoided, even though the receiver is brought to the oscillating condition. This has the great advantage of enabling the user of the set to tune in to far distant stations by making the receiver oscillate without much risk of interfering with the reception of his neighbours.

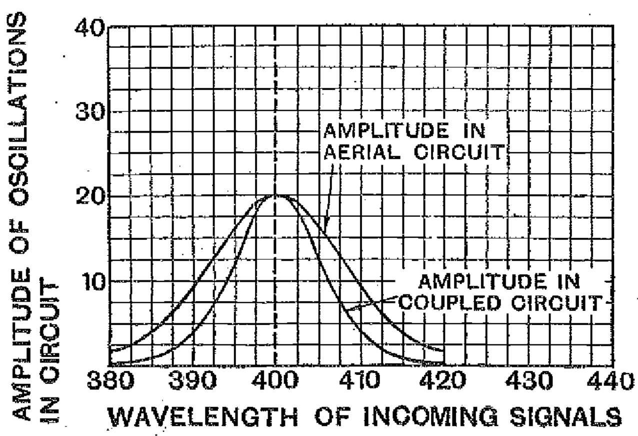
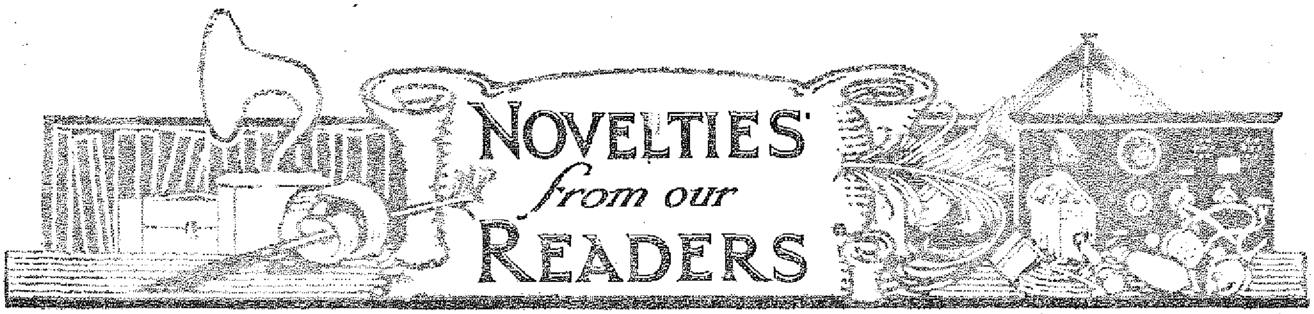


Fig. 5.—Connections of a two-circuit tuner.

Tuning the Circuits.

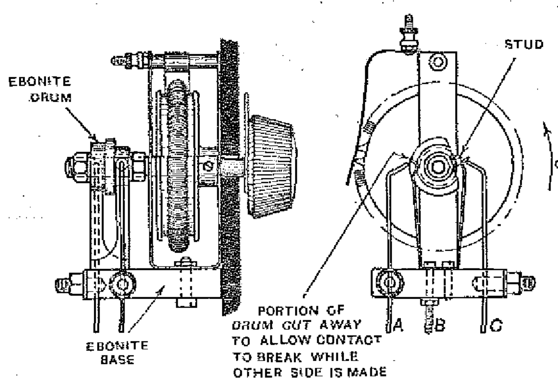
There is one other point to which attention might be drawn in this article, and that is in connection with the method of tuning a coupled circuit receiver. The ordinary method of tuning such a circuit is, first, to tighten up the coupling and search on both circuits until the required signal is picked up; secondly, to reduce the coupling until the signal is comparatively faint; and thirdly, to re-tune both the aerial and the closed circuits. The last two actions of this process should be repeated until the required degree of selectivity is obtained.



A Section Devoted to New Ideas and Practical Devices.

COMBINED FILAMENT RHEOSTAT AND SWITCH.

The rheostat shown is of a well-known type which lends itself to the fitting of contacts to an extension on the spindle. These may be arranged to switch a L.F. amplifying valve out of circuit when the filament resistance is turned to the off position, and by this means the number of controls fitted to the front of the instrument is reduced. The operation of the set is also considerably simplified, because it only becomes necessary to turn the filament resistance to the zero position to disconnect the amplifying stage.



A switch is fitted to the filament rheostat so as to disconnect an amplifying stage when the knob is turned to the "off" position.

The rheostat must first be fitted with a longer spindle to accommodate a small ebonite drum. The drawing shows details for constructing suitable cams which press against spring contacts made of hard brass or German silver. The moving contacts shown connected to the terminal B, engage on a pair of fixed contacts A and C. When used in a low frequency amplifier, A is connected to the primary of the transformer, B to the detector valve anode, and C to the telephones. For use with a high frequency amplifying stage, A is connected to the H.F. valve anode, B to the detector valve grid condenser, and C to the grid of the H.F. valve.—J. L. J.

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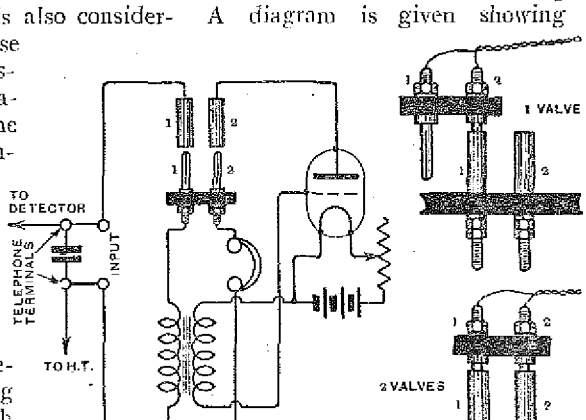
CHEAP L.F. VALVE SWITCH.

The accompanying illustration shows probably the very simplest of methods for switching a L.F. amplifier in and out of circuit. It will be seen to consist of two valve pins held apart by means of a small piece of $\frac{1}{4}$in. ebonite, which can be inserted in two valve sockets secured to the face of the instrument panel. A diagram is given showing the method of connecting up. To take the amplifier out of circuit, it is only necessary to insert the pin marked 2 into the socket 1.—A. T.



An L.F. valve switch constructed from valve pins.

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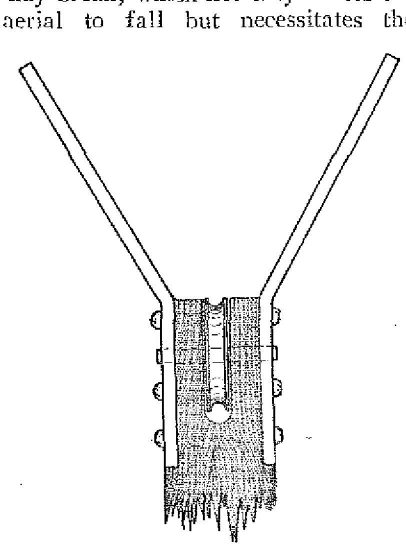
OVERCOMING THE BROKEN HALYARD DIFFICULTY.

There is always a risk that the aerial halyard passing through a pulley attached to the head of a mast may break, which not only causes the aerial to fall but necessitates the lowering of the mast in order to restore the rope through the pulley.



By terminating a mast in this manner, it is always a simple matter to restore a broken aerial halyard.

In the case of a tall or elaborately constructed mast, the process of lowering may be exceedingly difficult, and in view of this the new form of pulley shown above has been designed. Its operation is readily apparent, and should the halyard rope break it is only necessary to throw over the top of the mast a weight attached to string so that it falls between the two extension arms. With a string once over the pulley, the hal-

Novelties from Our Readers.—

yard can be restored. The construction is quite simple, and the arms should be made up from ⅛in. by ½in. iron. R. B.

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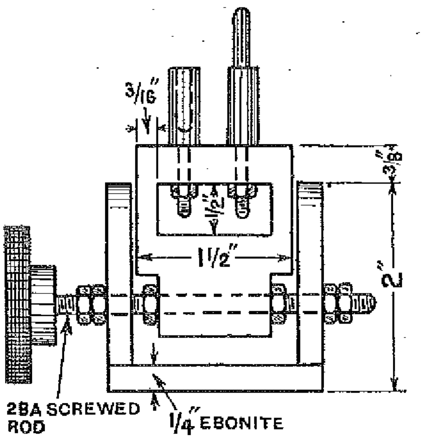
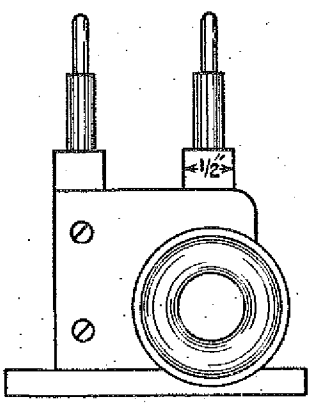
HOME CONSTRUCTED COIL HOLDER.

Constructional details are given for building up a two-coil holder, and the essential feature which has been introduced to simplify the construction consists of the use of valve legs



An easily constructed two-coil holder.

in order to give support for the plug-in coils. The valve legs are mounted by cutting a rectangular slot so that



Details of the end plates.

the nuts with which valve legs are usually fitted can be made use of, thus avoiding the need for tapped holes.—F. J.

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READING A WORKING DRAWING.

When making up a set from a small scale drawing of the kind often published in the pages of this journal, it will be found very helpful to first enlarge the diagram to full scale. The full-sized drawing can then be laid on to the face of the ebonite panel, and if any change is to be made in the type of components fitted as compared with the original design, it becomes quite a simple matter to place the purchased components on the full size drawing and observe whether sufficient clearance is provided before the drilling is commenced.

The full-sized drawing may then be secured to the panel by means of a blob of Seccotine here and there, and the positions for the holes marked through with a centre punch, thus entirely avoiding the use of either pencil or scratch lines. With the positions for the holes marked, the drawing should be removed, or otherwise the chips of ebonite will work in under the surface of the paper.

This method will probably be found preferable to the use of full-size printed diagrams, as the process of block-making and printing invariably introduces distortion, with the result that when the drilling has been carried out it may be found that some holes are slightly out of place. For the same reason do not paste the diagram on the ebonite, as the damping of the paper will shrink it.—R. D. S.

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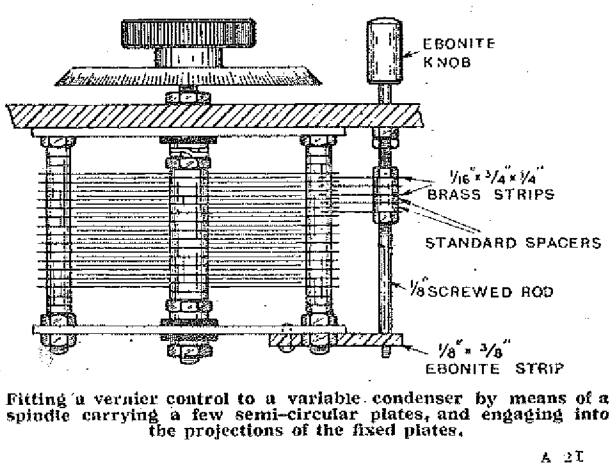
FITTING A CONDENSER VERNIER.

A method is shown for adding a vernier control to a variable condenser of standard pattern. It will be seen to consist of a rod carried by a bearing plate attached to the base of the condenser and passing through a hole in the face of the panel. To this rod a number of small plates are attached and arranged to move between the projections of the fixed plates.

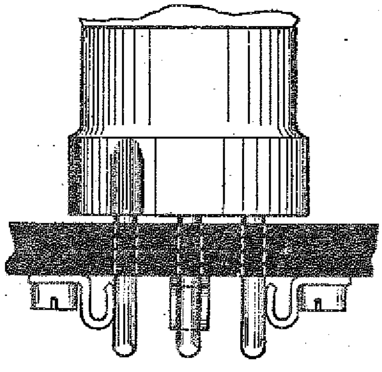
Although it may be thought that the capacity produced is very small, it will be found that a convenient vernier control can be obtained. The spindle carrying the small plates is, of course, connected across to the spindle of the condenser.—H. C. G.



Fitting a vernier control to a variable condenser by means of a spindle carrying a few semi-circular plates, and engaging into the projections of the fixed plates.

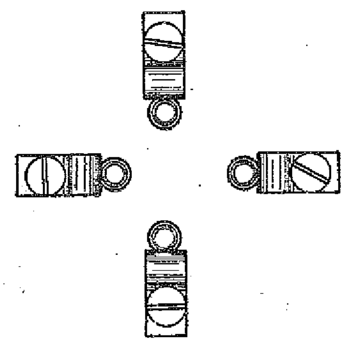
A VALVE HOLDER OF LOW CAPACITY.

Spring contacts will be found to be quite reliable for picking up connection with the base of a valve.



Design for a valve holder with contacts beneath the panel, and presenting very little stray capacity.

Suitable pieces of springy brass can be mounted to the underside of the panel, so that when the valve is inserted with its pins passing through



View showing the arrangement of the contacts on the underside of the panel.

clearance holes, a good rubbing contact is made with the surfaces of the springs.—F. G. P.

MEASUREMENT OF AMPLIFICATION AT THE LOWER RADIO FREQUENCIES.

The author shows the effect of the design of the coupling transformers of the H.F. amplifier on the amplification and selectivity. By employing reaction the amplification is considerably improved. A valve voltmeter was used in the tests.

G. W. SUTTON, B.Sc. (Lecturer in Electrical Measurements, City and Guilds (Eng.) College).

The Valve Voltmeter.

In a recent article the writer discussed the use of the valve voltmeter for measuring the various voltages employed in a broadcast receiving set. Since then he has had occasion to use the instrument almost daily for a variety of purposes, including the measurement of H.F. resistance, and has found it uniformly satisfactory.

One precaution should be noted in addition to those previously mentioned. When using the anode rectification type, the grid should invariably be connected to the point of higher potential and the filament to the "earth" side; while the mounting of the valve should provide the very highest insulation for the grid terminal and lead to valve. This insulation is, of course, of the greatest importance in resistance measurements, and should be of the order of at least 100 megohms.

When these matters have been attended to the voltmeter may be used with confidence for almost any purpose up to frequencies of, perhaps, 10^6.

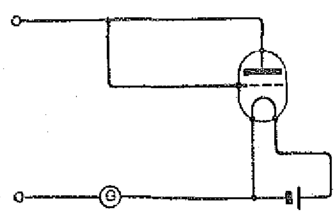


Fig. 1.—A valve rectifier and galvanometer.

For rough work a perikon, or other high-resistance crystal detector, in series with a galvanometer is, of course, useful. When calibrating a large batch of buzzer wavemeters two years ago the writer discovered what a considerable effect this arrangement can have on both the damping and natural frequency of a resonant circuit, however, and he thereafter employed a rectifying valve and high-resistance galvanometer connected as in Fig. 1.[2]

The thermo-couple has advantages for certain measurements, but demands a much more sensitive and expensive current indicator, is easily burnt out, and is sluggish in action. This last is a serious drawback when valve circuits are being used or investigated, as it precludes taking a series of readings and checking them with sufficient rapidity. Even when ample battery capacity is available small fluctuations of current are continuously taking place and the valve voltmeter, with critically damped milliammeter, then proves invaluable in obviating consequent irregularities in readings.

For the present purpose it was considered sufficient to assume that the voltmeter possessed a square-law calibration over the limited range employed. With the valve used (a D.E.R., old pattern, before the adoption of "gettering") this is true to within about 2 per cent. It was, therefore, assumed throughout that the applied voltage was proportional to the square root of the deflection produced.

Testing a Super-heterodyne Receiver.

Wishing to try out the possibilities of the Armstrong-Houck super-heterodyne receiver on a panel already fitted with valve-holders for attaching high frequency transformers, the writer was confronted with the necessity of constructing a two or three stage, transformer coupled amplifier at about 7,000 metres. This particular wavelength was adopted partly because a calibrated oscillator of this frequency was already available.

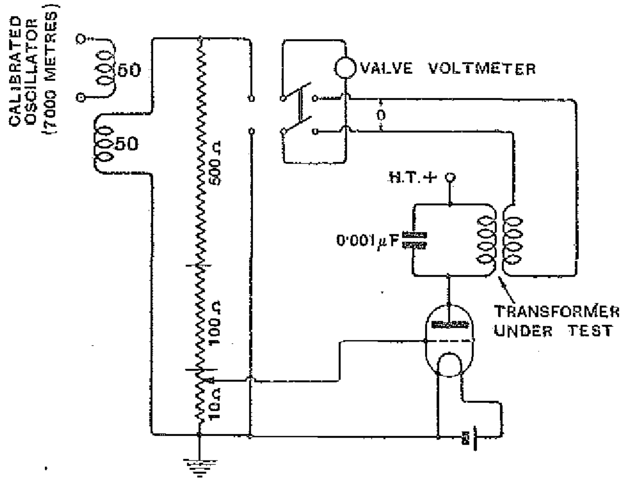


Fig. 2a.—The apparatus employed when testing the H.F. amplifier.

By rough calculation it was found that 500 turns on a diameter of 2in., and tuned by 0.001μF. fixed condenser would have approximately the required constants. Three such transformers were therefore wound, having a 1/1 ratio. The wire employed was No. 44 D.C.C.

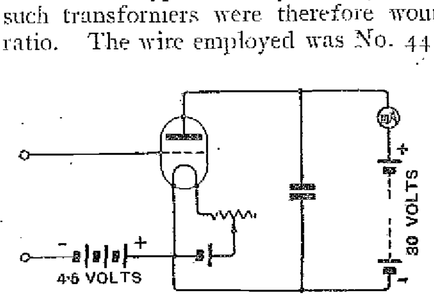


Fig. 2b.—Connections of the valve voltmeter employed in the circuit of fig. 2a.

The next step was to determine the sharpness of tuning and the amplification per stage, when using these transformers. As the range of the voltmeter was limited to about 1.5

[1] "Some Measurements on a Broadcast Receiver." *Experimental Wireless.* Nov., 1924. (*Vide* also the correction mentioned in the December number correspondence column.)

[2] Even this arrangement still suffers from these defects, though to a lesser degree.

Measurement of Amplification at the Lower Radio Frequencies.—
volts, and amplifications of between ten and several hundred were to be measured, some form of potential divider became necessary. The arrangement shown in Fig. 2 was, therefore, fitted up, and found to be most satisfactory. A straight length of No. 47 S.W.G. Eureka wire (about 450 ohms per metre), provided with suitable tapping as shown, and then measured on a resistance bridge, formed the potentiometer wire. This enabled a small known fraction of a volt to be applied to the "input" side of the amplifier, while the double-pole switch enabled the "input" and "output" readings to be rapidly compared. In conjunction with the voltmeter range itself, amplifications up to 3,000 or 4,000 could thus be measured with reasonable accuracy.

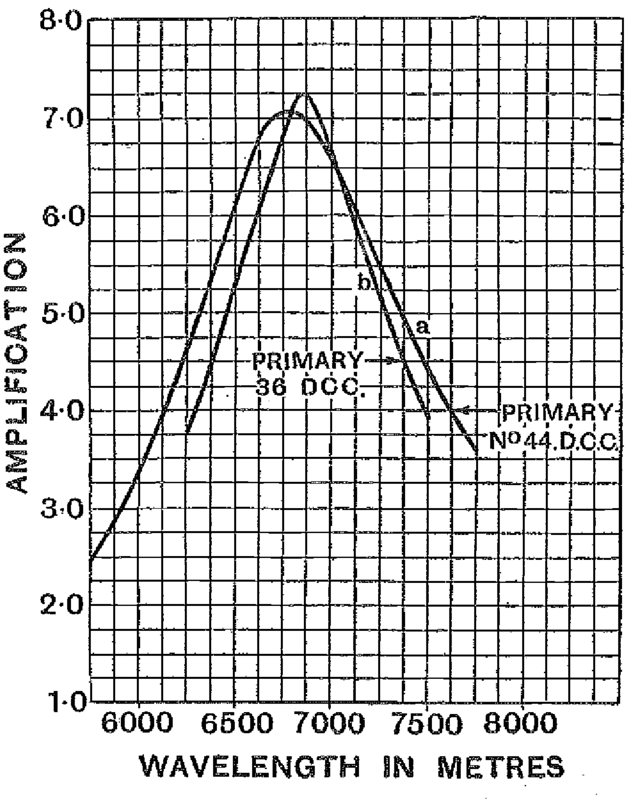


Fig. 3.—Effect of size of wire on amplification and selectivity.

Fig. 3 shows the results of the test on the first transformer. The amplification factor of the valve employed was about 8.0, the anode voltage about 70, and the grid voltage −1.5. These factors were kept constant in the remaining tests.

The damping is seen to be unduly high, as might have been expected from the fine gauge of wire employed. The primary was therefore rewound with the same number of turns of 36 S.W.G. D.S.C. wire, resulting in the limited improvement indicated by curve (b) Fig. 3. The use of still larger gauge wire would have rendered the transformers undesirably bulky.

It might have been found that much greater selectivity could be obtained by the use of iron cores. It was hoped, however, that the resistance trouble with the air-core

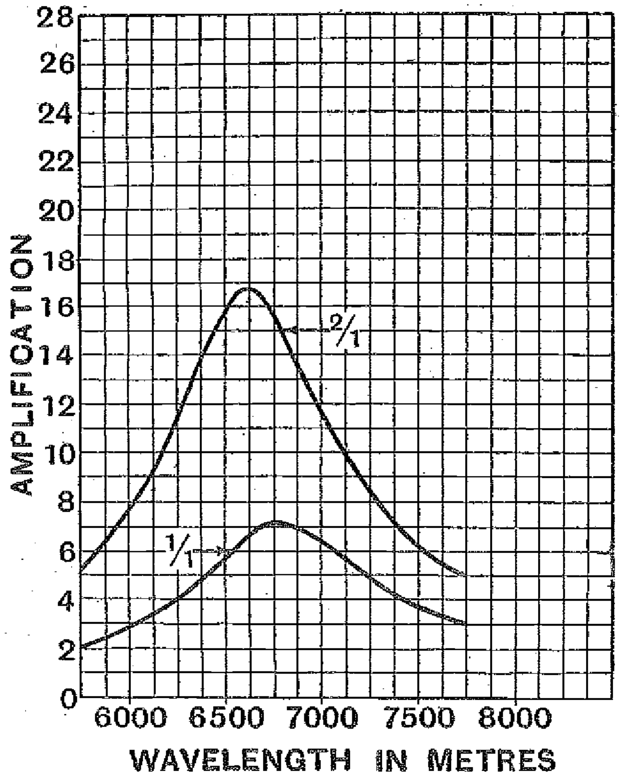


Fig. 4.—Comparison of transformers having ratios of 2/1 and 1/1.

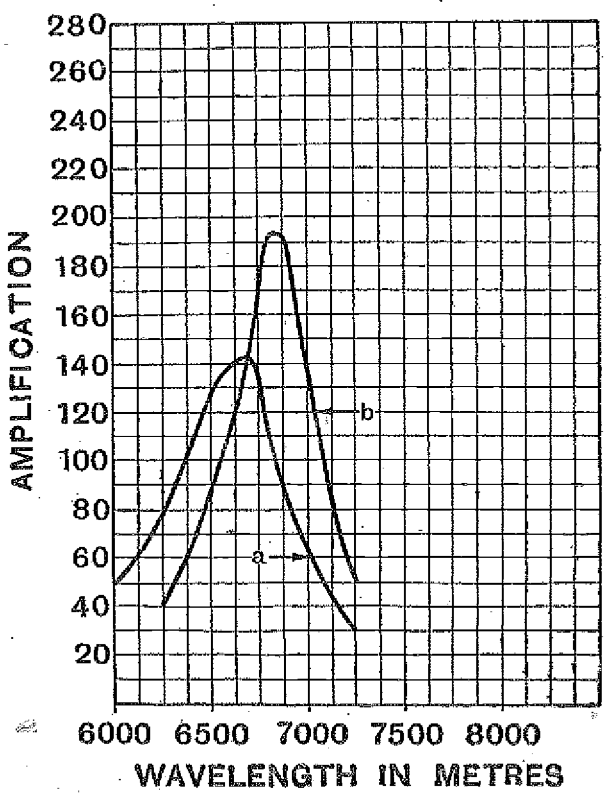


Fig. 5.—Amplification with a two-stage H.F. amplifier. The two transformers are here: (a) out of tune, and (b) carefully tuned.

Measurement of Amplification at the Lower Radio Frequencies.— transformers could be overcome by the use of reaction, and this was therefore proceeded with.

First, another 500 turns of No. 44 D.C.C. wire was wound on the secondary, thus making 2/1 step-up ratio. It is seen from Fig. 4 that the amplification is more than doubled by so doing. This suggests that larger step-up ratios might be employed with advantage. The point would need careful investigation, both theoretical and practical, as there are so many factors bearing on it, and in view of the subsequent results obtained by the use of reaction the matter was not proceeded with any further.

A Two-stage Amplifier.

A two-stage amplifier was now set up consisting of two 2/1 transformers similar to the one just described. It will be seen from curve (a) Fig. 5 that the two transformers were not tuned to quite the same wavelength. The improvement produced by carefully tuning them is shown by curve (b). Tuning was effected by placing a variable air condenser in parallel with the fixed one, across the primary of the transformer of shorter wavelength, and adjusting for maximum amplification.

The results still left much to be desired both from the point of view of selectivity and of amplification, and it was thought that the employment of reaction should effect considerable improvement in both. Capacity coupling offers distinct advantages for this purpose, and the arrangement adopted consisted of a single plate variable air condenser in series with a small fixed mica condenser. Two copper plates of about 1 square inch of foil separated by $\frac{1}{32}$nds of insulation formed the latter. This was adjusted so that, with the variable condenser at the maximum value the amplifier just oscillated. The control was perfectly definite for a given setting of the filament rheostats. With the voltmeter on the output terminals it was quite instructive to observe the conditions under which the second valve was set in oscillation. As the capacity reaction was increased a point was reached at which this just commenced. From then onwards the magnitude of the oscillation could be definitely controlled up to the maximum.

Exact tuning of grid and anode circuits, *i.e.*, of successive transformers, is neither necessary nor desirable in these circumstances, as an almost unmanageably small value of capacity then produces oscillation.

The most convenient method of approximate tuning is by adjustment of the number of primary turns on the transformers. This is far less troublesome than the adjustment of the fixed condensers; variable air condensers are unnecessary, and are undesirable from the points of view of bulk and expense. For this purpose *the primary should be wound outside the secondary.*

The circuit of the two-stage amplifier is shown in Fig. 6, and the results of the test in Fig. 7. Owing to the complications of a reflex circuit the large amplification indicated in Fig. 7 could not be obtained in the Armstrong-Houck circuit, nor in several modifications which were subsequently tried. Much more satisfactory results were obtained from a "straight" high-frequency amplifier followed by the above intermediate frequency amplifier.

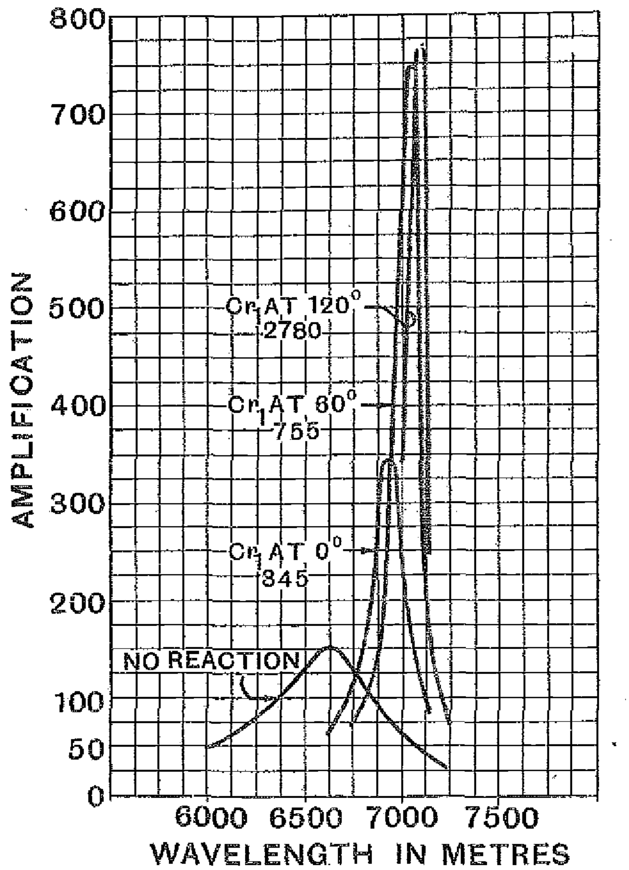


Fig. 7.—Effect of capacity reaction on two-stage H.F. amplifier. Note: C_{r2} adjusted so that C_{r1} at 180° just sets the valve in oscillation.

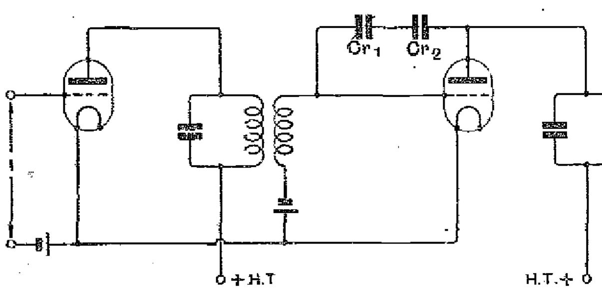
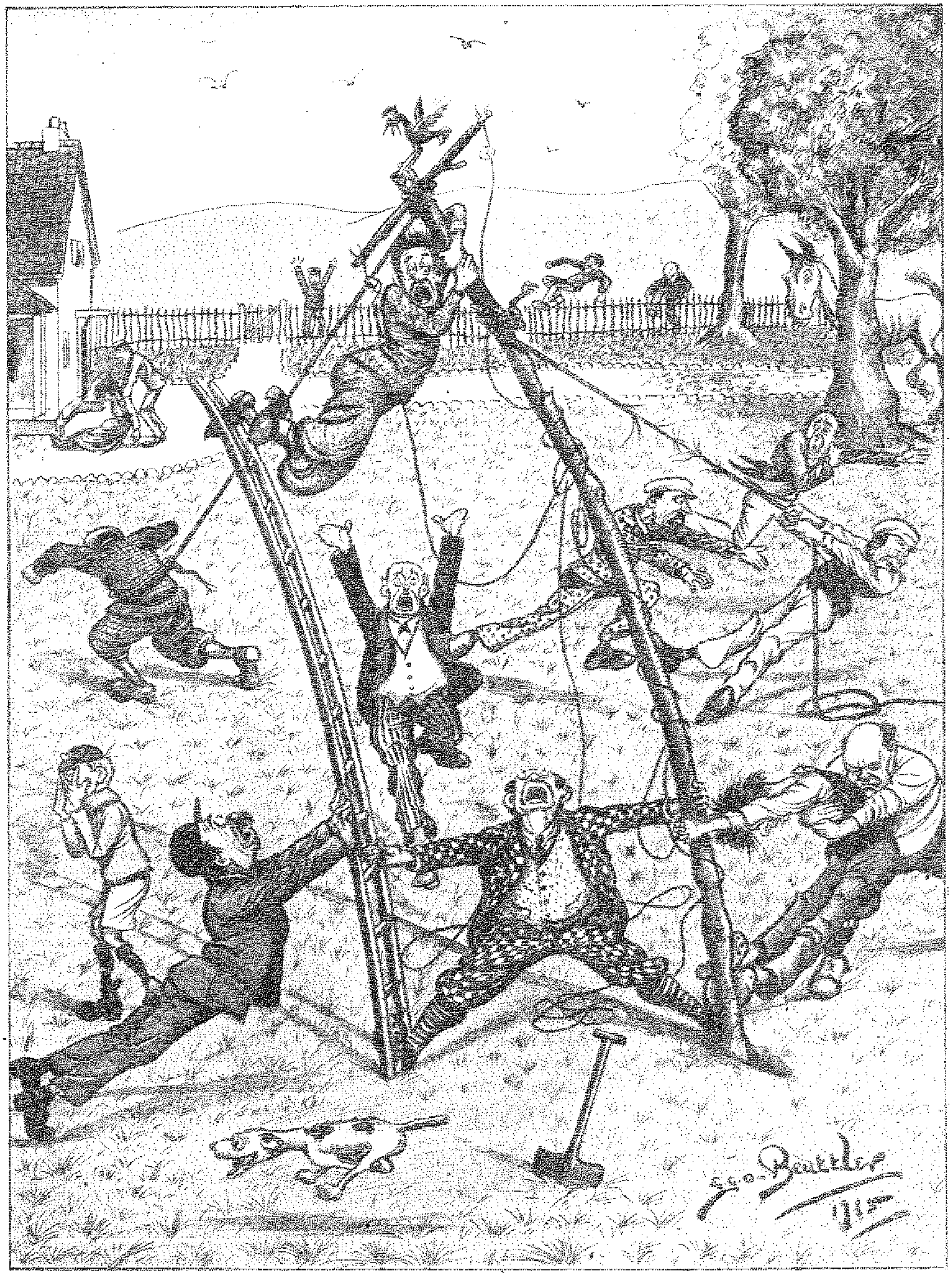


Fig. 6.—Connections of the reaction condensers.

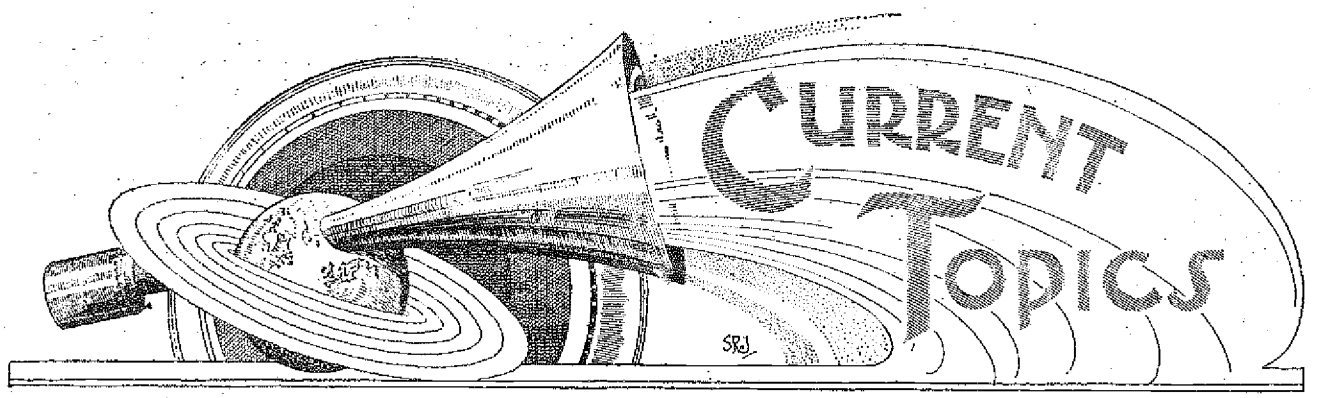
The Detector.

A Perikon crystal detector was used as the second detector. It has always appeared to the writer that the use of a valve for rectification is frequently not justified, except, of course, where it is required to employ reaction from its anode circuit. A reliable high-resistance crystal detector needs little or no adjustment. The damping which it introduces can usually be balanced out by reaction from the previous H.F. valve. *In this instance* it was found that a very small increase of the reaction condenser was sufficient for the purpose, and that the overall amplification was then materially unaffected.

THE TROUBLES OF THE "LISTENER-IN."



No. 2.—Stepping the Mast.



Events of the Week in Brief Review.

New German Relay Station.

German broadcasting stations have recently been springing up like mushrooms. The latest addition to their number is a relay station at Cassel, to work on a wavelength of 288 metres, with a power of 1 kilowatt. It will relay Frankfort's programme.

Increased Power at Ecole Supérieure.

A feature of a special programme recently broadcast from P.T.T. Paris on the occasion of its second anniversary was a speech by M. Pierre Robert, Under-Secretary for State. After giving a survey of the station's activities during the past two years, M. Robert promised his audience a great increase in the transmitting power in the near future.

Amazon Expedition Heard on Christmas Day.

Mr. J. Rodgers (6JO), of Falmouth, reports that he first heard SA WJS, the station of the Rice Expedition on the Amazon, on December 25th last.

Broadcast Enthusiasm in Vienna.

Although broadcasting in Vienna is only four months old, there are already more than 100,000 licence holders. It is also stated that there are several thousand "unofficial subscribers."

Batavia Behind the Times.

Amateur wireless is still under a ban in Batavia, in the Dutch East Indies. A small band of enthusiasts are petitioning the Government to remove the present restrictions.

French Transmitters on Wrong Wavelengths.

A protest against the indiscriminate transmission by French amateurs on wavelengths allocated to other nations is being entered by M. Léon Deloy, the well-known Nice amateur. M. Deloy states that reception of far distant stations is repeatedly spoiled by his own over-zealous countrymen.

A Water Aerial.

An experiment with a novel form of aerial has been carried out by French naval operators. The aerial consisted of a vertical column of water discharged from a nozzle. According to our contemporary, *Radio Belge*, the results were satisfactory, the transmitted signals covering a radius of about eight miles.

Venice Works with Mosul.

The latest European amateur to work with GHH1, that active station at Mosul, Iraq, is Signor Giulio Salom (1MT), of Venice. 1MT worked with Mosul on January 22nd at 10 p.m. (G.M.T.).

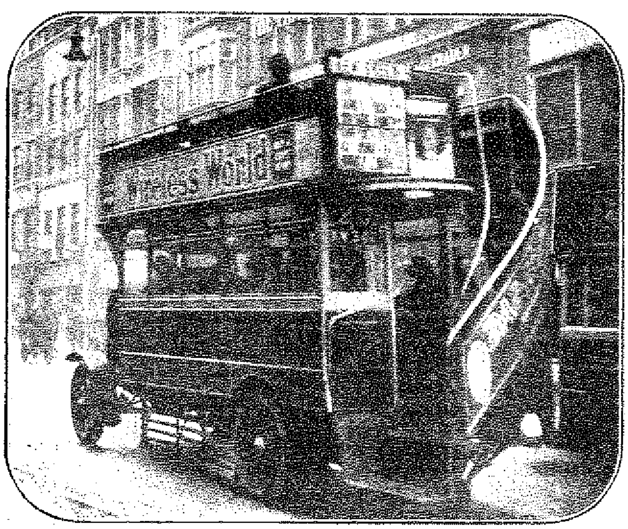
For the information of the many amateurs who may desire to send reports, the address of Signor Salom is Palazzo, Spinelli, Venice (21).

Have You Heard 8NA?

An illicit transmitter in the Bapaume area, using the above call sign, is reported to be ruining broadcast reception on wavelengths round 370 metres. Such an offender would soon be run to earth in this country.

Swedish Amateurs in Conference.

The first conference of Swedish radio clubs was held at Stockholm on Saturday, February 14th, and was attended by representatives of some 160 wireless clubs and other amateur associations. The principal matters of discussion were the Swedish broadcasting organisation, amateur transmitting work, and preparations for Sweden's part in the International Radio Conference to be held in Paris during April.



PROCLAIMED FROM THE 'BUS TOPS. How the "Wireless World" made its *debut* in Fleet Street. An interesting snap taken last week.

Another French Broadcasting Station.

Amateurs in Toulouse are impatiently awaiting the first programmes to be broadcast from the new station in that city. A "T" aerial has been erected on the roof of the Posts and Telegraphs building.

Amateur Telephony from the Antipodes.

A new record in amateur wireless was established on the night of Sunday, February 8th, when a wireless telephonic message transmitted by Australian 3BQ was picked up by Mr. E. J. Simmonds (2OD), of Gerrards Cross, Bucks. 3BQ is the station of Mr. Max Howden, of Box Hill, Victoria. It is interesting to note that Mr. Howden was also the first Australian amateur to effect two-way Morse communication with Great Britain. A photograph of Mr. Howden operating his transmitter appeared in our issue of January 14th, together with particulars of his station.

Transmitting to U.S. on Indoor Aerial.

M. Léon Deloy (8AB), of Nice, has added to his long list of successes by transmitting to America while using an indoor aerial. The aerial consisted of a single wire, fifty feet long, suspended vertically down the centre of a spiral staircase constructed of metal.

The first attempt at Transatlantic communication was unsuccessful, but at 4 a.m. (G.M.T.) on January 25th M.

Deloy's signals were picked up by American 3CHG in Philadelphia, who repeated the message and reported good reception.

Crystal Sets Only in Russia.

The poor Russian radio amateur would have a hard time in the company of a group of "super-heterodynists" and owners of other multi-valve receivers, writes a Moscow correspondent. The only sets at present used by Russian listeners-in are of the crystal type, and broadcast developments are exceedingly slow. This is in a measure due to the fact that, until six months ago, wireless reception was forbidden. It is felt also that broadcasting will never reach a very high standard until the present Government monopoly is removed, if ever!

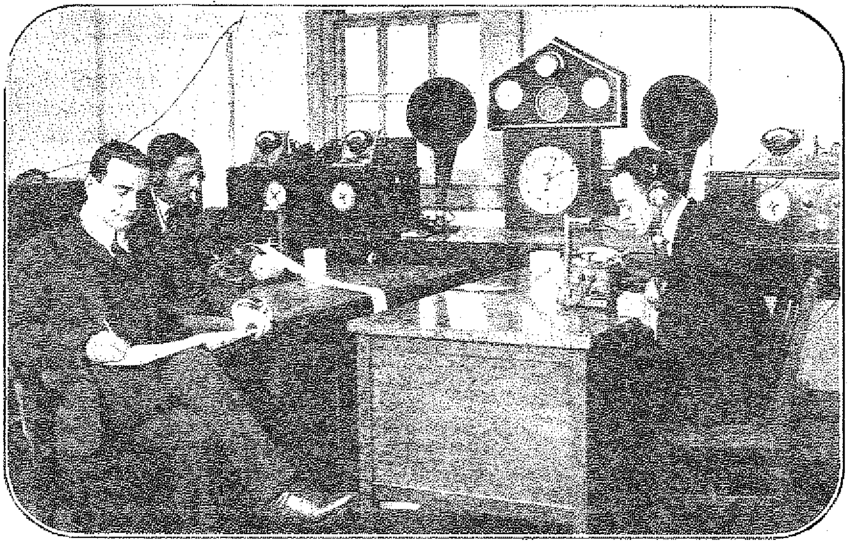
Amateur Transatlantic Telephony Feat.

Having transmitted to the Antipodes by Morse, amateurs are now turning their attention in the direction of telephony records, and already Australian 3BQ has accomplished the feat of telephoning to this country.

Another interesting performance is that of Mr. Ralph Bloxam (5LS), of Blackheath, who has carried on a conversation in telephony for a period of forty minutes with a Rhode Island amateur, American 1BF, the latter replying in Morse. This achievement was secured on Friday, February 13th, between 7.20 and 8.0 a.m.

Record "Log" for One Hour.

In the short space of one hour Mr. J. A. Partridge (2KF), of Merton Park, has picked up signals from SA WJS (the Rice Expedition on the Amazon), Argentine CB8, Mexican Bx, Australian 2DS, and from all the American districts except the 6th and 7th. This exceptional "log" was secured between 7 and 8 a.m. on Sunday, February 8th. On the evening of the same day 2KF worked for a period of an hour with Australian 3BD, who remarked that although the sun was rising in his part of the world the signals were increasing in strength!



WIRELESS IN THE ECLIPSE. Elaborate experiments were conducted by the engineers of the Radio Corporation of America to determine the effect of the recent solar eclipse on wireless signals. Dr. Alfred N. Goldsmith is seen on the left in the photograph with other engineers who assisted in the experiments.

Wireless for Paris Police.

The Paris ether will shortly ring with descriptions of suspected criminals, for the Paris police force is following the lead of Scotland Yard in the adoption of wireless as an aid to criminal investigation. A central transmitting and receiving installation will be placed at headquarters to communicate with smaller sets at all the district police stations.

In addition to its use in the detection of crime, wireless will be employed extensively in traffic control, in the quelling of riots, and in the solution of kindred troubles affecting the French capital.

Amateur Telephony from the Clouds.

Disappointment ran high in Minneapolis, Minn., when clouds obscured the eclipse of the sun. But if the citizens were denied the satisfaction of seeing the phenomenon, they had the opportunity of "hearing" it, as described in a vivid manner by a wireless amateur flying above the clouds.

A number of amateurs planned the "stunt," and one of them, Hugh S. McCartney, took his telephony transmitter on board the aeroplane. His "rapid-fire" description of the eclipse was picked up by Raymond Pfisterer (9CCX) on a low loss receiver, from which it was relayed to the remote control panel of WCCO, the 500-watt broadcasting station of the Washburn Crosby Company.

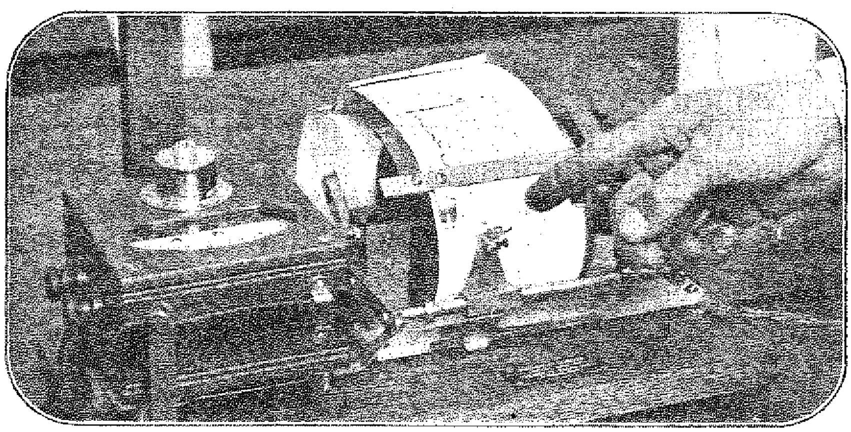
Japanese Amateur Activity.

The reception of his signals in Japan is reported by Mr. W. G. Dixon (5MO), of Newcastle, who states that Japanese JKWZ heard him on January 20th. He has also received verification of the reception of his transmissions in Bombay, and has recently worked with Australian 3BQ.

Another Japanese amateur, Mr. Hiroshi Ando (JFWA), of Tokio, has been heard in this country, by Mr. A. H. Fielding (2AVI), of Birkdale, Lancs. Mr. Fielding has received confirmation that he picked up JFWA's signals on November 21st last, when using a two-valve (0-v-1) receiver and indoor aerial.

Infringement of Patent.

As readers will have seen in our advertisement pages of last week, Messrs. Burndept, Ltd., are issuing a warning concerning certain coil-holders on sale which are not of their manufacture, but infringe their patent number 193150. Whilst it is the firm's intention legally to uphold their rights in this matter, they state that they are quite willing to enter tain applications from potential licensees who are reputable British companies, but not from foreign firms.



WIRELESS IN THE ECLIPSE. A "close-up" of the recording instrument used in the tests. Operated by a highly sensitive relay it was designed to show the minutest variations in signal strength. Two receivers were used for the reception of short and long waves respectively.

EUROPEAN REGULAR

The following tables show at a glance the times of transmissions (G.M.T.) of the principal European Broadcasting Stations. The tables are arranged in order of wavelength and abbreviations are used to show the style of programme during the transmissions. A list of these abbreviations are given at the top of the opposite page.

The transmissions shown in the tables are at the times they can be heard in this country.

Station	Call Sign	W/L	No.	9 A.M. 15 30 45 10 15 30 45 11 15 30 45 12 NOON 15 30 45 1 15 30 45 2 15 30
PARIS, EIFFEL TOWER	FL	2650	1	M N M
RADIO PARIS	SFR	1700	2	N S C C SN N C
CHELMSFORD	5XX	1600	3	
HILVERSUM	NSF	1050	4	
VIENNA (Wien)		530	5	T C
ZURICH		515	6	N T N
BERLIN		505	7	M N C S Rel M N M S C M
ABERDEEN	2BD	495	8	
MUNICH		485	9	S C N S C
SWANSEA (Relay)	5SX	485	10	
BIRMINGHAM	5IT	475	11	
FRANKFORT		470	12	T N
EDINBURGH (Relay)	2EH	465	13	
KONIGSBERG		463	14	TN N
LEIPZIG		454	15	S Rel. M C T M N
PARIS, ECOLE SUP. des P. & T.		450	16	
STUTTGART		443	17	SC
BELFAST	2BE	435	18	TuFC
ROME	URI	425	19	S C
GLASGOW	5SC	420	20	
BRESLAU		418	21	M N SCNT C T M N M N
MUNSTER		410	22	S C M N T
NEWCASTLE	5NO	400	23	Tu Th C
HAMBURG		395	24	S Rel C L T N N M
MADRID	RI	392	25	
BOURNEMOUTH	6BM	385	26	
MANCHESTER	2ZY	375	27	Th C Tu C
LONDON	2LO	365	28	TuTh F C
CARDIFF	5WA	351	29	
LEEDS-BRADFORD (R'l'y)	2LS	346	30	C
PARIS (Petit Parisien)		345	31	
PLYMOUTH (Relay)	5PY	338	32	
HULL (Relay)	6KH	335	33	
DUNDEE (Relay)	2DE	331	34	
NOTTINGHAM (Relay)	5NG	322	35	
LIVERPOOL (Relay)	6LV	315	36	M W C
STOKE-ON-TRENT (Relay)	6ST	306	37	
SHEFFIELD (Relay)	6FL	301	38	C
BRUSSELS	SRB	265	39	

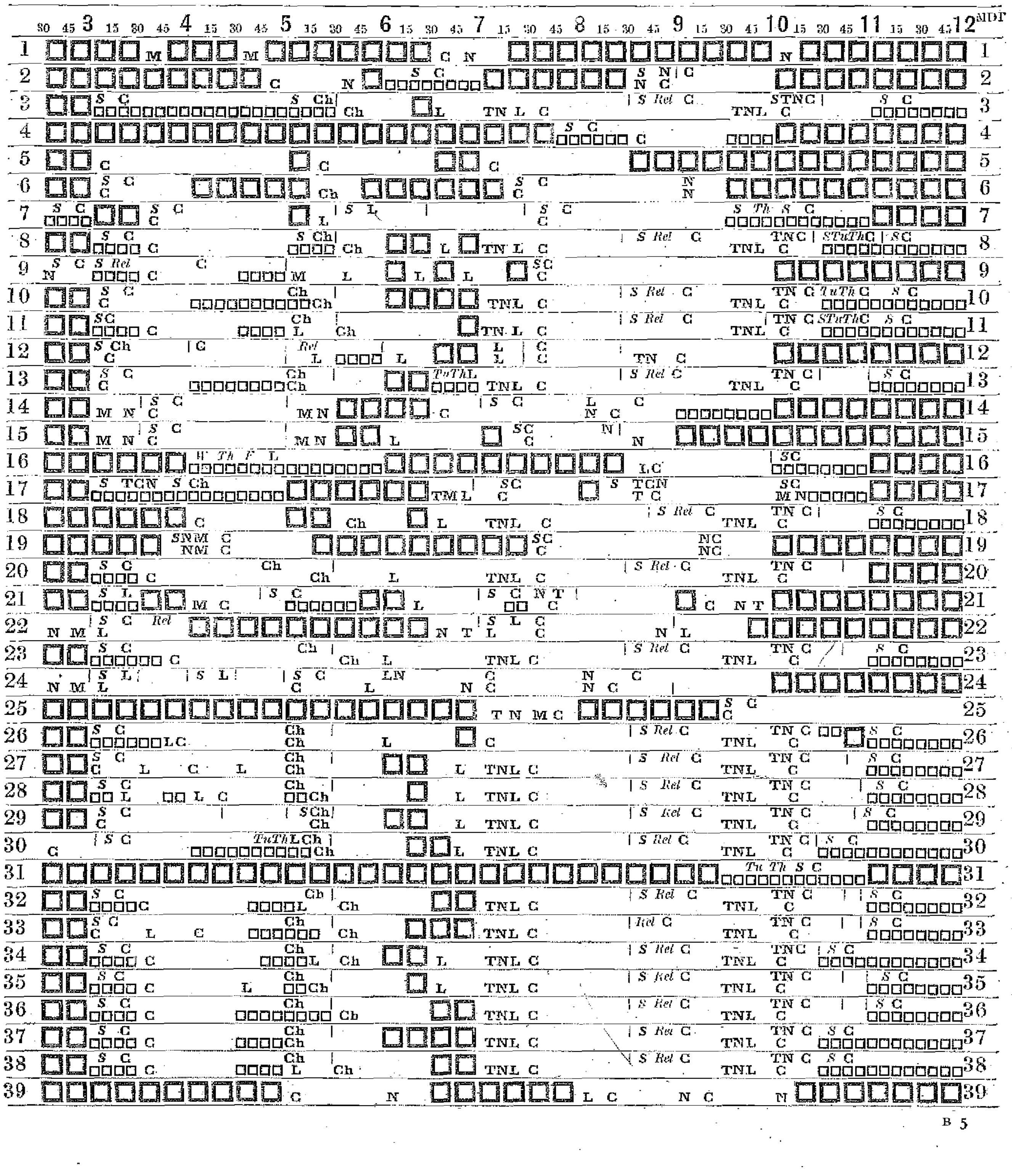
BROADCAST TIMES.

Abbreviations used throughout the Tables below. **C** = MUSICAL PROGRAMME. **N** = NEWS and/or WEATHER FORECASTS. **M** = MARKET and EXCHANGE NEWS and PRICES. **T** = TIME SIGNAL. **L** = TALKS and LECTURES. **Ch** = CHILDREN'S CONCERTS and TALKS. *Rel.* = RELIGIOUS ADDRESS. *Days of the week are abbreviated as:* S. M. Tu. W. Th. F. S.

Week-day Regular items are shown as :— M

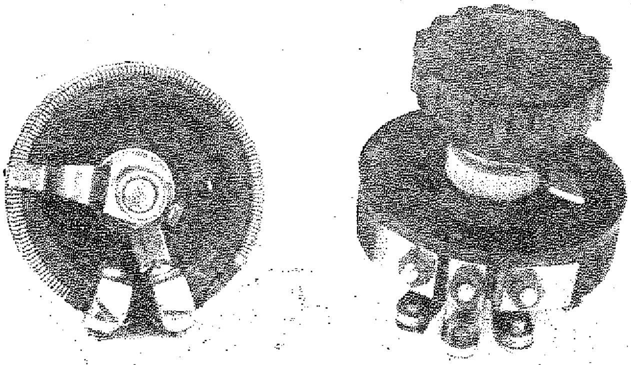
A Sunday Concert would appear as :— SC

A Lecture on Tuesdays and Thursdays as :— TuTh L



AMERICAN TYPE FILAMENT RHEOSTAT AND POTENTIOMETER.

Both the filament resistance and potentiometer are built upon Bakelite mouldings which are remarkable for their clean finish. The filament rheostat is available in five different resistance values between 6.5 and 40 ohms, and the potentiometer has an approximate total resistance of 400 ohms.



Resistances and potentiometers, products of Messrs. Gaston E. Marbaix.

On test the contact was found to be particularly reliable and operated over the wire without creating the slightest interruption. The compact design and solid construction of the instruments as a whole, combined with the fact that only a single panel hole is required for mounting, renders them particularly suitable for use by amateurs building their own sets.

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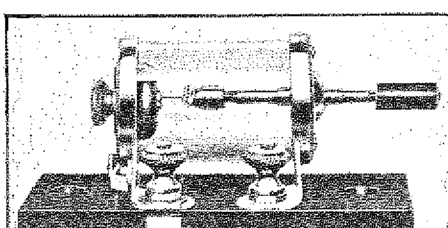
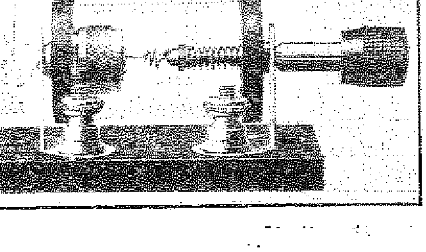
THE G.E.C. CRYSTAL DETECTORS.

Two new crystal detectors have recently made their appearance. It will be seen that they are totally enclosed under glass covers, which has become an almost essential feature in crystal detector design, in order that the contact may be protected from dust and dirt and the corrosive action of the atmosphere. Both types are beautifully finished, the pressed parts being nickelled. The micrometer adjustment with which one of the models is fitted operates exceedingly well and provides a means for easily obtaining a good adjustment.





(Above) The G.E.C. detector, and on the right a detector with micrometer adjustment.

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"LEAKFREE" RED LINE PANELS.

Messrs. Fullers United Electric Works, Ltd., of Chadwell Heath, have recently placed on the market a range of standard ebonite panels suitable for use in wireless instrument construction. The amateur usually experiences difficulty in preparing a rectangular panel, for unless workshop facilities are available it is a tedious process filing the edges true, and he will appreciate the convenience of these panels which he can purchase already squared up. Another advantage is obtained inasmuch as the ebonite is graded and he has a guarantee as to its quality. In order that there shall be no confusion with inferior grades the manufacturers have constructed their sheets of ebonite with an intermediate layer which is of a reddish colour, so that to whatever size or shape the panel may subsequently be cut the identification mark still remains.

The standard sizes are: 6in. × 6in., 9in. × 6in., 12in. × 9in., 12in. × 12in., and 18in. × 9in., and in thickness either $\frac{3}{16}$in. or $\frac{1}{4}$in. Although this is a very liberal range of sizes we should have liked to have found available a panel measuring about 7in. × 12in. to 14in., which is a size so generally adopted when making up a set which consists of a vertical panel attached to a wooden base.

The ebonite is finished with a velvet matt surface which will greatly add to the good appearance of the finished set.

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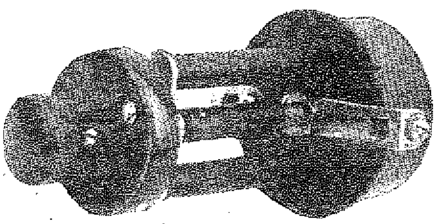
A RELIABLE VARIABLE GRID LEAK

So much difficulty has been experienced in the construction of a reliable variable grid leak that amateurs have been a little cautious in fitting such a component to their sets.

The new variable grid leak just introduced by the Igranic Electric Co., Ltd., makes use of a reliable contact sweeping around a graphite covered surface. The graphite line is raised so that in use there is no chance of a change occurring in the width, which would, of course, upset the calibration of the component.



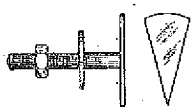
The Igranic Electric Co.'s variable grid leak.

A special feature which will readily be appreciated is that the rubbing contact is driven through an ebonite stem and the entire electrical parts are well spaced from the surface of the panel. By this means the leak can be connected in any part of the circuit without risk of detrimental effects being produced when the hand is brought near the surface of the panel in the process of tuning.

The dial is of unique design, and consists of a calibrated ivorine scale revolving behind a moulded cover. The resistance can be varied from zero to approximately 5 megohms, which is, of course, a range most suited for obtaining good rectification with maximum signal strength.

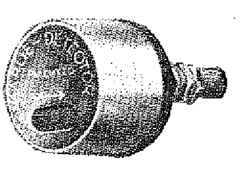
THE DECKO DIAL INDICATOR.

When an instrument panel is to be engraved there is no difficulty in providing a scratch line for indicating the setting of condenser dials, etc. The amateur, however, very often builds up his set by a process of assembling the components on the panel, and does not feel inclined to completely dismantle the apparatus to permit of the panel being sent to the engraver. He will welcome, therefore, the introduction of this dial indicator, which, if anything, gives a better appearance than the more usual scratch line. The brass pointer measures nearly ½ in. in height, and is about $\frac{3}{16}$ in. across at its widest point, and is obtainable nickelled or in polished brass.



THE HARLIE DETECTOR.

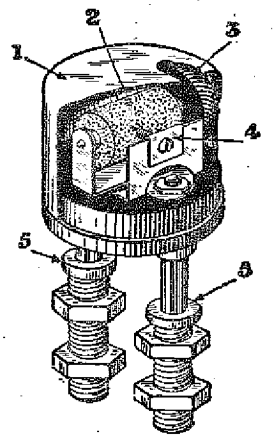
The crystal detector so invariably adopted by the beginner suffers from the defect of difficult adjustment, and for this reason a valve is often employed as a detector for no other reason than the stability it gives, with an absence of critical adjustment.



The design of the new Harlie detector entirely eliminates the need for critical manipulation, and is in consequence particularly suited for use in the construction of fool-proof crystal receiving sets.

In construction it consists of a crystal of cylindrical formation (2) which is mounted on a spindle and can be rotated by means of a small milled ebonite knob (3). Resting against the cylinder is a metal wire contact adjusted to give a suitable pressure. The wire is carried on a metal clip (4) which is movable on its supporting bracket, so that contact can be obtained with any part of the crystal. Thus to operate the detector it is only necessary to slowly propel the ebonite knob until the required signal strength is obtained.

In use the crystal was found to possess a sensitiveness rivalling any of the galena types, and a good detecting point was easily found. The entire mechanism is enclosed under a nickel metal cap, giving the detector a good appearance and protecting it from dust. Another feature is that it is provided with plug-and-socket connectors (5), so that it can easily be withdrawn from circuit or reversed.



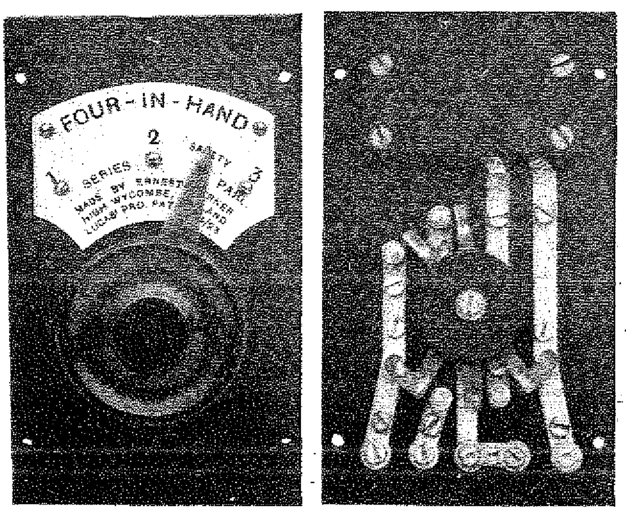
The internal construction of the Harlie detector

THE FOUR-IN-HAND AERIAL TUNING SWITCH.

By the operation of a single knob several combinations in the connections of the aerial tuning condenser and inductance are obtainable, in addition to a safety position when the aerial is earthed.

A fixed condenser of capacity 0.0005 mfds., which is fitted to the switch, can be connected in shunt across the tuning inductance while the variable tuning condenser remains series connected.

A feature of the switch is that all contacts are carried in a protected position beneath the panel, adding very much to the good appearance of a receiving set to which the switch may be fitted. The spring contacts are of hard bronze and make reliable connection.

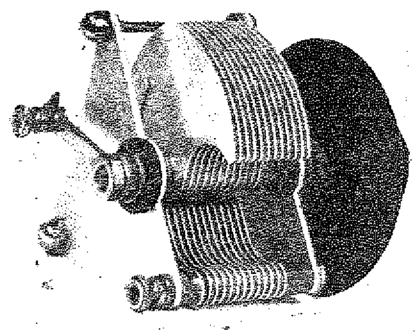


A recent product of Messrs. Ernest Turner of High Wycombe. The switch provides for making the several changes required in the process of aerial tuning.

THE LAMPLUGH SQUARE LAW CONDENSER.

This new type condenser is of unusual and original design. The moving plates follow a symmetrical design and resemble in shape the blade of a shovel or an arrow head.

A report by the Natural Physical Laboratory shows that a tuning range of 180 to 755 metres is obtainable with an efficiently designed tuning coil having an inductance of 279 microhenries, with the 0.0005 mfd. condenser. The curve showing the relationship between scale degrees and wavelength is practically straight over this range.



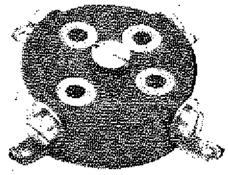
The new Lamplugh condenser. The plates are of unusual design.

The instrument is beautifully finished and of robust construction.

BARRIES LOW CAPACITY VALVE HOLDER.

The reduction to a minimum of the capacity presented between the sockets should be the aim in valve holder design.

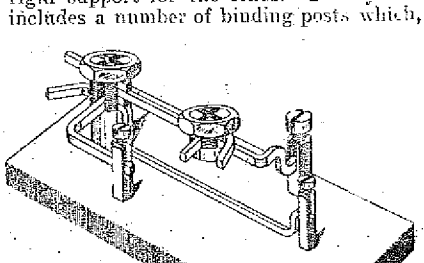
In the Barries valve holder a low capacity is obtained by shortening the length of the sockets and at the same time producing a holder which does not occupy excessive depth. It is a component of particularly good finish, and can be mounted either beneath the instrument panel or attached to a baseboard.



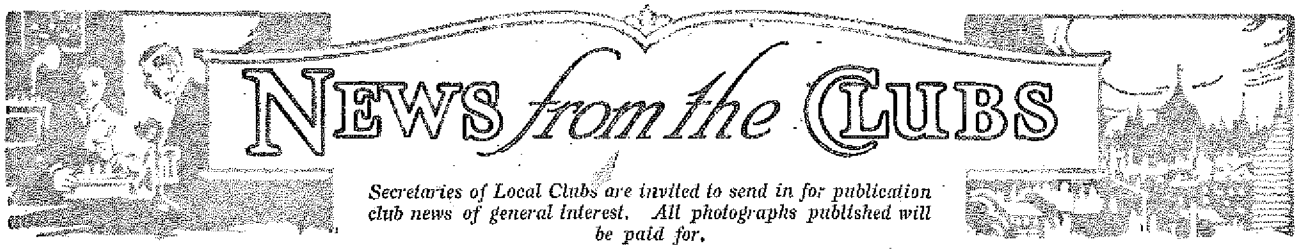
Barries low capacity valve holder.

"KRISCROS" CONNECTORS.

This entirely new form of connector has been introduced to simplify instrument wiring by avoiding the need for soldered joints and at the same time providing rigid support for the leads. The system includes a number of binding posts which, by means of slots and locknuts, may be made to grip the wire to give the necessary support. By bunching the number of wires in a slot the device serves as a distributor for leads which are connected together.



A specimen wiring carried by Kriscros connectors.



NEWS from the CLUBS

Secretaries of Local Clubs are invited to send in for publication club news of general interest. All photographs published will be paid for.

Ilford and District Radio Society.

Mr. E. G. Dennis spoke on "How It was Done in the Navy," on February 3rd. Being an ex-C.P.O., Mr. Dennis was able to deal authoritatively with naval wireless developments, and imparted many interesting facts.

Dublin Wireless Club.

Interesting material for the beginner and expert alike was provided in a lecture on "The Care and Maintenance of Accumulators," given by Mr. J. H. Lureing on February 5th. The lecturer dealt very fully with the construction of various types of secondary cells and gave valuable hints on keeping accumulators in good condition.

Kingston and District Radio Society.

Mr. J. E. Nickless paid a visit to the Society on January 26th, and gave an exceedingly interesting talk on "Short Wave Reception." Mr. Nickless was well worth hearing, and his remarks provided the members with much useful information.

Hon. Secretary: Mr. R. C. Wilson, 8, Bloomfield Road, Kingston-on-Thames.

Hackney and District Radio Society.

A most successful dinner, followed by a musical programme, took place at the Elephant Hotel, Dalston, on January 19th, and was attended by more than fifty members.

On January 26th, Mr. G. A. V. Sowter, B.Sc., gave an instructive talk on "Technical Aspects of Crystal Reception." He described in detail the results of the recent National Physical Laboratory tests which had led to the conclusion, among other things, that a counterpoise earth produced the best results.

Nestanglo Radio Society.

On Thursday, February 5th, members of the London staff of Messrs. Nestlé & Anglo-Swiss Condensed Milk Co., met at 6-8, Eastcheap, E.C.3, to inaugurate a radio section of the Nestanglo Social Club, under the chairmanship of Mr. G. T. Walden. By a unanimous vote Mr. H. E. Swift was elected president, Mr. J. R. Harrison being appointed chairman. Meetings are to be held at 6 p.m. on alternate Thursday evenings at headquarters. On other Thursdays the Radio Room will be available to members for experiments, informal discussions, and the perusal of wireless literature.

The secretary would be glad to hear from other societies with a view to arranging experiments and the exchange of lecturers. Hon. Secretary: Mr. J. H. D. Clark, Radio Section, 6-8, Eastcheap, E.C.3.

Wimbledon Radio Society.

Captain P. P. Eckersley and Mr. Arthur R. Burrows were the chief speakers at the Society's public meeting held on January 29th.

In his own inimitable style, Captain Eckersley gave a racy account of the early trials and tribulations of the B.B.C.'s engineering staff, and the progress which had been made in the two and a half years since the inception of broadcasting.

In the course of his talk, the chief engineer of the B.B.C. mentioned the value of the radio societies, and it is hoped that all present took to heart his remarks on "Oscillation."

Mr. Burrows gave details of the manner in which the programmes are arranged, and dealt with some of the difficulties encountered by the programme staff. A great amount of correspondence is received, and Mr Burrows read several interesting letters from the previous day's post-bag.

Sir John Power, presiding, proposed thanks to the speakers, Mr. C. E. P. Jones seconding.

A charge of 6d. was made for admission, the proceeds being devoted to the Wimbledon Hospital.

Hon. Secretary: Mr. P. G. West, 11, Montana Road, Wimbledon, S.W.20.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 18th.

North Middlesex Wireless Club.—Lecture: "The Neutrodyne Circuit." By Mr. L. Skinner.

Radio Research Society, Peckham.—Practical Night. Valve Tests.

Golders Green and Hendon Radio Society. Lantern Lecture: "Some of the Continental Broadcasting Stations." By Captain L. Plugge.

THURSDAY, FEBRUARY 19th.

Luton Wireless Society.—Demonstration in Measurement of Efficiency. By Messrs. Bowyer-Lowe, Ltd.

Barnet and District Radio Society.—Lecture: "Transmission." By Mr. H. B. Gardner.

FRIDAY, FEBRUARY 20th.

Radio Society of Great Britain (Transmitter and Relay Section). At 6.30 p.m. (Tea at 5.30), at the Institution of Electrical Engineers. Lecture: "Master Oscillators." By Captain P. P. Eckersley.

Sheffield and District Wireless Society.—Elementary Lecture: "The Valve." By Dr. Walls.

Inland Revenue Radio Society.—At 5.30 p.m. Ordinary Meeting.

TRANSMITTING NOTES.

Please Report.

British amateurs are especially asked to listen for the Americans on Sundays between 15.00 and 16.00 (G.M.T.) on 20 and 40 metres, and to report reception to Mr. Gerald Marcuse.

Important Meeting.

On Friday, February 20th, an important meeting of the T. and R. Section will be held at the Institution of Electrical Engineers, when at 6.30 p.m. Captain P. P. Eckersley will give a Talk on "Master Oscillators." Tea will be served at 5.30.

Where are the Canadians?

American signals are still coming in at great strength, but many British amateurs have expressed surprise at the small number of Canadians who now appear to be working. The few who make themselves heard are mostly operating on a wavelength of 125 metres.

Telephony from Australia.

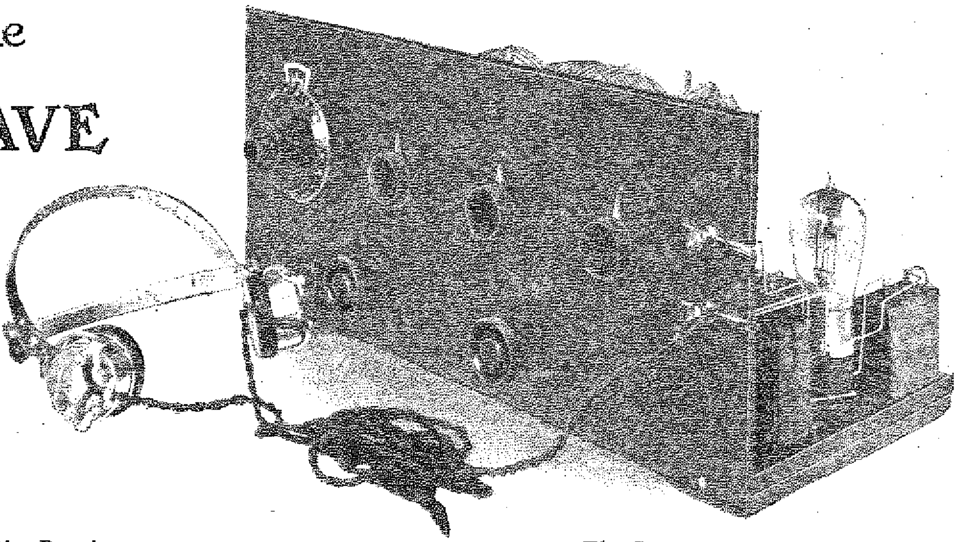
Considerable excitement has been caused generally during the past fortnight over 2NM's frequent communications with WJS, the station of the Rice Expedition on the Amazon. WJS uses a 2 kilowatt charging set driving a motor generator.

The principal event to be recorded is, of course 2OD's reception of telephony from Australian 3BQ on February 8th, reported elsewhere in this issue. The night in question was exceptionally favourable for Australian reception, but this class of work is being frequently spoilt by various foreign amateurs who seem to do nothing but transmit CQ calls with raw A.C. on the plates of their valves.

The Paris Conference.

Particulars are now available regarding the cost of the projected trip to Paris for the International Amateur Conference in April. For a party of not less than 25 persons the cost per head will be £11 11s. This will entitle the party to second-class travel tickets via the Short Sea route, comfortable hotel accommodation in Paris from April 14th to 21st, motor car drives round the city, and will defray many incidental items of expenditure. Passports are, of course, necessary, but British subjects do not require the French Visa. All those interested in this proposal should communicate at once with Gerald Marcuse (2NM), Hon. Secretary, T. and R. Section, Radio Society of Great Britain, 53, Victoria Street, London, S.W.1.

Building the SHORT WAVE RECEIVER



PART II.

On the right is a view of the set. The two lower knobs are for adjusting the Aerial and Reaction Coils.

By W. JAMES.

Arrangement of the Receiver.

IN Part 1 of this article the writer discussed the more important points in the design of a short wave receiver, and gave instructions for making the aerial, closed circuit, and reaction coils.

We have now to deal with the arrangement of the components on the panel and base. It is as well to emphasise again that the coils must be placed well away from such parts as the tuning condenser and intervalve transformer. The set will, therefore, be much larger than the more usual type of two-valve receiver, but as the correct arrangement of the components is such an important matter, the relatively large size is to some extent an indication that the parts are suitably spaced.

The accompanying photographs show the general arrangement of the set. On the left of the front panel is the knob and dial of the tuning condenser, and in line with this the knobs of the potentiometer, and the two filament resistances. Of the lower two knobs, the one on the left is attached to the spindle of the aerial coil, and the one on the right to the reaction coil.

Attached to the lower edge of the front panel is a base which carries the remaining components and the connection strips.

The Front Panel.

The front panel is of ebonite measuring 18in. × 8in. × ¼in., and should be marked and drilled out as indicated in Fig. 1. Notice in particular the two holes through which the spindles of the aerial and reaction coils pass. These should be of larger diameter than that of the spindles; the construction of the moving coil holders is such that there is no need to employ the panel as an additional bearing.

The Base.

On the base of the set, which is of mahogany, and measures 17½in. × 8in. × ⅜in., are mounted the parts shown in Fig. 2. Special attention should be given to the fixing of the aerial and reaction coils. The closed circuit coil is arranged to slide between these coils, and is held in place by a pair of phosphor-bronze strips, which have one of their ends screwed to a piece of wood secured to the base.

Two terminal strips are employed. The sizes of these are given in Fig. 3, and they are screwed to the back edge of the base board, as shown by the photographs.

Wiring.

The wiring connections, given in Fig. 4, are quite straightforward. Carefully follow the diagram, and when wiring be sure to run the wires fairly low, in order that the aerial and reaction coils can be moved from the vertical position through about 75 degrees. It will be found that there is ample room for the wires connecting the coils, and these wires should be well spaced.

As the low-frequency portion of the set is compactly

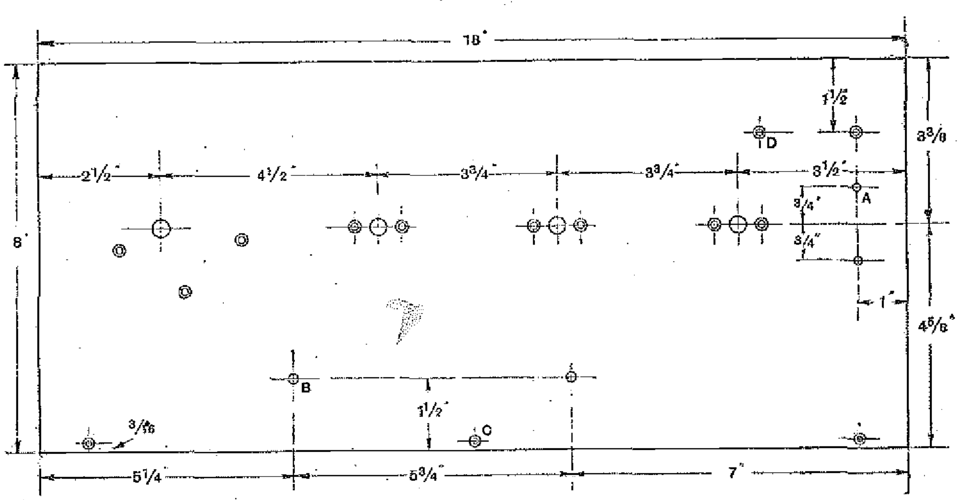


Fig. 1.—Details of the ebonite front panel. A = drill $\frac{5}{32}$ in. B = drill ¼ in. C = drill ⅛ in. and countersink. D = drill $\frac{5}{32}$ in. for 4 B.A. countersunk screws.

Building the Short Wave Receiver.

arranged, the wires connecting these components run close together, and should be carefully bent to shape to give reasonable spacing.

Testing the Set.

The valves recommended are a D.E.V. for the detector, and a D.E.5 for the L.F. stage. As the D.E.V. valve has a filament current of about 0.3 ampere at 3 volts, a separate positive terminal is provided, and should be connected to +4 volts. The second positive filament battery terminal for the D.E.5 valve is joined to +6 volts. A common negative is used.

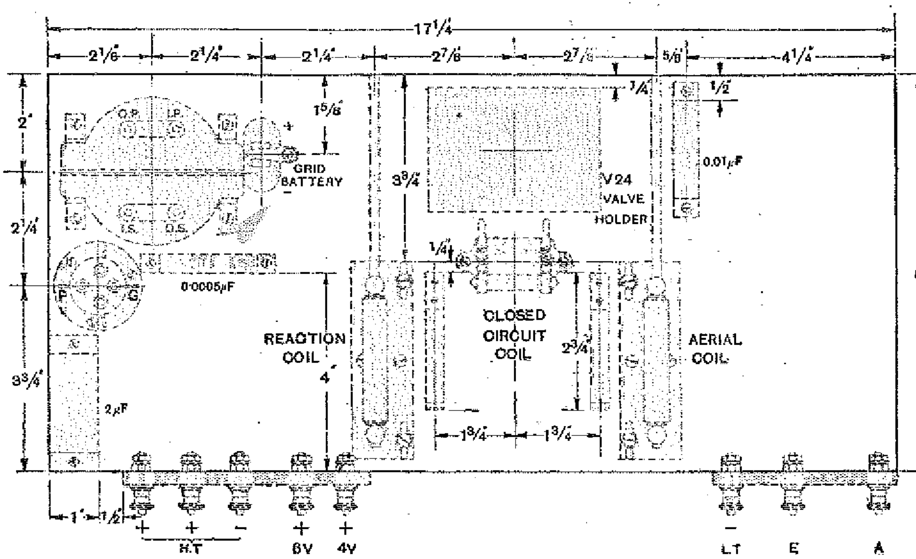


Fig. 2.—Details of the base, showing the position of the components.

For the anode of the detector an H.T. voltage of 15-30 will be required, and for the L.F. stage about 90.

With the set connected up, test for oscillation by bringing the reaction coil closer to the closed circuit coil. It will be found that the factors determining the ease with

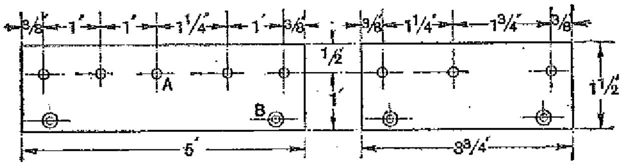


Fig. 3.—The ebonite terminal strips. A = drill $\frac{5}{32}$ in. B = drill $\frac{1}{8}$ in. and countersink.

which the set oscillates are: the coupling of the reaction coil, the coupling of the aerial coil, the H.T. voltage of the detector, its filament current, and the setting of the potentiometer. The most suitable values of H.T. and L.T. can quickly be found. Then, when a signal is heard, a fine adjustment can be made by the reaction coil, the aerial coil, and the potentiometer.

The adjustments should be such that the set oscillates smoothly—not suddenly breaking into oscillation as the reaction coil is brought nearer the closed circuit coil. Good results cannot be obtained unless very critical adjustment of the degree of reaction is possible. Of course, the most suitable filament temperature, grid bias, and anode voltage can only be found by experiment, as even valves of the same type have slightly different constants. With regard to the best value of grid leak to employ, this is entirely a matter for experiment. It is generally found that a leak having a higher resistance than usual, such as 5-10 megohms, is best when receiving weak signals. A good average value for normal conditions, however, is 2 megohms, but the effect of using a higher resistance leak should certainly be tried.

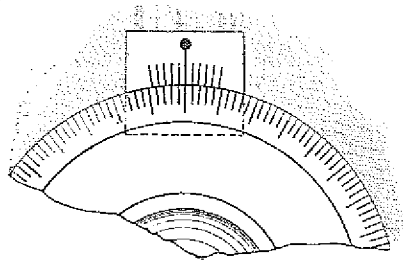
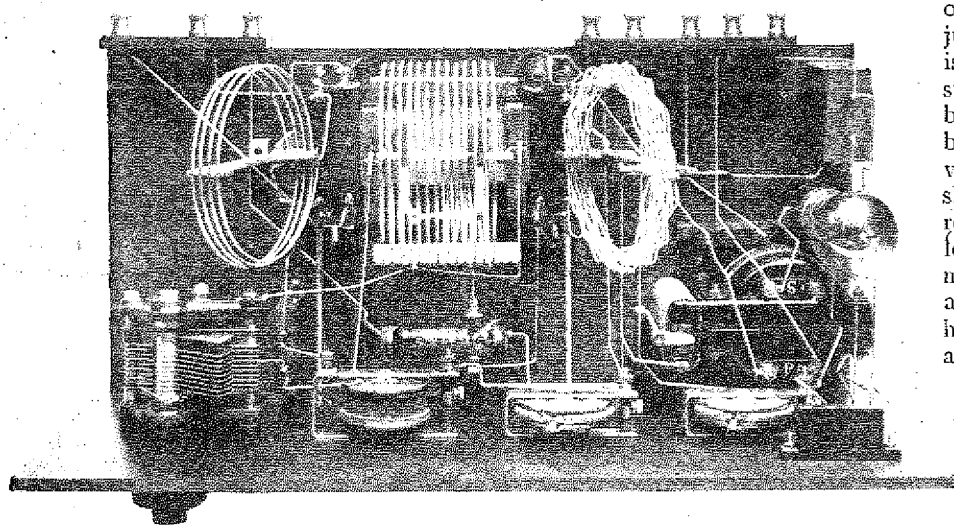


Fig. 5.—A vernier setting may be obtained by sticking a piece of paper, marked as shown here, above the scale of the dial.

As a help in accurately setting the tuning condenser a



View of the set from above. On the panel may be seen the tuning condenser, potentiometer, two filament resistances and the telephone condenser. The centre coil is the removable closed circuit coil; on the left the aerial coil, and right, the reaction coil.

Building the Short Wave Receiver.—

vernier arrangement is employed. This consists of a piece of paper divided into ten divisions, corresponding with nine divisions on the dial. The arrangement is sketched in Fig. 5.

With such a sensitive receiver as this the user will find that the number of stations he can tune in is really an indication of his ability to handle the set.

COMPONENTS REQUIRED.

1 Ebonite panel, 18 in. × 8 in. × ¼ in.
1 Piece of ebonite, 5 in. × 1½ in. × ¼ in.
1 Piece of ebonite, 3¾ in. × 1½ in. × ¼ in.
1 Mahogany board, 17¾ in. × 8 in. × ⅜ in.
1 Tuning condenser with vernier, 0·00025 microfarad, of the "square law" type (Sterling).
1 Potentiometer, 300 ohms (Igranic).
2 Filament resistances, about 4 ohms (Igranic).
1 Valve holder, pin type for board mounting (Burndept).
1 Valve holder, V.24 type (Marconiphone).
1 Intervalve transformer, ratio 6:1 (Marconiphone Ideal).
1 Grid condenser and leak, 0·0002 microfarad and 2-5 megohms (Dubilier).
1 Fixed condenser, 0·0005 microfarad (Dubilier).
1 Fixed condenser, 0·001 microfarad (Dubilier).
1 Fixed condenser, 0·1 microfarad (T.C.C.).
1 Fixed condenser, 2·0 microfarad (T.C.C.).
1 Two-cell grid battery.
10 Terminals, 4BA.

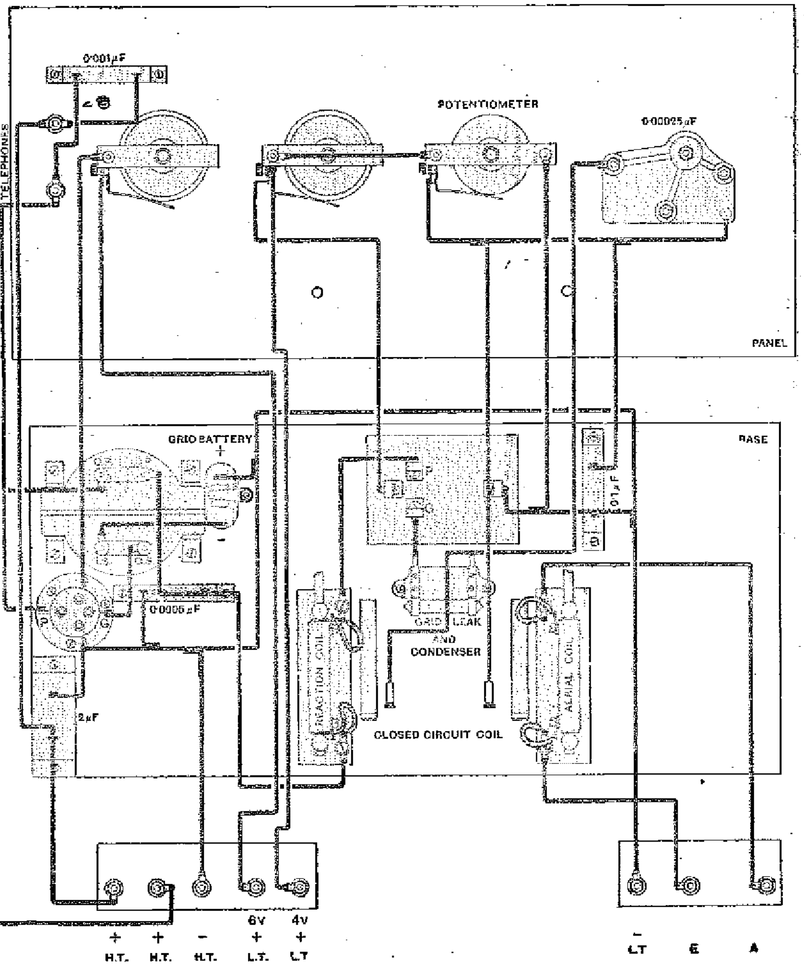


Fig. 4.—The wiring diagram.

CALLS HEARD.

Battersea.

French :—8AB, 8AP, 8BU, 8BY, 8CA, 8CN, 8CPP, 8DU, 8ÉU, 8GD, 8GI, 8GL, 8GP, 8HSG, 8HSM, 8LPR, 8NS, 8QG, 8RO, 8SG, 8SM, 8SR, 8SSU, 8UU, 8VV, 8WK, 8WY, 8ZZ. *Dutch* :—0GC, 0II, 0KH, 0MS, CRE, 0RP, 0RW, 0ZN. *Danish* :—7EC, 7ZM. *Finnish* :—2NCA, 2NM. *Belgian* :—4CA, P2. *Italian* :—1AM, 3AF. *Luxembourg* :—LOAA. *Sweden* :—SMZN. *Swiss* :—H9AD, H9AL. *American* :—3QK.

(Reinartz 0-v-0.) Pse QSL. All cards answered. C. W. PICKEN.

Nice, France.

British :—2OD, 2NM, 5KM, 2JX, 2MM, 2RB, 6NF, 2FN, 6LJ, 2JF, 5LF, 2LZ, 2CC.

(About 100 metres. 1-v-0.)

LEON DELOY.

Dublin.

British :—2CQ, 2DR, 2DX, 2FN, 2KF, 2LZ, 2OM, 2WD. 5BV, 5CX, 5GF, 5HS, 5MA, 5SZ, 5TZ, 6FQ, 6LJ, 6MP, 6NF, 6RW, 6RY, 6VP.

(0-v-1.) D. O'DWYER.

Thornton Heath, Surrey.

American :—1AAY, 1ABS, 1AEA, 1AF, 1ANU, 1ARD, 1ARI, 1ARY, 1BAN, 1BES, 1BG, 1BGQ, 1BH, 1BIT, 1BSD, 1CGU, 1CI, 1CKP, 1CMB, 1CMP, 1CV,

Lists submitted for publication in this section should be as short as possible. They should contain only calls heard within the previous fortnight and believed to be of reasonably distant origin. Compliance with these conditions will considerably enhance the value of the section from all points of view.

1DA, 1ER, 1ERI, 1EZ, 1HSD, 1LF, 1MT, 1NF, 1NN, 1OX, 1OW, 1PP, 1SY, 1WB, 1XM, 2AAY, 2AG, 2AHA, 2AWJ, 2BE, 2BGU, 2BN, 2CE, 2CGI, 2CEI, 2CJ, 2CLA, 2CV, 2DD, 2GK, 2MC, 2RR, 2TP, 2WL, 2WR, 3AD, 3ADJ, 3ADQ, 3ANJ, 3AJ, 3BM, 3CHG, 3KJ, 3LG, 3SS, 3UDR, 3YO, 4CZ, 4DU, 4EB, 4EK, 4EO, 4FT, 4EW, 4SB, 4TE, 4TV, 4XL, 5HJ, 6AFH, 6AWP, 6AWT, 6BKU, 6CHL, 6HP, 7AFO, 8AV, 8AVL, 8CU, 8DA, 8ES, 8NB, 8UIM, 8UJ, 8UP, 8VT, 9AD, 9BHT, 9DM, 9DN, 9EP, NKP, SJ, WGH, WJS. *Canadian* :—1NN, 1NU, 2AU, 2CG, 5IN.

(0-v-1.) CAPT. F. C. MCMURRAY and R. E. LAWRENCE BEENE (2FM).

Eltham, London, S.E. (Jan. 18th, 0.00 to 6.0 a.m.)

American :—4BQ, 1KC, 3CHQ, 1CJN, 3CW, 1ZA, 4EQ, 1AA, 4EQ, 1AA, 4DO, 1PL, 2NB, 1AR, 1ARY, 4XE, 2GK, 1ER, 1BSG, 1CRU, 3AI, 3ADQ, 1CAK, 1SF, 1BP, 1AUC, 1DQ, 1BGQ, 1RD. *French* :—8GVR, 8WZ, 8FK, 8GO, 8EV, 8AB, 8EN. *Dutch* :—0RE, 0GC. *Belgian* :—4AS. *Italian* :—3MB. *Danish* : 7EC. *British* :—5KM, 2AUC.

(0-v-1.) H. W. EVERITT.

NEWS FROM THE STATIONS.

Matters Irish.

Broadcasting in Ireland does not seem to be altogether on a happy basis.

The B.B.C. have their station going at Belfast, and programmes are giving great satisfaction, with the exception of the Sunday transmissions, which in the opinion of listeners are not lively enough.

oooo

Irish Transmissions on Sunday

The B.B.C. not unnaturally wish to travel very slowly in the matter of Sunday performances in Ireland, but they have received sufficient indication that the North of Ireland is at least as progressive as Scotland, and that they don't want to be made "step-bairns." The result will probably be that the amount of broadcasting on Sundays will be increased.

oooo

The Free State Position.

The broadcasting position in the South of Ireland has been anything but happy.

The Free State Government have been tinkering with the question for at least two years, and the only broadcasting that the South of Ireland listens to is from the B.B.C. Station.

oooo

Argument for Private Enterprise.

There may be many reasons for the delay, but the South of Ireland people ought to have been more energetic in getting a station going, because they have provided an argument to those who feel that the State cannot manage things as well as private enterprise, or as well as the happy connection of State and private enterprise which is the basis of the B.B.C.

oooo

Religious Ideas in Broadcasting.

A Christian periodical of the highest standing makes the somewhat uninformed proposal that facilities be provided for certain bodies to broadcast programmes governed by specifically Christian motives. This is because the religion broadcast from the B.B.C. is not quite as advanced in certain directions as the paper and its readers stand for.

Does it never occur to these excellent people that the present undenominational service of the B.B.C. is as nearly ideal as it is possible to be?

oooo

Programmes for Every Sect?

If this particular paper, and those who think like it were able to have broadcast programmes in accordance with their own ideas, then every sect in creation would justly have the right to have the same facilities, and the wilder and more extreme the sect, and the more remote from conventionality and orthodoxy, the keener they would be on their broadcasting facilities.

oooo

Edinburgh and Glasgow Again.

An enterprising dealer in wireless apparatus in Edinburgh has been having a little plebiscite on his own as to what particular programme Edinburgh desires. His figures were: London 477, Glasgow 46, no change 49.

While, of course, the figures given are somewhat small to form an accurate estimate of wireless opinion in Edinburgh, the probability is that they are representative and fairly accurate.

oooo

London at Any Cost.

It is one of the most astonishing things imaginable how Edinburgh people refuse to have anything from Glasgow, no matter how good it may be, and it is no exaggeration to say that there are a vast number of otherwise intelligent people in Edinburgh who would rather have a band of street musicians from London than a Scottish orchestra from Glasgow.

One would have thought that just as wireless knows no country, it would know no town, and that it would not matter in the slightest to a listener where the concert came from, provided that it was a good one.

There is something extraordinarily parochial and provincial about the suggestion that the ether waves must come in a specific direction.

oooo

B.B.C. and the Theatres.

The second meeting of the representatives of the Entertainment Industries was even more harmonious than the first, and one or two of the theatrical people who had been implacable in their hostility to broadcasting in any way or form seem to have come round to the opinion that perhaps after all they had better make friends with the "manna of unrighteousness" while there was yet time.

oooo

Signs of Harmony.

The points upon which there was agreement included :—

The theatrical managers as a whole to be dealt with rather than individual members.

The theatrical people to say which plays should be broadcast.

On every occasion on which a play is broadcast there should be certain blank areas or stations to which it would not go, so that the rights of touring companies would be preserved, and there was actually a measure of agreement on the question of finance.

oooo

How Things Stand.

Certain proposals of the B.B.C. in this respect were referred back for further consideration of the various interests represented.

On the whole the outlook is extremely friendly. Of course the B.B.C. are in a strong position, and as was indicated last week in these Notes, they can really get all the shows they want without limitations of any kind.

oooo

A Problem of Policy.

The question has often been asked of late as to the rules governing interference by the Government in connection with B.B.C. Talks.

It is well known that a certain distinguished economist was deeply chagrined recently because his Talk on Reparations was turned down by the B.B.C. This gentleman, however, managed to secure a good deal of publicity for his views in certain periodicals at home and abroad, so that the nations of the earth were not ignorant as to how he would settle things.

oooo

Treading Warily.

The B.B.C. are precluded in their licence from broadcasting political or acutely controversial matter, and this Talk was arranged by a body which professes to be, and usually is, utterly divorced from party politics, but the Talk contained a very one-sided view of Reparations, and as it fell due to be delivered at the same time as the British and French representatives were discussing the problem of reparations, it had to be withdrawn.

When it is considered that Chelmsford is practically a Continental station, it will be seen that it would have been highly inadvisable for the B.B.C. to permit this Talk to go on.

oooo

Barring Controversial Talks.

As a matter of fact, however, they did not take the responsibility of turning down the Talk. They submitted it to the Post Office, who in turn submitted it to the Foreign Office, and it was the Foreign Office that very rightly turned the Talk down.

The B.B.C. would recede from popular favour if it departed from its excellent rule of complete freedom from political and acutely controversial topics and from *ex-parte* statements of any kind.

oooo

A Bedraggled Studio.

The B.B.C. are making constant experiments in acoustics just now, and the beautiful studio at 2LO which was the joy and delight of the æsthetic members of the staff now occasionally presents a very bedraggled appearance with half the curtains down and half of them up.

It is rather remarkable how the experts have changed their opinions with regard to draperies and acoustics.

oooo

The Happy Mean.

The first studio at 2, Savoy Hill is still in existence, and it has five hangings of drapery, so much so in fact, that there is not the vestige of an echo. Then the new large studio was erected, which had only one hanging of drapery, and that was not very heavy.

Experiments have also been tried in rooms with bare walls, but there is too much resonance there, so that the happy mean seems to be half-draped studios.

FUTURE FEATURES.

Sunday, February 22nd.	
London and 5XX (3 p.m.)	Oratorio: "The Creation." (Haydn.) Conducted by Percy Pitt. S.B. to other stations.
Birmingham (3 p.m.)	Chamber Music Programme.
Bournemouth (3 p.m.)	Band of 2nd Batt. the Argyle and Sutherland Highlanders.
London and 5XX (9 p.m.)	Casano's Octet.
Cardiff (9 p.m.)	Handel Programme.
Monday, February 23rd.	
London and 5XX	Barnado's Musical Boys.
Belfast	A Handel programme.—The composer's birthday.
Tuesday, February 24th.	
All stations except 5XX	Programme of Old English music.
5XX	Popular Orchestral Programme.
Wednesday, February 25th.	
Birmingham	Coleridge-Taylor Programme, relayed from the Town Hall, Walsall.
Manchester	Symphony Concert, conducted by Percy Pitt.
Glasgow	Popular Night, Pianoforte and Violin Recital. S.B. to other stations.
Thursday, February 26th.	
London	Light All-British Concert. S.B. to other stations.
Manchester	A Light Programme.
Friday, February 27th.	
Birmingham	First English Production of Boris Godunov.
Cardiff	Popular Programme.
Aberdeen	Music and Drama: "A Tale of Two Cities."
Saturday, February 28th.	
London	Sixth Query Programme.
Manchester and 5XX	Grand Opera: "Samson and Delilah."

Should We Have Announcers' Names?

The B.B.C. are being overwhelmed with requests that once again they publish the announcers' names, and they are at a loss to know why people should want to know them. Perhaps the real explanation is to be found in the fact that a good many people have little bets as to the identity of the announcers on a particular night, and the cancelling of their names has precluded this agreeable form of indoor sport.

oooo

Sir William Bragg's Rare Faculty.

One of the most interesting things done by the B.B.C. of late has been the series of Talks by Sir William Bragg. He seems to possess, as no other modern lecturer does, the faculty of making abstruse science simple, and a difficult subject plain.

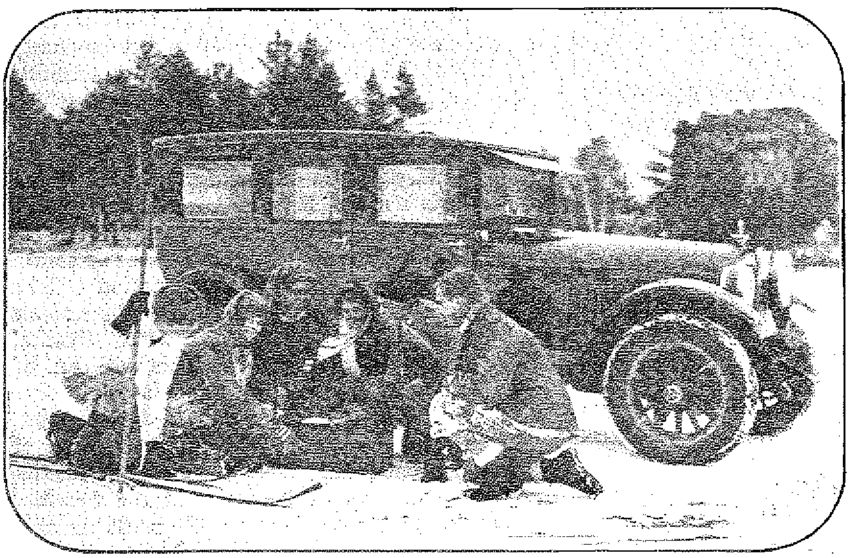
There is so much of the other thing in evidence, namely, people who have an easy subject to handle, and who work it up into something very impressive, that is abstruse and difficult. We hope it may be possible to secure Sir William Bragg's services for further talks in the near future.

oooo

Authors Before the Microphone.

It was quite interesting being at 2LO when Jerome K. Jerome was reading extracts from his works the other day. Mr. Jerome undoubtedly is more effective in his own metier than in speech making. He read his works with some zest, but seemed to suffer from a cough which affected his utterance considerably.

Unlike W. W. Jacobs, his face does not remain absolutely immobile when he is speaking, but he enters into the spirit of his works with great interest.



IS IT GOOD FOR THE SET? Our American cousins rarely do things by halves, as this photograph testifies. The party is picking up a broadcast programme at an American winter resort.

CHARGING ACCUMULATORS AT HOME.

Methods Making Use of the Supply Mains.

Accumulator charging is often inconvenient and expensive. The difficulty of maintaining the filament current supply can be solved where a public electricity service is available, and the various methods of accumulator charging are here described.

By F. H. HAYNES.

THE problem of accumulator charging is undoubtedly a bugbear to the majority of users of multi-valve receiving sets, because it is one usually involving inconvenience and expense. The number of valves to be used in a receiving set is, as a rule, viewed with the object of providing the necessary strength of signal, and almost regardless of maintaining the filament current supply. The introduction of dull emitter valves has gone a long way to relieve the difficulties of accumulator charging, but with sets operating loud-speakers and fitted with three or more valves the process of maintaining filament current must be carefully considered.

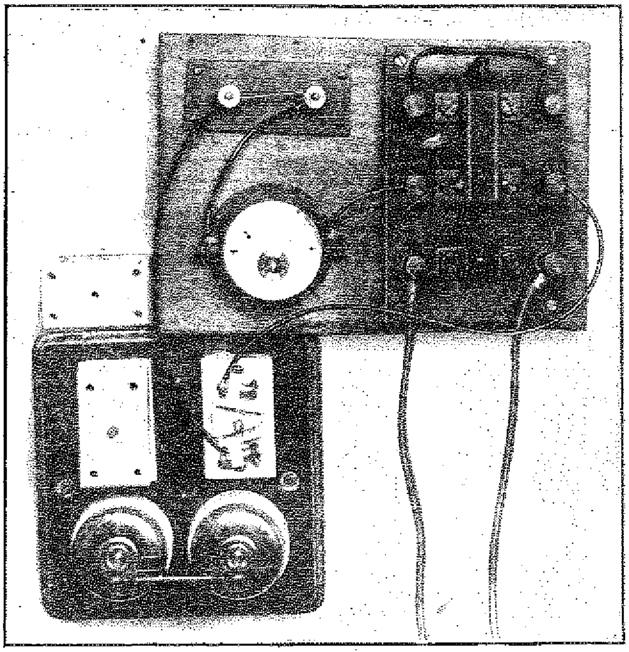
It may be said at the onset that, unless electric supply is available, there is no alternative but to carry the heavy batteries to and fro from the local charging station or to make use of a charging and delivery service.

To install a small gas or petrol engine for the purpose of driving a dynamo is out of the question in the environments of a dwelling-house. Such a generating plant is expensive to install, difficult to silence, and requires constant attention while running.

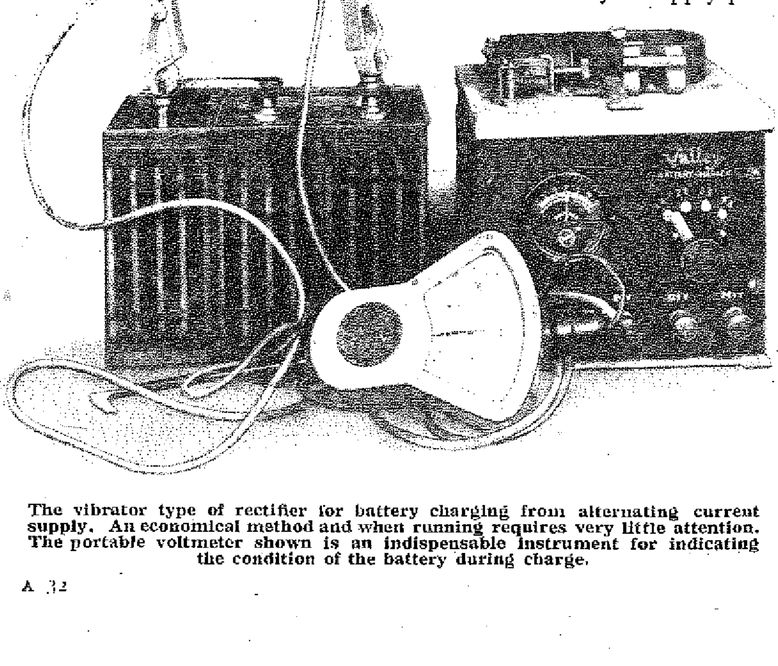
Charging from Direct Current Supply.

Fortunate is the man with a supply of direct current. The most economical method of charging a small six-volt battery from D.C. supply is to interpose it in the mains so that the current consumed on the house circuits is all passed *via* the battery. The battery, of course, must not be joined in circuit on a supply used for heating and cooking purposes, or where the current exceeds more than a few amperes. In ordinary circumstances the current passed on a house-lighting circuit at any time rarely exceeds 3 amperes. Power circuits are invariably separately wired, and it is usually possible to break in on a supply passing a moderate current. The maximum charging rate should not exceed that specified by the makers in their instructions, which is usually a figure representing one-tenth of the actual ampere-hour capacity of the battery. It is quite worth while to make up a simple charging board consisting of a cheap pattern ammeter, a double pole two-position switch, and a fuse, as shown in the accompanying illustration. The fuse shown consists of a pair of terminals mounted on a piece of scrap ebonite, though a porcelain fuse with base can, of course, be purchased quite cheaply. One end of the fuse is wired to the ammeter, the other side of which is taken to one of the centre contacts of the switch. The remaining centre contact and the fuse are fitted up with short flexible leads for connection to one or other of the two main fuses (consumer's fuses).

One of the mains on a direct current



An easily constructed charging board, for use with a direct current supply, shown connected up to the main lighting switch. For charging small batteries the method is practically costless. The accumulator leads are connected to the lower contacts of the double pole switch. With this switch in the upper position the battery is out of circuit.

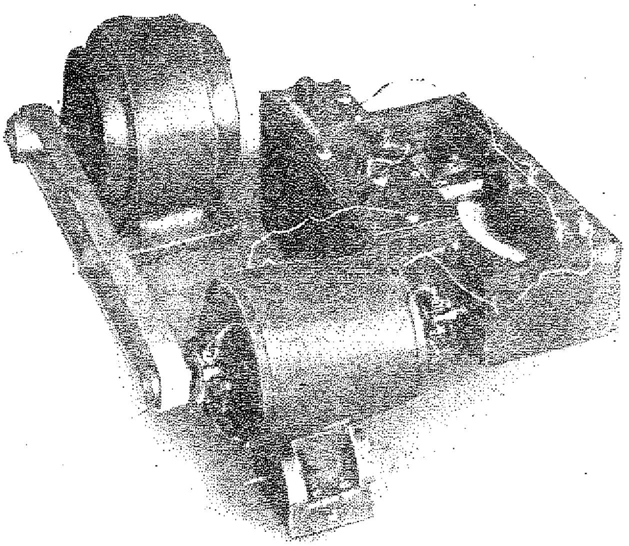


The vibrator type of rectifier for battery charging from alternating current supply. An economical method and when running requires very little attention. The portable voltmeter shown is an indispensable instrument for indicating the condition of the battery during charge.

Charging Accumulators at Home.—

supply system is earthed at the power station, and it is to the earthed main that this charging apparatus is fitted. By so doing the chance of receiving shocks while handling metal parts is practically eliminated, whilst the battery is almost at earth potential

It is no use determining the polarity of the mains to find out which is the earthed side of the supply, for



In the experimenter's workshop a small motor running off the mains is usually available. Here a ¼ h.p. A.C. motor is coupled up to a small dynamo of a type obtainable from dealers in ex-Government electrical apparatus.

on the three-wire D.C. system the positive may be earthed in one house, while on the other side of the street it may be the negative. The quickest test is to place one finger on the conduit tubing, and briefly touch each of the fuses in turn with the other hand. A violent shock will be received from the fuse, which is above earth potential, though a slight shock may be felt from the other. As an alternative, a lamp should be fitted in a holder joined to a few feet of flex. One of the leads must make good connection on a bright part of the conduit tubing, and the other should be touched, in turn, on to each of the two main fuses. On one of the fuses the lamp will light to its full brilliancy, and it is to the other fuse that the charging board must be connected.

To connect the charging board in circuit the fuse wire is removed and the two leads from the board joined up to the fuse wire terminals. The removed piece of fuse wire should be inserted in the fuse on the board. Now, with the switch in the top position the ammeter, which should have a full scale reading of about 6 amperes, will show the current passed on the house supply when any of the lights or other apparatus is switched on.

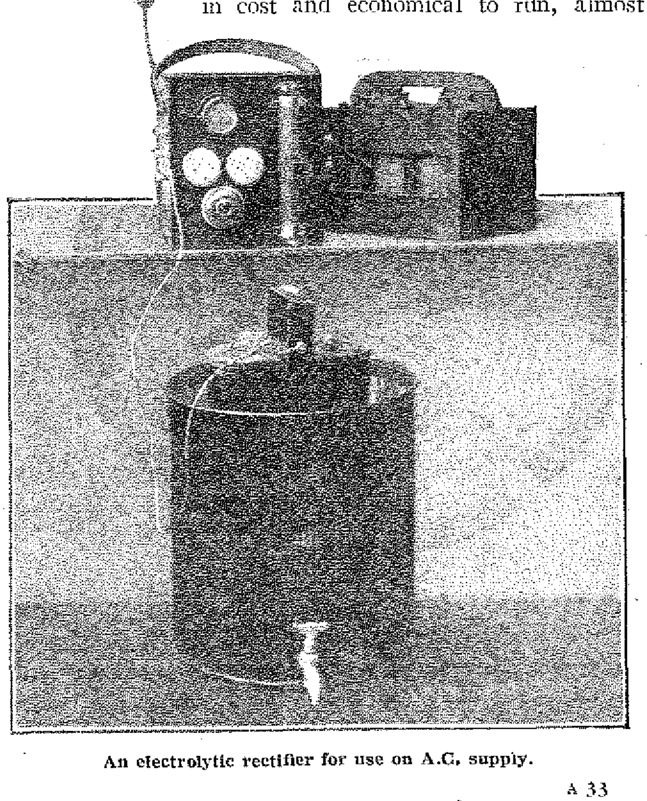
The double-pole switch should next be thrown over to the bottom position to test for polarity, and before doing so, one must make sure that one of the lighting switches is on, though, of course, the lamps will not light up as the circuit is broken. The two leads coming from the double-pole switch are then immersed to about an inch in a tumbler of water, and spaced about half an inch apart. The tumbler should be quite dry on the outside, and must not stand on a metal surface (such as the gas meter); neither is it advisable to hold it in a moist hand. Bubbles of gas will be seen to be evolved from both of the wires, though much more freely from one than the other. A few drops of vinegar or a little lemon-juice added to the water will greatly increase the liberation of gas from the wires. The lead around which a brisk effervescence takes place is the negative, and must be joined to the negative terminal of the battery for charging. With the switch in the up position the other lead may be joined to the positive of the battery, while by throwing over again to the lower position the battery will be on charge when current is passed on the house circuits, the ammeter indicating the charging rate.

Under no circumstances must the battery stand on a metal or conducting surface while in circuit, for should frothing occur there is a chance of it being ruined by connection to earth. A good battery, however, does not froth. See, always, that the acid is higher than the tops of the plates, and fill up only with distilled water. When fully charged and not on circuit, each cell should give a voltage of almost 2.5, whilst the positive plates should be of a dark chocolate colour and the negatives a pale slate.

Charging from Alternating Current Mains.

There are many ways of utilising an alternating current supply for accumulator charging. Each method makes use of special apparatus which, when supplied, carries instructions explaining in detail the manner of use. It is therefore only necessary to mention the various methods, and a selection is usually based entirely on the question of cost.

The vibrator rectifier is probably the most generally used. It is moderate in cost and economical to run, almost



An electrolytic rectifier for use on A.C. supply.

Charging Accumulators at Home.

silent in operation, and is usually designed to give an output suitable for charging high tension accumulators as well as 2 or 6 volt filament batteries. The contacts should be of liberal size and the vibrating arm light. Silver to carbon contacts work well, and with the charger properly adjusted so that the circuit is broken when the battery potential equals the transformer output potential will run with less sparking than an electric bell. A rectifier of this type should be installed in a position where it will not be subjected to vibration, for vibration of a frequency nearly equal to that to which the reed is designed to respond will throw it out of step and cause sparking.

There is little doubt that the Tungar rectifier is the best device available for charging small batteries. It makes use of the thermionic emission from a large filamented valve, and consequently, as a rectifier of alternating current, is perfect. It is, of course, entirely silent in operation, though somewhat expensive in original cost, and the large valves require periodically renewing.

Electrolytic rectifiers will deliver a pulsating current suitable for accumulator charging. It is difficult to design a charger of this type suitable for home use, though several good attempts are to be found on the market, and in which some process of cooling is applied to the electrolite.

Rectifiers having revolving armatures driven by a synchronous motor are also in favour. Such an instrument must be silent in operation, and both the motor and its rectifying commutator should be specially designed to avoid accident to the battery on charge. Certain types do, however, run without producing the hum of revolving machinery and sparklessly produce a commutated pulsating output.

For the experimenter, mention might be made of the motor generator as a means of charging from A.C. supply. At the present time small dynamos of high-class manufacture can be procured from dealers in ex-Government stores, whilst there may be available a motor of moderate size which is normally employed for running the equipment of the experimental workshop.

BASKET COILS OF HIGH INDUCTANCE.

THE inductance of a basket coil depends on the number of turns, the diameter of the coil and its depth (or length). Hence if we can put more turns on the former by winding them in a different manner, we increase the inductance of the coil without increasing its diameter. Actually, if twice the number of turns are put on, the inductance of the coil is approximately four times as great. Hence with a given variable condenser we shall be able to tune to a wavelength of $\sqrt{4}$ times that when an ordinary basket coil of the same size is employed

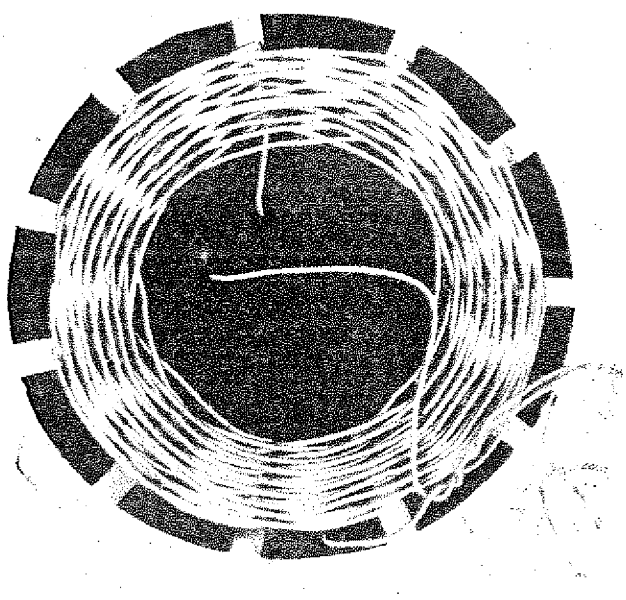


Fig. 1.—A basket coil with a pitch of 4.

The coil of Fig. 1 has twice as many turns as the ordinary type of basket coil (wound with a pitch of 2). To wind such a coil we proceed as indicated in Fig. 2, which shows the first four turns. It will be noticed

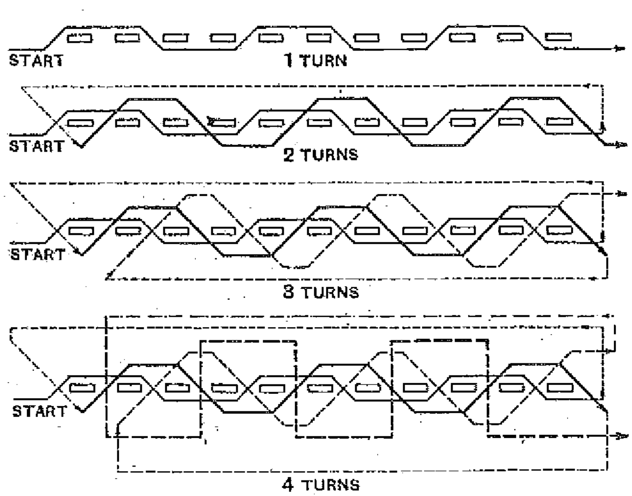


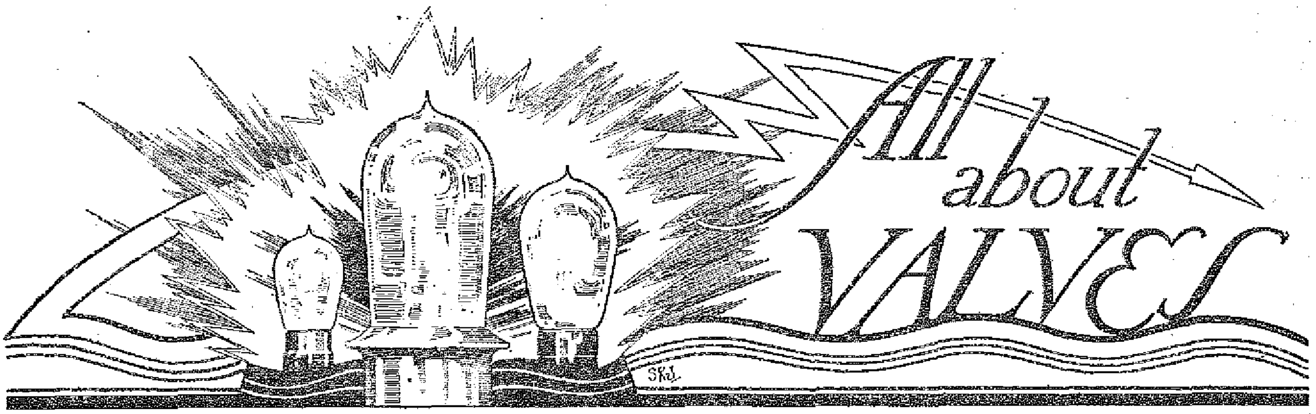
Fig. 2.—Method of winding the basket coil.

that the wire is passed through alternate slots. This is clearly shown by the drawing of the first turn in Fig. 2.

When the second turn has been wound we have one wire in each slot, but there is not a wire on the front and back of every projecting piece. We have to wind four turns before there are two wires in each slot. Then each projecting piece has two wires passing along the front and the back. This style of winding is usually adopted when a coil having a relatively large inductance for a given size is required.

This coil has a pitch of four; therefore, the number of turns may be found by counting the number of layers and multiplying by two.

W. J.



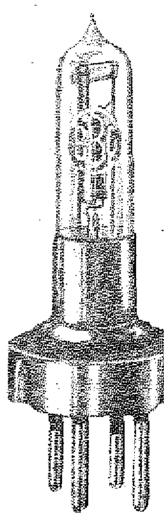
Four British Valves.

THE four valves described below are representative of British manufacture at the present time, and, although they have been dealt with individually in earlier issues of this journal, the present tests have been carried out on valves of recent purchase.

We have selected these four valves for this article, first, on account of their similarity, and, secondly, because in one respect they differ very materially one from the other. Their similarity lies in the fact that either, suitably adjusted, will give excellent results when operating as a H.F. amplifier, detector, or L.F. amplifier.

The most striking difference between them is that of the current and voltage required for filament heating. In one case, for example, the voltage is as low as one volt, whereas in another the minute current of 60 milliamperes is all that is required.

Now, although valves are designed to have certain characteristics, it should be remembered that it is commercially impossible to construct them with such a degree of uniformity that their characteristics will be exactly similar in all respects, and if a number of valves of the same type are tested their curves will be found to vary slightly one from the other. For this reason then the data which we have given in these notes is to be considered as typical of the type under consideration, and, owing to different valves being used, the present figures may differ to some extent from those previously given.


The Mullard Wecovalve.

The Wecovalve.

This useful little valve is rated by the makers as follows :—Filament volts, .8 to 1.1; filament current, .25 ampere; plate voltage, 15 to 50.

This valve is so well known that a description of its appearance is unnecessary, but where economy of space is essential the Wecovalve has a distinct advantage over all other types. The results of our tests are given in the following table :—

WECOVALVE.

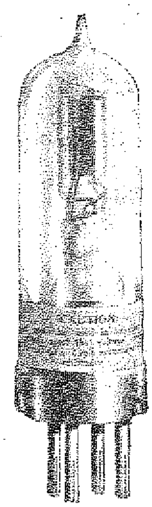
(Mullard Radio Valve Co., Ltd.)

Filament Volts 0.98. Filament Amps. .25.
Emission (total) 5.6 milliamperes. Filament Efficiency 22.7 milliamperes per watt.

Plate Volts.	Plate Current at zero grid Volts.	Grid Bias.	Plate Current in milli-amperes.*	Amplification Factor.	Plate Impedance.
20	0.38	Zero	0.38	6.2	25,500
30	0.78	−1	0.5	6.2	25,000
40	1.3	−2	0.68	6.2	24,000
50	1.9	−2.5	0.96	6.25	22,500
60	2.55	−3	1.28	6.25	20,000

* Plate current when grid is biased to the value shown in Column III.

In actual operation we found about 20 volts H.T. a suitable value when the valve is used as a detector or H.F. amplifier. For L.F. work this may be increased to, say, 60 volts, at which value the grid should be biased to the extent of at least −3 volts. The figures in the above table give the minimum bias to apply to the grid for the corresponding plate voltage in Column 1. The magnification factor maintains a steady value of about six and a quarter throughout the range tested, the plate impedance decreasing, as is usual, with an increase of plate potential. If anything, the Wecovalve would seem to give of its best when used on the low frequency side.


The Ediswan A.R. ·06.

The A.R. ·06.

This is a valve of the 60 milliampere class, and its consumption is, therefore, within the range of dry batteries. Actually, we favour the use of an accumulator wherever possible, but to those whom the difficulties of battery charging are so great, a "60 milliampere" valve offers the best solution.

All About Valves.—

The table gives the results of our tests on a sample valve of this type.

A.R. ·06.

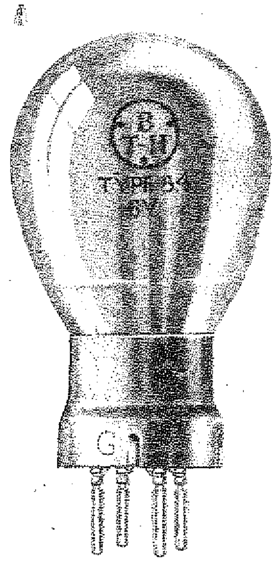
(Edison & Swan Electric Co., Ltd.)

Filament Volts 3.0. Filament Amps. .063.
Emission (total) 7.0 milliamperes. Filament Efficiency 37.1 milliamperes per watt.

Plate Volts.	Plate Current at zero grid Volts.	Grid Bias.	Plate Current in milli-amperes.*	Ampli-fication Factor.	Plate Impedance.
20	0.16	Zero	0.16	10.25	63,000
40	0.44	−1	0.3	10.55	62,500
60	0.95	−1.5	0.54	11.0	56,000
80	1.4	−2	0.8	11.8	46,000
100	1.96	−3	0.98	11.8	40,000

* Plate current when grid is biased to the value shown in Column III.

The magnification factor and impedance of the A.R. .06 are somewhat higher than is usual in general-purpose valves, and for this reason our practical circuit test showed the valve to give its best performance as a detector or H.F. amplifier; 40 to 45 volts H.T. will be found suitable. When used in the first stage of a L.F. amplifier the plate potential should be increased to 80 or so, biasing the grid in accordance with the figures given in the table. This type we found to be particularly good as a H.F. amplifier.



The B.T.H. B4.

The B.4.

Designed originally as a power amplifier, the B.4 is rapidly becoming considerably used for general work. It is rated at 5-6 volts .25 ampere on the filament, plate potential 40 to 120. As in similar valves of this type a flattened grid and anode as well as a V-shaped filament are employed with the object of keeping the plate impedance low.

The tested sample gave the following results :—

B.4.

(B.T.H. Co., Ltd.)

Filament Volts 6.0. Filament amps. .24.
Emission (total) 47 milliamperes. Filament efficiency 32.5 milliamperes per watt

Plate Volts.	Plate Current at zero grid Volts.	Grid Bias.	Plate Current in milli-amperes.*	Ampli-fication Factor.	Plate Impedance.
40	1.4	Zero	1.4	6.25	12,200
60	3.1	−3	1.4	6.25	12,200
80	5.4	−4	2.4	6.3	10,000
100	7.8	−5	3.5	6.4	7,800
120	10.7	−6	5.2	6.4	7,700

* Plate current when grid is biased to the value shown in Column III.

The total emission obtained is, as shown above, of a very high order, reaching no less than 47 milliamperes at 6 volts. If this valve is used for ordinary work, it is, therefore, possible to dull the filament quite appreciably. Using the valve as a high-frequency amplifier and detector and with a plate potential of 45 to 50 volts, we found we could reduce the filament potential to just below 5 without losing signal strength. The advantage of modern design is reflected by the figures of Column 6, which shows the valve to have a very low impedance.

Due to this fact, the valve oscillates with much less reaction than is usually required, and the set should, therefore, be handled carefully until the operator is accustomed to the new "feel."

It is, of course, on L.F. work that valves of this class excel, and, used with, say, 100 volts H.T., and at least −5 grid bias* (in actual practice up to about −8 may be used with this H.T.), good distortionless amplification will be provided. In our own particular test we used 100 volts H.T. and −6 grid bias, the results being all that could be desired. The more we handle valves of this class the better we like them.

The D.E.R.

This is one of the oldest, if not the first, British Dull Emitter to be marketed. Rated at 1.8 to 2 volts, it will work direct from a 2-volt accumulator, and normally consumes about .35 ampere, plate voltage rating 30 to 80. Tests on a valve of recent manufacture have been lately conducted, our results being given in the table below.

D.E.R.

(The M.O. Valve Co., Ltd.)

Filament Volts 2.0. Filament Amps. .355.
Emission (total) 26 milliamperes. Filament Efficiency 33 milliamperes per watt.

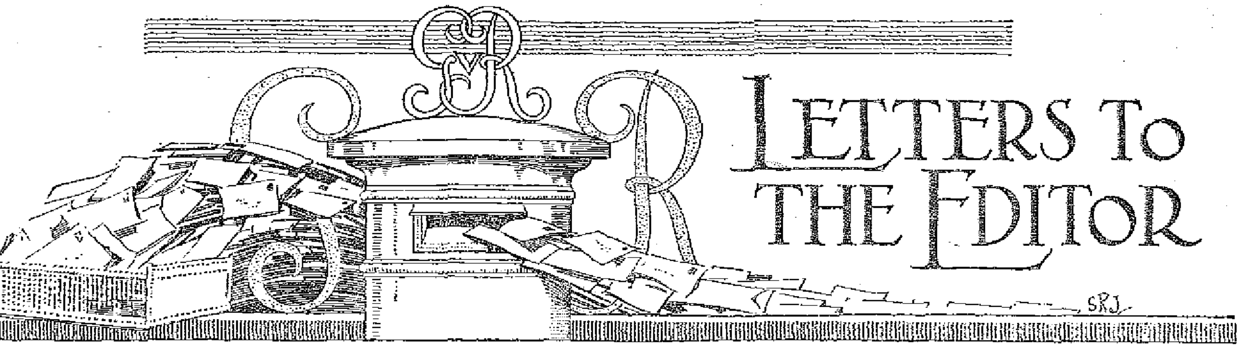
Plate Volts.	Plate Current at zero grid Volts.	Grid Bias.	Plate Current in milli-amperes.*	Ampli-fication Factor.	Plate Impedance.
40	0.56	Zero	0.56	9.6	36,000
60	1.2	−1.5	0.72	9.8	32,500
80	1.95	−2	1.24	10.0	29,500
100	2.7	−3	1.5	10.0	29,000

* Plate current when grid is biased to the value shown in Column III.

This type seemed quite at home in any part of the set, and gave excellent results in all parts of our standard circuit. When being used as a detector care should be taken to connect the grid return lead to the + terminal of the filament battery. While critical adjustment of the plate voltage is unnecessary, about 40 volts will be found a suitable value for H.F. and detector work. For L.F. amplification increase the H.T. to 60 volts or more, adjusting the grid bias as indicated by the minimum values given above. A valve which will give good service coupled with reliability is our opinion of this type.

The foregoing valves, taken from the many now offered for sale, are good examples of their particular class. Well up to the exacting British standard, they are such that their manufacturers may indeed be proud of their products.

* The value of grid bias in the table is the minimum which should be used for the corresponding plate voltage.



LETTERS TO THE EDITOR

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, the "Wireless World," 139-140, Fleet Street, E.C.4, and must be accompanied by the writer's name and address.

RECORD LOW POWER TRANSMISSION?

Sir,—What must be a record for low power transmission is revealed in the reception of a QSL card from U4CH at Miami, Florida. His input is stated as 5 watts, radiation being figure 0.2 amps! Signals were received here on November 28th last at a strength of R3 on a 0-v-1 Reinartz without earth. 4CH was heard working with two American stations, and the reception is now confirmed. Miami is about 4,500 miles from here.

Glasgow. J. GORDON RITCHIE.

THE OSCILLATION NUISANCE.

Sir,—I have read with the keenest interest your editorial appearing in the January 21st issue of *The Wireless World and Radio Review*. While agreeing that the oscillation nuisance should be put down, I feel that it would be distinctly unfair to the man, whether experimenter or only broadcast listener, who understands the principles of radio, and who uses his set in a reasonable and proper manner, to forbid the use of reaction, so depriving him of the benefits obtained from its correct employment.

I realise that the question is one of great difficulty, but if the offenders can be located, would it not be possible to impose fines or suspend their licences, as is done in the case of motorists who do not recognise the rule of the road?

R. COLLINGS.

Camberwell.

[Now that the Post Office is unable to deal with the oscillation nuisance, it is suggested that the police might take the matter up. Motoring has made the policeman's lot often a very difficult one, yet he would have our deepest sympathy if called upon to produce evidence of excessive interference by oscillation. Surely nearly every listener is an offender!—ED.]

Sir,—I was very pleased to read your leading article regarding the above. It is high time something was done to remove this annoyance during broadcasting hours. But surely one can expect nothing else, especially when one well-known, large company manufactures sets, say with detector and one or two L.F. valves, having reaction in its simplest form; direct on aerial, which are supplied to the merest novices, who cannot help and are not to blame for their interference. I have come in touch with several of these sets, supplied only in the last few weeks. Surely manufacturers should not be allowed to send out such apparatus. Why, even a schoolboy, with the aid of his weekly paper, can make a much better set than these, and certainly will cause little or no interference. But of course things are changing—what with the P.M.G. testing sets and now doing away with the tests—and even our Editor, I find, recently contributed an article giving instructions for making one of these 2-valve guilty sets. Probably in the near future we shall have this trouble remedied. 2HY.

Sir,—Those who knowingly cause interference should be hung, drawn, and quartered. But those who spoil the pleasure of others by allowing their sets to oscillate and energise an aerial circuit are usually blissfully unconscious of their own iniquity.

It would be especially hard on single valve users to deprive them of the inestimable boon of reaction.

The simplest and most humane remedy would seem to be in so designing sets that as soon as self-oscillation does occur a most unbearable howl is heard in the telephones or loud-speaker of the offending set.

This is not a complicated matter. Most single valve reflex sets, for instance, obligingly (though not designedly) do this. There are other ways of getting the effect, so that by the use of "squegger," or grid-blocking dodges, *à la* Flewelling, a suitable vile screech will afflict the ear-drums of the offender as soon as he pushes reaction far enough to make his set oscillate. GUY C. BEDDINGTON (5KA).

Villa Yolanda, Ospedaletti, Italy.

Sir,—To my mind there is only one way of reducing the oscillation nuisance, and that is by removing the inducement to oscillate. I strongly urge fewer provincial programmes, and more relay stations. The former would be less inducement for the ignorant listener in Aberdeen or Manchester to get Newcastle or Bournemouth on a single valve, and *vice versa*; and the latter would mean more crystals and fewer valves to oscillate.

On grounds of economy, too, this seems such a good policy that it is surprising the B.B.C. have not considered it before. Two good programmes instead of twenty indifferent ones—say, one from the high-power station and the other relayed to all the rest—would cost far less, while they could be improved in quality in every way. Some of the provincial items are often very mediocre; in fact, one usually searches *The Radio Times* for what is worth listening to during the week, rather than for the nightly entertainment.

As for more relay stations, surely every big town should be supplied? This would be another sound economic proposition, as the resulting five thousand or more licences in each area would pay the B.B.C. well, and only introduce more non-interfering crystal listeners.

This seems to be a positive remedy, whereas legislation against the use of reaction is not only negative, but almost impossible to enforce, even if passed!

Remove the inducement to "howl" and the squealing may be less. M. PROCTER-GREGG.

Blackburn.

DON'TS FOR TRANSMITTERS.

Sir,—Do you think that the following "Don'ts" would be of interest to your transmitting readers? They are based on observations made while receiving during the past two months.

1. Don't on any account, unless with special permission, give CQ calls; never mind who else you hear doing it.
2. Don't work above 250 metres when any of the B.B.C. stations are working. When on 440 metres, keep to it.
3. Don't say "Hello, everyone," etc. Leave that to the B.B.C.

4. Don't, while transmitting, refer to any piece of apparatus with which you are dissatisfied, unless it is home-made.
5. Don't, if you have only an artificial aerial, transmit with the object of seeing your call sign in the "Calls Heard" section of the *Wireless World*. Not only amateurs read this journal.
6. Don't fail to use parliamentary language at all times.
7. Don't forget that you may be heard by hundreds, so do not lower the prestige of amateur transmitters.
8. Don't send out jazz tunes on Sunday. If you must grind out music, play something decent.

January 20th, 1925. A TRANSMITTER SINCE 1912.

EAST AFRICAN WIRELESS ACHIEVEMENT.

Sir,—You will be interested to learn that lately I have been successful in receiving messages from the United States of America. I am now in a position to listen in regularly to three or four American stations. My set was built by me locally and I am only using four valves.

You will remember I was the first person to succeed in this colony in the reception of long distance messages. At my first attempt I was able to listen in to Mozambique, and now I am able to receive messages from across the Atlantic—spanning a distance of several thousand miles. ABDUL RASHID.

P.O. Box 207,
Nairobi, Kenya Colony,
December 29, 1924.

REPORTS, PLEASE.

Sir,—I am a constant reader of your splendid paper from the first copy and look forward to Friday, when we get it over here, like a Bank Holiday! I am one of the very first amateurs on the island to do experimental work.

I should like to ask my fellow readers if they would send me reports of any of my transmissions which they may hear. My call sign is G 6PU.

Wishing you all the success you deserve.

c/o Barns Garage, E. J. W. AHIER.
New Street,
Jersey, C.I.

STABLE H.F. AMPLIFICATION

Sir,—I was very interested in the high-frequency amplifying circuit described by Mr. Somerset Murray in your issue of February 4th.

The development of the final circuit from the original arrangement illustrated in fig. 1 of the article is certainly interesting, but I think it has misled Mr. Murray in the interpretation of the action of the final arrangement.

I would suggest that a comparison between fig. 5 of the article and the circuit diagram of a choke-coupled amplifier will provide an alternative and somewhat simpler interpretation of the action of Mr. Murray's circuit. The latter is seen to consist essentially of a choke-coupled amplifier with a tuned rejector circuit substituted for the grid-leak resistance usually employed. This would account for the stability as well as for the selectivity of the circuit. It would also account for the tendency to self-oscillation when the coupling condenser is very small, for under these conditions an oscillating circuit of comparatively low decrement is the input circuit of a valve having a large inductance in the anode circuit. It is well known that an inductive load in the anode circuit of a valve may, under certain conditions, lead to a negative input circuit resistance.

This interpretation also indicates that Mr. Murray's circuit will probably be much more effective than the usual choke-coupled arrangement, since the grid-filament capacity forms part of a tuned rejector circuit, which will have the effect of considerably reducing the effective shunt capacity across the choke in the anode circuit of the preceding valve.

If I have given the correct reason for the tendency to self-oscillation when the coupling capacity is small, it is probable that this tendency could be removed without loss of sensitivity by including resistance, not in the actual choke coil itself (the resultant impedance of which would probably be lowered thereby), but as a separate element in series with the choke coil.

The circuit is a very interesting one, and it is to be hoped that it will engage the interest of experimenters.

F. M. COLEBROOK.

National Physical Laboratory,
Teddington, Middlesex.

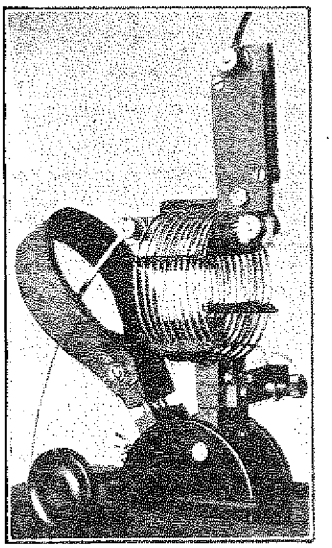
KDKA AT 10 A.M.

Sir,—At a few minutes to ten on January 27th I tuned in a strong carrier wave on the condenser setting which gives KDKA on his short wavelength, but as it was then of course broad daylight with the sun shining I did not think it could be Pittsburgh and altered the tuning. However, I tried again at 10.5, and music, which was uncommonly like KDKA, was heard at little, if any, below the usual midnight strength of that station. I could hardly believe it was KDKA, but a minute or so later the voice of the announcer dispelled all doubt by saying it was KDKA giving a transmission specially for the "Melbourne Herald."

After another musical item messages of greeting were read to the "Melbourne Herald" and the people of Australia. Then followed more music, and at 10.30 strength of reception was falling off slightly, and another L.F. valve was switched in (up till this time a 0-v-1 combination was being used).

Messages were again read but could not be made out so clearly as the first time.

What struck me as most interesting was the fact that for the first half-hour the strength, as I have already mentioned, was practically as good as when darkness covers the whole distance.



A plug-in fixed coupler used by Mr. Reid for short wave reception.

As I cannot read Morse transmissions, I have not built a special set for low wavelengths, but use a plug-in fixed coupler, of which I enclose a photo, in my ordinary 1-v-2 set; the coil, as you will note, is made after the style of the low loss coils recently described in *The Wireless World* by Mr. F. H. Haynes.

J. REID.

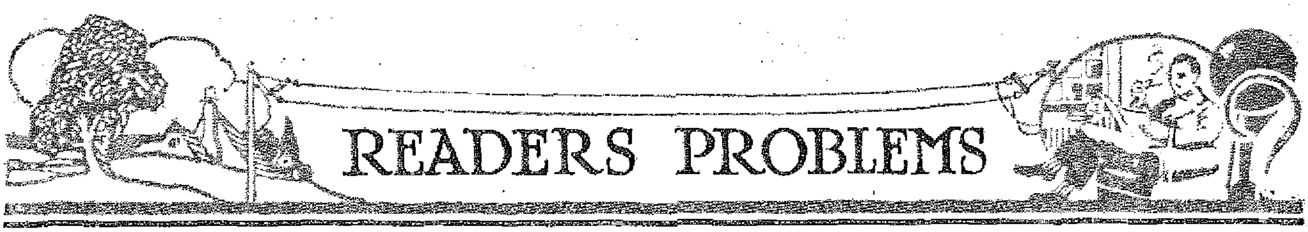
Dumfries, N.B.

A SURPRISING CLAIM.

Sir,—In the *Southern Daily Echo* of February 2, Mr. A. Steel, an ex-assistant engineer of the Post Office, is reported to have said, *inter alia*, at a dinner in Southampton:

"Wireless had made enormous strides during the last year or two, but he did not agree with the suggestion that in a few years it was going to scrap the whole telegraph and telephone system. He thought that wireless experts had much for which to thank the engineering department of the Post Office. Nearly all the different parts that went to make up a receiving set had been brought out by the Post Office Engineering Department. They had practically invented these parts and brought them right from the crude state to the perfect instrument."

Well, we know the Post Office invented harmonics and cosy corners for cables, and that it "brought out" from the "crude state" that queer fowl the wireless inspector. But some of Mr. Steel's alleged claims are startling, and I am tempted to ask him, by your courtesy, to mention one—only one—part of a wireless receiving set which was "practically invented" or even "brought out" by the Post Office Engineering Department. Can it be that Mr. Steel is thinking of thermionic valves or variable condensers? L. HIND.



Readers Desiring to Consult the "Wireless World" Information Dept. should make use of the Coupon to be found in the Advertisement Pages.

The Care of Accumulators.

MANY complaints are made concerning the expense and trouble of accumulators, it being frequently found that after a new battery has been in use for some time it shows a great falling-off in its rated ampère-hour capacity. The result of this is that more frequent visits to the charging station are necessary, involving, of course, a much larger bill for accumulator charging over a given period than was anticipated, not to mention the trouble of transporting this bulky article to and from the nearest garage.

In nearly all cases that are brought to our notice the fault lies at the door of the users in not following the very explicit directions given by all reliable accumulator makers. The modern accumulator manufactured by firms of repute is a very reliable article indeed, and the chance is very remote that a faulty one will pass out of the factory without being detected in the stringent examinations usually given by the makers.

Instructions for bringing new accumulators into service are usually printed very clearly on the side of the instrument. It is necessary first to fill the accumulator to the top of the plates with electrolyte (sulphuric acid) of the specific gravity recommended by the makers. This varies somewhat in different makes, but invariably lies between 1.200 and 1.250. The acid should be tested carefully with a hydrometer before being put into the accumulator. It should then be placed on a very slow and prolonged charge extending over two or three days at not more than half the usual charging rate. The electrolyte should then usually be emptied out and fresh put in. The specific gravity of this second electrolyte is usually of a slightly different value from that of the first, and the instructions on this point should be read carefully. The battery should then be charged again at the normal rate. In many cases the battery is ruined at the outset by the fact that users do not trouble to throw away the first electrolyte as advised, since they think that because the battery appears to function perfectly well this is unnecessary. The result is that, before many weeks have passed, the battery is damaged, and white patches commence to appear over the plates, indicating the presence of lead sulphate. The remedy for removing this is to fill the battery with fresh electrolyte and put it on charge at a very slow rate. If this fails to prove effective, there is very little that can be done by the ordinary amateur, and the accumulator should be despatched to the makers for repairs rather than placed in the hands of local people. After being in use for some time it will be noticed that the electrolyte does not cover the tops of the plates. This is due to the evaporation of the H_2O component of the electrolyte, and distilled water should be added. On no account should acid be added, unless some has been actually spilt. The accumulator should have fresh electrolyte every few months. The cost of this will be amply recovered in the greatly extended life of the instrument.

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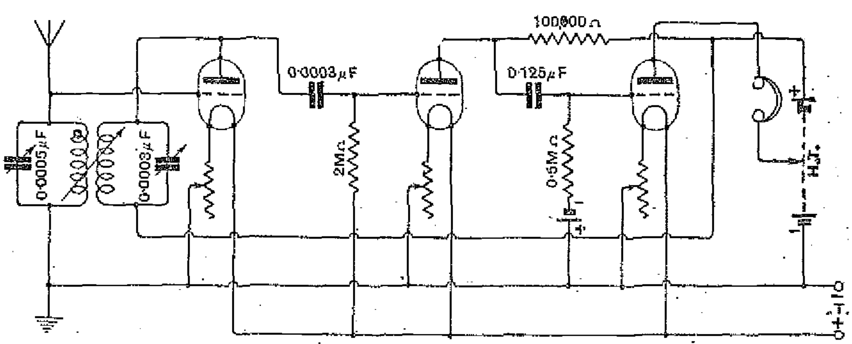
Obtaining Reaction in a Three-valve Set.

A READER wishes to construct a three-valve set containing one H.F. stage and the usual magnetic reaction. He wishes to know if a method can be devised for accomplishing this, using two coils only instead of the customary three. The third valve is to be a resistance-coupled note magnifier.

Whilst, of course, this can easily be effected by using an H.F. transformer for coupling the H.F. valve to the detector, we assume from the context of our correspondent's letter that he does not wish to incorporate one of these components into his set. We illustrate here a method whereby the usual coil in the anode circuit of the detector valve is omitted, reaction effects being obtained by coupling together the anode and aerial coils. This arrangement will be found quite effective. It is, of course, the method used for obtaining reaction effects in reflex circuits having a crystal detector. The third valve is arranged as a resistance-coupled note magnifier in accordance with our correspondent's requirements.



A three-valve receiver with one H.F. detector and one stage of resistance coupled L.F. Reaction is obtained by coupling the anode and aerial coils.

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Resistance-Coupled L.F. Amplifiers.

AN impression appears to exist in the minds of several readers who have written to us expressing their disappointment with the quality obtained from resistance-coupled amplifiers that this method of coupling is a panacea for all distortion in L.F. amplifiers. The idea appears to have gained ground that when this form of coupling is used all the rules given for good quality reproduction with transformer coupling can be ignored, and that special valves are no longer called for.

Distortion in transformer coupling, when all other precautions, such as the use of proper power valves, grid bias and H.T., have been taken, is due partly to the fact that the primary winding of the transformer does not offer so great an impedance to the lower frequencies as it does to those higher in the scale; the reason being that the impedance of any inductance increases in direct proportion to the frequency. Uneven amplification therefore takes place. This is counteracted to a certain extent by using transformers containing a large number of turns on the primary, and having a core of sufficient cross-sectional area. There

Readers Problems.—
still, exists, however, a form of distortion which is due to the magnetic hysteresis of the iron core, and various other causes. This can to a large extent be eliminated by *using correctly designed cores containing* a large number of laminations, but it cannot be denied that the use of resistances, when their disadvantage of high H.T. requirements and low amplification per stage is set aside, is the best method of coupling to adopt in cases where the highest quality is desired. When properly designed, this form of coupling does not tend to emphasise any particular musical frequency, and, furthermore, eliminates the distortion due to the use of an iron core. The use of resistances, however, in no way assists in reducing distortion in the valve itself, due to it not having a sufficiently large permissible grid voltage swing or to its normal grid potential occurring on an unsuitable portion of the curve. The use of "R" type valves with no grid bias in a resistance-coupled amplifier may result in very bad distortion—no less than if transformer coupling were used.

oooo

Resistances for 0·06 Dull Emitters.

A *READER wishes to use two valves* of the 0.06 type in conjunction with two D.E.5 valves in his standard four-valve set, and also to insert a fixed resistance to control the filament current of the two 0.06 valves. As he intends to use a 6-volt accumulator to light all the valves he wishes to know the correct value of resistance to insert.

As the current taken by the two valves is 0.12 amps. and we require to drop 3 volts across the series resistance it will be necessary to insert a resistance of not less than 25 ohms in one of the leads supplying current to the filaments of these two valves. We can, however, raise *this value to 26 or 27 ohms without impairing* the efficiency of the valves, and at the same time provide a larger factor of safety for the valves. The D.E.5 valves, of course, can be operated with the usual type of 5 ohm variable resistance.

Switching Arrangements for Valves of Different Impedance.

A READER wishes to construct a three-valve set embodying two stages of transformer coupled power amplification with the usual switching arrangements. He intends to use a low ratio transformer to follow the high impedance detector, but desires also to experiment occasionally with a low impedance valve in this position, and wishes to know if it is possible to arrange the switching so that the output from the detector valve can be passed straight to the high ratio transformer in the second stage when desired.

Our diagram given below illustrates a method of accomplishing this. It will be noticed that when both switches are to the right, both stages of amplification are eliminated, and by bringing either switch to the left it is possible to pass the output of the detector valve to either the low or the high ratio transformer. Bringing both switches to the left gives two stages of amplification. The usual arrangements for correct H.T. potential and grid bias for the power amplifying valves are shown.

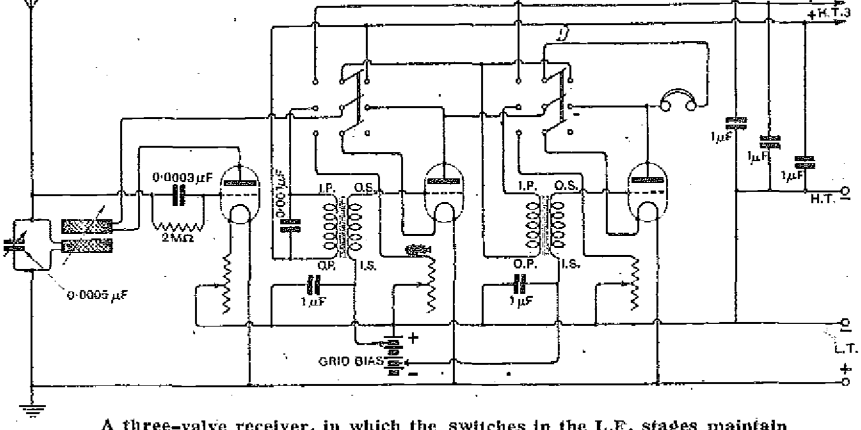
oooo

Coupling Condensers in L.F. Amplifiers

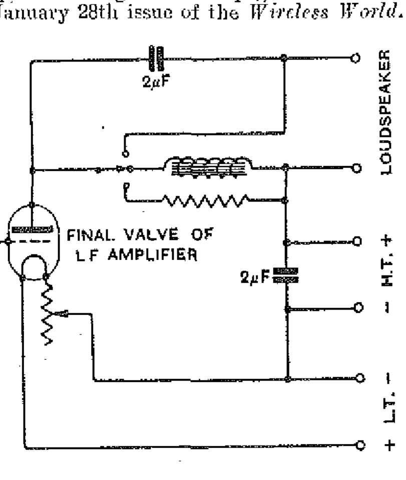
A *READER has noticed that* whenever we give diagrams in this section of the journal, which embody choke or resistance L.F. coupling, the value given for the coupling condensers usually lies between .25 and .05 μF, and he asks if there is any special reason for this.

The potential differences set up across the anode resistances by the varying musical frequencies is transferred to the grid of the following valve by the coupling condenser. Many people are in the habit of making the value of this condenser far too low, with the result that the lower frequencies fail to reach *the grid of the second valve.* If care is not taken to make this condenser large enough, the same uneven amplification of high and low notes that often occurs in transformer-coupled amplifiers will be present when resistance coupling is used. If, for the sake of purity, we employ resistance coupling with its attendant low amplification per stage, and its high anode voltage, it is foolish not to get the utmost out of it by neglect of seemingly trivial points. No "best" value for this condenser can be given, as musical tastes vary, but it can be said that to a person with a normal musical ear a condenser having a capacity of approximately .25 μF will be found to give the correct balance of high and low notes. However, provided that the value of this condenser is always kept above .05 μF, frequency distortion will be scarcely noticeable. Many musical people prefer the accentuation of the higher notes, and it is not a bad plan, therefore, to arrange to have one or two coupling condensers, so that either may be brought into circuit by means of a stud switch. The value of the grid leak may be from .25 to .5 MΩ.

Some useful notes on the value of anode resistance and H.T. voltage required are given on page 573 of the January 28th issue of the *Wireless World.*



A three-valve receiver, in which the switches in the L.F. stages maintain the correct plate potentials.



An experimental filter circuit.

An Experimental Filter Circuit.

WE often receive requests from readers for diagrams of filter circuits suitable for using in the anode circuit of the final valve in order to prevent the steady H.T. current passing through the loud speaker windings. Many readers desire switching arrangements for cutting this circuit out at will.

We therefore give above a method of switching by means of which either a choke or resistance-coupled filter circuit can be used, or, if desired, the filter circuit may be eliminated altogether. The impedance of the choke must be very high if a valve of the ordinary type is used, the inductance value being 100 henries or so, but if a low impedance power valve is used, this value may be considerably reduced. The same remarks apply to the resistance. The correct value for the condenser is really a matter for experiment, but if it be made between .25 and .5 μF, it will be found that it will transfer the musical frequencies to the loud speaker without distortion. Many people prefer to make the value of this condenser much larger. It is advisable that for best results this condenser have a mica dielectric.

The Wireless World and Radio Review

No. 289. WEDNESDAY, FEBRUARY 25TH, 1925. VOL. XVI. No. 3.

Assistant Editor: F. H. HAYNES. Editor: HUGH S. POCOCK. Assistant Editor: W. JAMES.

Editorial Offices: 139-40, FLEET STREET, LONDON, E.C.4 - Telephone: City 4011 (3 lines).
Advertising and Publishing Offices: DORSET HOUSE, TUDOR STREET, LONDON, E.C.4. - Telephone: City 2847 (13 lines).
Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street. Telegrams: "Cyclist Coventry." Telephone: 10 Coventry.
BIRMINGHAM: Guildhall Buildings, Navigation Street. Telegrams: "Autopress, Birmingham." Telephone: 2970 and 2971 Midland.
MANCHESTER: 199, Deansgate. Telegrams: "Iliffe, Manchester." Telephone: 8970 and 8971 City.

Subscription Rates: Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries abroad, £1 3s. 10d. per annum.

WHAT OUR READERS SAY.

OUR invitation to readers to send us their views on the first number of our new series has resulted in an overwhelming response.

Whilst it is our intention to reply individually to each letter received, it will be impossible to do so without some delay; we therefore take this opportunity of thanking our readers for their ready response to the invitation.

As regards the expressions of opinion received, a very large majority vote assures us that the reception of our first number in the new form has been more favourable than our most optimistic hopes had anticipated.

No expression of opinion, however strong, can be unanimous from readers so numerous and so varied in their interests, and we have therefore welcomed criticisms as much as unqualified expressions of approval.

Under Correspondence in this issue we publish a few from amongst the flood of letters received, and have endeavoured to include representative letters of all views in order that we may have this opportunity of replying to the points of criticism raised.

We anticipated that the change in size would not be welcomed by those readers who have appreciated the convenience of the old size when bound in volumes, and we agree that it is always unfortunate, from this point of view, when a change in size is introduced. There is also the objection raised to the nature of the paper on which the present issues are printed. Both these innovations have been necessitated by the great increase in the number printed. The size is one which is a recognised standard for journals having a large circulation, whilst the changes which have been made in the general style of printing and paper are due to the fact that the very large number printed necessitates the adoption of what are virtually newspaper methods.

One particular advantage which is obtained through enlarging the size of the page is that a more satisfactory arrangement and display of illustrations becomes possible, whilst space is provided to allow for additional text and, consequently, more detailed descriptions in the articles.

Some of the more advanced readers have expressed regret that pages of a lighter or rather less technical character have been included. It may be pointed out that this matter is all additional to what was included under the old *régime*, and it seems rather selfish to adopt the attitude that every reader must find only such matter in each issue as is of direct interest to himself.

Our desire is to provide a journal having a wider appeal than the somewhat specialised character of past issues could ensure, but there is no intention on our part to deprive our older supporters of the type of articles and information which they have become accustomed to expect. With every confidence we ask our readers to compare *The Wireless World* with any other weekly wireless publications, irrespective of the price, and we are content to leave our future success to the choice which they will make.

CONTENTS.

THE FIGHT FOR FREEDOM.

THE most eventful moment in the history of the wireless amateur in this country—long anticipated—has at last arrived. With the fate of the Wireless Telegraphy and Signalling Bill is coupled the fate of the British amateur, and it is, therefore, not in the least surprising that the terms of the present Bill have aroused such universal interest not only amongst amateurs, but amongst all users of wireless telegraphy, and have formed the subject of comment in almost every section of the Press.

The new Bill purports to "re-enact and amend" the Wireless Telegraphy Act of 1904, and "to make provision with respect to visual and sound signalling, and the use of etheric waves for the transmission of energy."

It is perhaps unnecessary to discuss here those sections of the Bill which are already included in the 1904 Act, because that Act respected the rights of the experimenter and made provision for his work. In fact, it may be said that nothing in the 1904 Act obstructed amateur activities to any serious extent, and it was only the administration of the Act in the Departmental regulations made by the Postmaster-General which has in the past hampered amateur experimental work and interfered with his rights which seemed clearly recognised in the wording of the 1904 Act.

The Right to Experiment.

The most serious aspect of the present Bill, from the point of view of the amateur, is that it is now proposed to leave it to the discretion of the Postmaster-General to form whatever regulations he may think desirable, whilst at the same time giving every facility for legalising these regulations so that when once they have become law it will be of no avail to dispute them, as it has been possible to do in the past, when they were merely departmental regulations.

Under Clause 3 of the Bill we read:

(*a*) "as to the terms, conditions and restrictions on or subject to which licences or any class of licences under this Act are to be granted, renewed, suspended or withdrawn; and

(*b*) "requiring any operators or other persons engaged in the working of wireless telegraphy to be provided with certificates, and making provision as to the manner and conditions of the issue and renewal of any such certificate, including the examinations and tests to be undergone, and the form, custody, production, cancellation, suspension, endorsement and surrender of any such certificate, whether issued before or after the passing of this Act."

No Limit to Post Office Restrictions.

When we analyse this clause we find that it enables the Postmaster-General, if he so desires, to require that every amateur who wishes to construct his own apparatus or to experiment must produce a certificate of technical qualifications or be the holder of a science degree, whilst he may also be required to describe the exact nature of any experiments to be carried out and therefore to disclose information which he may quite reasonably desire should not be made known.

Under Clause 3, Section 3, provision is made for regulations drawn up by the Postmaster-General to become law without the procedure of discussion and voting in Parliament, it being left to chance opposition to find out any objections to the regulations within a period of twenty-one days from the date that the regulations are laid on the table of the House. Such a procedure gives a very unfair advantage to the Postmaster-General.

Perhaps the most surprising section of the new Bill is Clause 7, which reads as follows:—

"The provisions of this Act, shall apply to the installation and working of apparatus for utilising etheric waves for the purpose of the sending or receiving of energy without the aid of any wire connecting the points from and at which the energy is sent and received as they apply to the installation and working of apparatus for wireless telegraphy."

This clause appears to encroach upon matters which have hitherto been regarded as quite outside the jurisdiction of the Post Office, and no provision was made in the Act of 1904 to give such wide powers to the Postmaster-General as are suggested here.

Extraordinary Extension of Post Office Control.

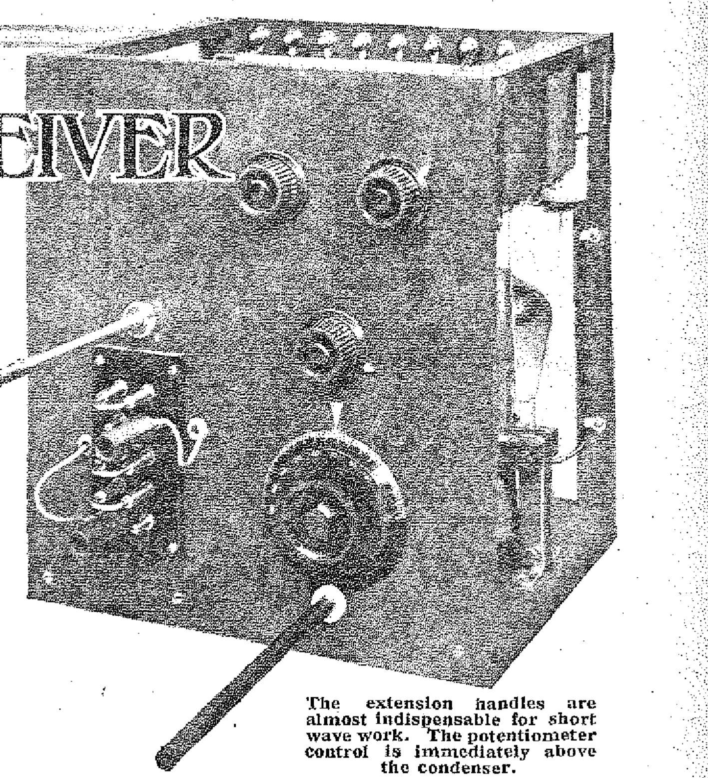
It would appear from the wording of the clause that in future a licence must be procured from the Postmaster-General before any apparatus capable of generating etheric waves can be installed for the reason that such apparatus could be applied to wireless telegraphy. In speaking of etheric waves, both light and heat are included with wireless telegraphy and similar apparatus.

Although the transmission of energy by wireless methods has not at the present time been developed, yet in the light of present-day knowledge it may be nearer realisation than is generally supposed, and if eventually such a system becomes of practical value it might be expected that the control would come under the Electricity Commissioners. It seems out of place, therefore, that the control of such a system should come under the Postmaster-General. It would appear sufficient if a clause were substituted stating that no person should maliciously operate apparatus capable of interfering with the transmissions or reception of messages signalled by means of ether waves commonly employed for wireless telegraphy.

Even then it might be necessary to limit such a clause, otherwise the Postmaster-General, in assuming responsibility for the control of such transmissions, would find it necessary to prevent the accidental induction from electric light wires, interference caused by apparatus such as electrical lifts in buildings where wireless apparatus is installed, interference with reception which is experienced in areas where electric trams or railways are located, and many other similar causes which may affect the transmission or reception of wireless telegraphy and telephony.

Reviewing the Bill as a whole, it would appear that it has been drafted without adequate technical supervision and with little consideration for individual rights. Where the Bill appears to us to be most unfair is that it gives the Postmaster-General power to deprive an individual of the right to experiment, which can be done through the enforcement of impossible regulations, whereas this right to experiment was carefully protected under the Wireless Telegraphy Act of 1904.

ALL RANGE RECEIVER



The extension handles are almost indispensable for short wave work. The potentiometer control is immediately above the condenser.

It is with the object of providing a set which will receive on the broadcasting and higher wavelengths, and at the same time give efficient reception down to 50 metres, that this design has been developed. Many transmissions are now regularly taking place on the short wavelengths, including high power American broadcasting, and with this receiver the amateur can tune down to almost the shortest waves without the need for duplicating any part of his receiving equipment by constructing separate short and broadcast wave receivers.

By F. H. HAYNES.

IT is generally recognised that a set designed for reception on broadcasting wavelengths is unsuitable for short wave work, yet there are many users of broadcast receiving sets who are interested in the wavelength band 200 to 50 metres, and the purpose of the design given here is to show how a set of simple construction can be made up to give good results on all wavelengths.

How the Tuning Range is Provided.

When plug-in coils are used to change the tuning range it is, of course, possible to use specially constructed inductances of only a few turns for tuning to short waves. It is advisable to use a three-coil holder, so that a loose-coupled aerial tuning circuit may be provided, and the writer has found it possible to go down to about 50 metres with such an arrangement. It cannot be overlooked, however, that the coil holder with the usual pattern of self-supporting plug-in coil is by no means satisfactory on short wavelengths, but one great advantage is obtained, which is, that reaction coils varying only slightly in their inductance values can be interchanged to provide the critical self-oscillation control so necessary in short wave work.

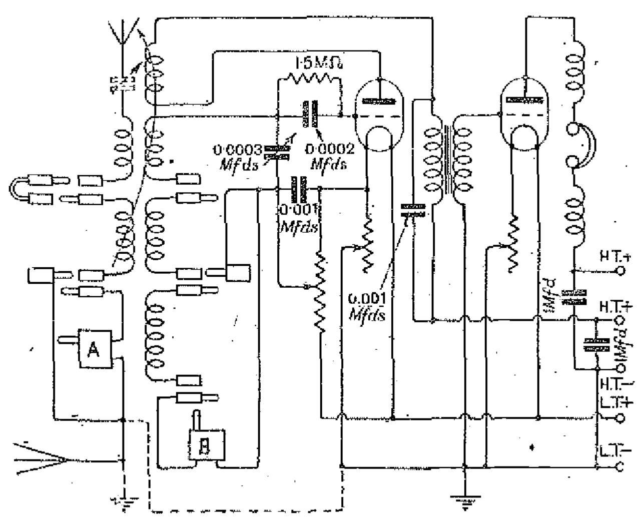


Fig. 1.—The circuit is a detector valve with reaction followed by a note magnifier. The short wave tuning inductances are shown while loading coils may be added at A and B or inserted into the plug and socket connectors in place of the "U" links.

The Circuit.

From the circuit (Fig. 1) it will be seen that a loose coupled aerial tuner is used, and by means of "U" links the inductance valves of both aerial and closed circuits can be varied. Additional plug-in coils may be inserted in holders to extend the wave range to the broadcasting band and beyond.

There is nothing unusual in this circuit, which is the straightforward arrangement favoured by probably the majority of those devoting their attention to the lower wavelengths. The utility of the set for all-range reception comes about by the use of a reaction coil, which is movable through 90°, and can thus be made to couple either on to a vertical plug-in coil, or tilted down into the horizontal plane of the short wave inductances. Thus, reaction is obtained by means of a plug-in coil, and when a reaction coil of critical inductance value is needed for the short waves, various coils can be interchanged.

For short wave tuning a coil of high efficiency is employed having low self capacity and being practically "air-supported," thus limiting the dielectric loss which occurs when turns are carried in the usual way on formers of insulating material having poor dielectric properties. In designing a short wave set we must remember that, unless the inductances are adjustable in value, the

All Range Receiver.—

wave range will be far too limited. It is found, in practice, when using a loose coupled set, that one aerial inductance may be used over a band of possibly 80 to 150 metres. This can only be done, however, when the aerial tuning coil brings the aerial wavelength to a value of approximately midway in the range, and the coupling with the tunable closed circuit must, therefore, be tightened towards maximum when the aerial wavelength is to be dragged to either the higher or lower wavelengths on the tuning range. Thus, the use of an aerial coil which cannot be varied almost nullifies the purpose for which loose coupling is provided.

Loose coupling is used in short wave receivers partly to provide selectivity, but its most important use is to adjust the load thrown on the aerial circuit by the absorbing closed circuit according to the amplitude of the oscillations set up by the incoming signals, and also to very critically regulate the negative resistance of the aerial as brought about by the oscillating circuit.

Bearing these points in mind, the aerial coil is fixed as regards its position with the closed circuit, and both aerial and closed circuits are varied by means of tappings arranged to minimise dead end effects.

The reaction coil links up into the field of the coupled inductances, and for this reason, with the aerial and grid ends of the two coils adjacent, care must be taken to see that the relative direction of winding of the two coils is correct. Hence in shaping up the wire for threading on to the ebonite supporting strips, one coil will resemble a left-hand and the other a right-hand screw, so that, were the aerial and closed circuits to be linked across at the top, the direction of winding would be continuous.

At intervals on both of the coils short direct leads are brought out to the plate carrying plugs and sockets for the "U" links. To prevent dielectric loss here only thin ebonite is used. The spacing between plugs and sockets, incidentally, is 9/16 in., so that the "U" links in both aerial and closed circuits can be substituted by plug-in coils for loading purposes. In order that the coupling, thus provided when two coils are inserted, may be in the same direction as that produced by the fixed coupling of the short wave coils, the plugs of the aerial circuit are on the opposite side to those of the closed circuit, as will be seen from the illustrations, and also from the supplement showing the practical wiring.

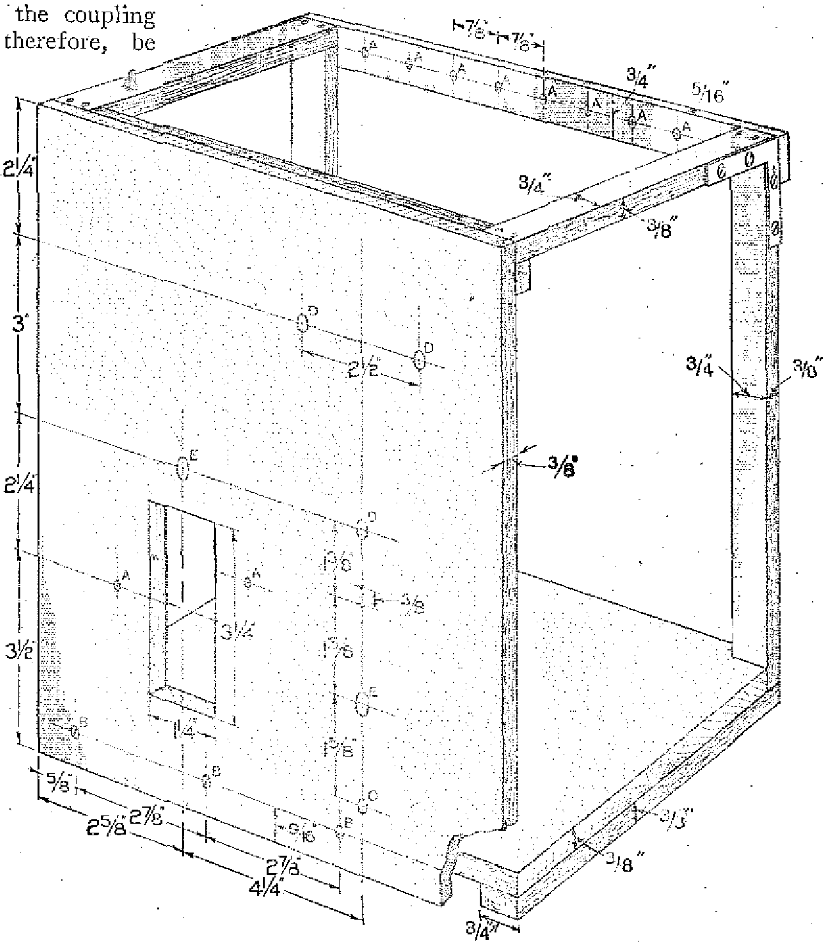


Fig. 3.—Dimensional drawing for constructing the front panel and framework used to carry the apparatus. Sizes of holes: A, 3/16 in., B, 1/8 in., C, 7/32 in., D, 5/16 in., E, 3/8 in.

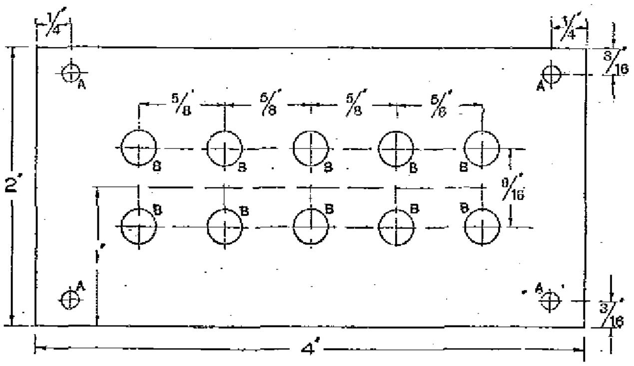


Fig 2.—Constructional details of the ebonite plate carrying the plugs and sockets. The spacing between plugs and sockets is given as 9/16, so that plug-in coils can replace the "U" links. The links are intended for a spacing of 5/8 in., but can be easily adapted. Sizes of holes: A 1/8 in., B 1/4 in.

The remainder of the circuit is on orthodox lines, and consists of a detector valve with grid condenser and leak rectification with potentiometer to give additional control over self-oscillation, and followed by a note magnifier.

It will be observed that high-frequency choke coils are inserted in the leads to the telephones. Although this has become somewhat general practice since its introduction, the writer would explain that these coils are only effective when the high-tension and low-tension batteries stand upon insulating material so as to present a low capacity to earth. Such coils are, of course, effective in preventing the large and varying earth capacity produced with the telephones placed upon the lead. It is as well to "tie down" the filament circuit to earth potential,

All Range Receiver.—

as provided by the earth wire, and if a counterpoise is not used, the leads shown dotted in Fig. 1 should be inserted. With a counterpoise the aerial and closed circuits are entirely separated.

The Design.

The form of construction departs somewhat from the more usual design employed in amateur instrument work. A good published design can always be followed explicitly without experiencing difficulties not apparent at the onset, yet one cannot help observing that the amateur invariably takes a design and modifies it either to suit the limitations of his skill or to make use of components he has to hand or for which he has a preference. The writer has, therefore, constructed a model on simple and inexpensive lines, and the experienced reader need not possess any great confidence in his own ability to be able to adapt his set to more ambitious requirements.

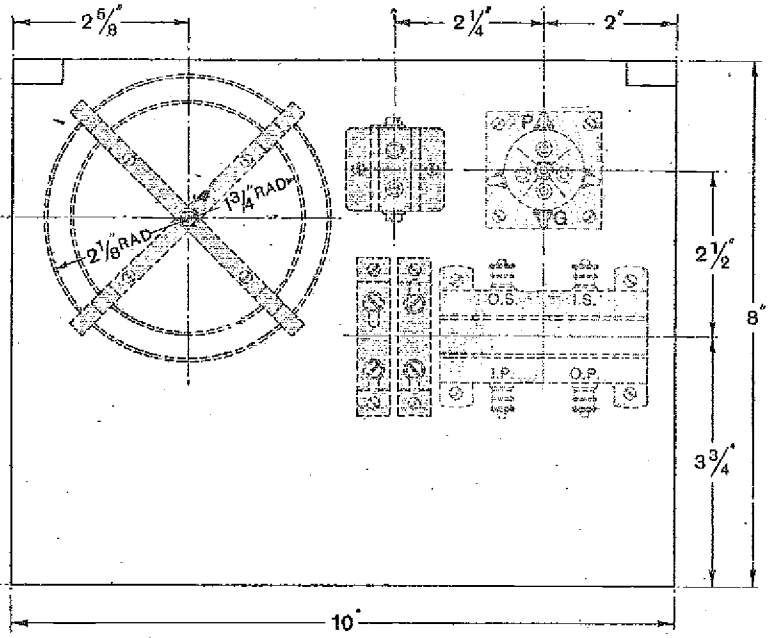
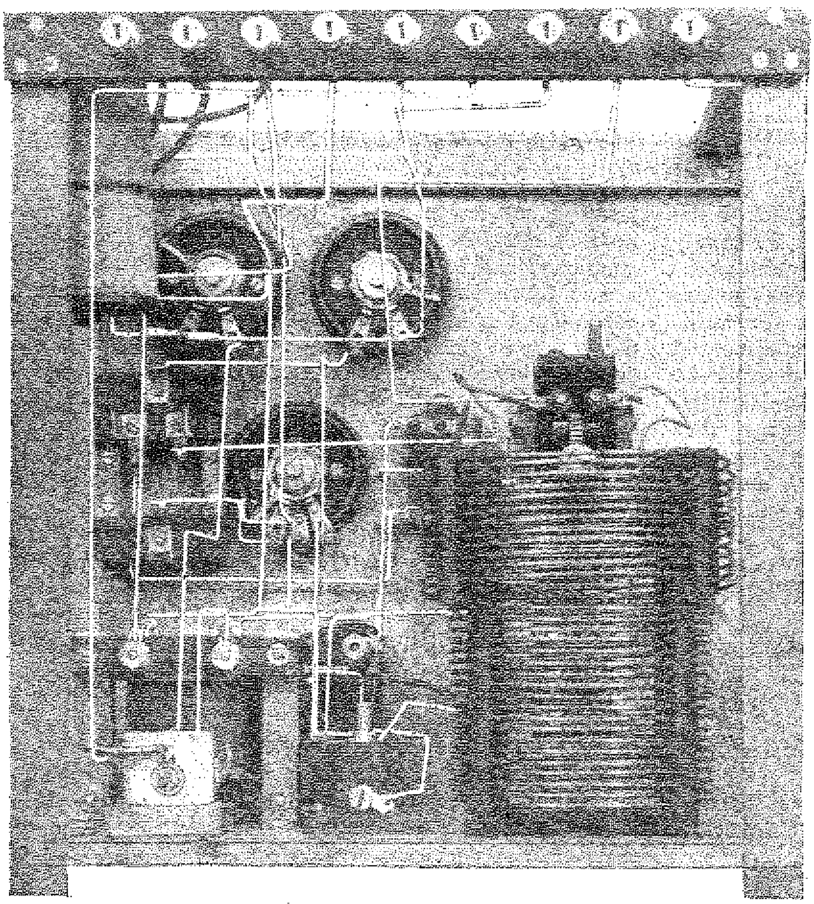


Fig. 4.—The layout of the components on the base board.

The components are carried in a wooden frame, of which details are given in Fig. 3. The wood, which is mahogany, is purchased finished planed to size, and by accurately sawing and filing the ends the framework can be easily made up, and the construction will be found to be much more simple than that of making a cabinet. The top and side members which give support to the front panel are held up square by means of brass "L" brackets, obtainable from most ironmongers; and, if the finished framework is not sufficiently rigid, it may be further strengthened by bracketing at all of the corners.


A rear view, showing the short-wave tuning coils and the arrangement of the components within the frame.

Constructing the Low Wave Coils.

The most difficult part of the construction is the making of the tuning coils. Strips of ebonite are made up from ¼in. sheet, and it is essential to obtain a high-grade ebonite for mechanical as well as electrical reasons. The holes must be accurately marked out and carefully centre-punched, or otherwise they may run one into the other, or so alter the pitch of the turns that the winding of the wire becomes difficult. The inner coil, which is the closed circuit, is carried on four strips 5in. in length by ⅝in. in width. They carry 34 holes $\frac{5}{64}$in. in diameter, so that 33 turns of wire can be supported in spiral formation when the ends are finally trued up, and leaving ⅝in. spare for securing the coil to the baseboard. The turns of the aerial circuit are threaded into four pieces 2in. in length by ⅝in. in width, and include 13 holes of the same pitch as the closed circuit to give support to 12 turns. These low loss coils were first described in a previous

PARTS REQUIRED.

- *¾ in. planed mahogany board for front panel and base board. (Hobbies, Ltd.)*
- *¾ in. × ⅜ in. planed mahogany strip for supports.*
- *7 plugs, 5 sockets and 5 "U" links, nickel plated (Precision Screw Co., Ltd.).*
- *"L & P" coil holder, with long handle.*
- *2 filament resistances.*
- *1 potentiometer.*
- *Variable condenser (J.B.), capacity 0·0005 mfd.*
- *2 T.C.C. condensers, 1 mfd.*
- *2 condensers, 0·001 mfd.*
- *1 intervalve transformer.*
- *9 terminals.*
- *¼ in. ebonite for coil supports, V24 valve holder and terminal strip.*
- *⅛ in. ebonite for "U" link panel.*
- *1½ in. to 1¾ in. ebonite tube for choke coils, about 3½ in. required.*
- *Clips for V24 valve.*
- *1 valve holder.*
- *1 lb. No. 16 S.W.G. enamelled wire.*
- *½ lb. No. 16 tinned copper wire (for connecting up).*
- *2 (or more) suitable brass "L" brackets (about 1½ in. or 2 in. limbs.)*
- *1 Batten type single-coil holder for attaching to base board (Edison Bell).*

issue of this journal[1] to which the reader is referred for more detailed information. Much trouble may be saved by procuring the strips from a wireless dealer who cuts his ebonite with a circular saw, and in many instances strips already cut to size for this purpose are obtainable from stock.

The wire is No. 16, enamel-covered, and the turns are shaped by winding on cylinders a little smaller in diameter than the required finished size. Suitable cylindrical tins can usually be found, and, to prevent the sides crushing, should be filled with plaster of Paris and allowed to set. The required length of wire must be straightened by stretching, and wound directly on to the cylinders with turns touching. In winding, the respective cylinders should be rotated in opposite directions, as referred to earlier.

The turns are easily threaded into the strips, and the ends made off by turning back and soldering. When the sides have been adjusted to be precisely parallel, the tenth turn from the bottom is cut, and the ends bent back and terminated, as is also the sixteenth turn. The aerial coil having been wound, the turns are tightened up, so that its ebonite supports grip the supports of the closed circuit. Counting up from the bottom, the seventh turn is cut and terminated, with the ends facing in the same direction as the terminations on the closed circuit, so that the tapping leads can all be taken direct to the plugs and sockets.

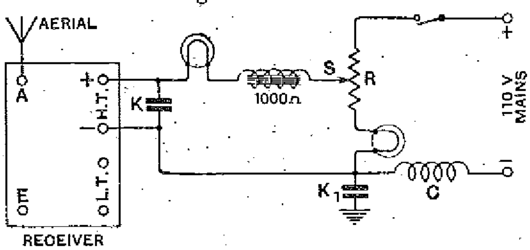
[1] *Wireless World and Radio Review*, Vol. XIII., No. 20. February 13th, 1924.

(*To be concluded.*)

FURTHER NOTES ON OBTAINING ANODE CURRENT FROM D.C. MAINS.

By G. G. BLAKE, M.I.E.E., A.Inst.P.

In *The Wireless World* for January 21st last I described a method of obtaining a silent H.T. supply for wireless reception from D.C. mains, which works perfectly satisfactorily. It is, however, open to one objection, viz., that, although a leakage of a few milliamperes to earth is of very slight moment, when compared to the leakages which already exist on most D.C. systems, should a number of wireless receivers simultaneously make use of this method, the total leakage thus caused might be sufficient to hamper the electrical engineers when making insulation tests on their mains.



In order to avoid any eventual trouble of this kind, I have carried out further experiments, and find that an equally good H.T. supply can be obtained from the mains by the method shown in Fig. 1.

R is a "Zenith" 440 ohm resistance in series with a 16 candle-power carbon filament lamp (110 v.). The positive H.T. terminal of the set is connected through a small 4-volt lamp and a 1,000-ohm iron-cored choke to a sliding contact S, as described in the before-mentioned article. The negative H.T. terminal is connected to the negative main, through a high-frequency choke C. K1 is a condenser of .002 μF, or larger capacity. Almost any size condenser would answer, its object being to insulate the D.C. mains from earth, while it allows the H.F. oscillations in the aerial system to pass to earth.

The object of the choke C is to prevent the H.F. oscillations from going into the negative main, and to ensure that they pass to earth through K1.

A good deal of latitude is allowable in the selection of this coil. A "Gambrel" coil "G" or "H" will be found suitable when receiving broadcasting.

If it is desired to test out some other make of coil, or a home-wound helix, it should be inserted in its place in the negative main lead, and signals received—

(1) With the earth disconnected from condenser K1, and

(2) With the condenser K1 connected to earth.

Signals should be much louder with the latter connection.

In case 1 the station will be found further along the scale of the condenser which tunes the aerial circuit of the set; and in case 2 the signals will come in at full strength on the same position as when the set was normally earthed.

INTERFERENCE.

PART I.

In this Article the Author Describes Methods of Reducing Interference due to Direct Current Machines, and Discusses the Problem of Atmospherics.

By N. W. McLACHLAN, D.Sc.(Eng.), M.I.E.E., F.Inst.P.

Introduction.

ENOUGH has been written and patented on the subject of interference to animate the archives of an institution for centuries. A goodly proportion, although written quite ingeniously, has been based on misconception. I have in mind the many devices, some intricate, others simple, and the majority impotent, for eliminating X's atmospherics. Moreover, the task of reviewing a subject of this nature is very difficult, because there are no new methods to be presented. However, an attempt will be made to treat the subject in more generalised form, although particular cases will be cited. At the outset it is well to remember that if an interfering source is strong enough, it cannot, in the commonly accepted sense, be eliminated, or even perceptibly reduced. Under such circumstances the solution of the interference problem is to be sought in strategical paths. Either the offending source is rendered electrically *hors de combat* or removed to a great distance. Alternatively, the site of the receiving station is shifted.

Practical Considerations.

Taking first the practical side of the situation, the reader really desires to know how interference can be combated. In dealing with this problem, it is advisable to follow in the footsteps of our medical practitioners and diagnose the trouble if possible. There are two main considerations: (*a*) the source of disturbance; (*b*) the type of disturbance. For example, the source may be a motor or a dynamo, and the type either a.c. or d.c.

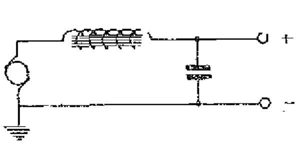


Fig. 1.—A simple method of reducing interference from a direct current machine.

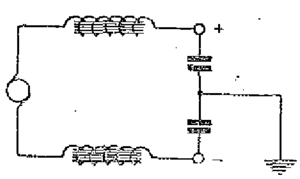


Fig. 2.—Another filter circuit. Add another section if necessary.

The effect from any of these must be of an intermittent or alternating character, but the a.c. type may be less impulsive than the d.c. With a pure a.c. interference, the remedy might be some trap or simple filter circuit, but with impulsive d.c., say that due to commutator sparking, the remedy would be different. No hard and fast rules can be drawn up for curing interference, because every case must be diagnosed and treated according to requirements. Let it be reiterated that where the disturbance is sufficiently strong no cure may be possible *at the receiver.*

For the sake of completeness, an analysis of types of interference has been prepared and is set out as follows. Each type of interference mentioned is followed by the remedy or remedies proposed. In connection with the use of screens, astatic coils, and filter circuits, the reader ought to refer to the author's article in *The Wireless World* on "Selective Receiving Circuits." [1]

1. Noises of an impulsive nature, *e.g.*, D.C. machines.

(*a*) Shunt machine with condenser of the order of 4 microfarads if one side is earthed. Include a low-resistance choke of large inductance as shown in fig. 1. When machine is not earthed use methods of figs. 2 or 3. The machine terminal should not be earthed unless it is absolutely essential.

(*b*) Earth mat or counterpoise as far as practicable from source of disturbance. This is effective where interference is due to earth currents, provided the mat is not earthed and is not in the field of currents.

(*c*) Frame aerial with or without reaction.

(*d*) Open or frame aerial with filter circuits, the various components to be astatic or screened or both.

Commutator Sparking.

Clean commutator, true up in lathe if necessary, bed brushes properly.

2. Induction and earth currents from tramway systems.

See No. 1.

Run aerial at 90° to tramlines; or use cage aerial. Use earth mat or counterpoise. Keep aerial and earth system as far away as possible and avoid coupling between the aerial system and the source of disturbance.

Try a large condenser, say, 1 or 2 microfarads, between earth-lead and receiver.

3. Commutator ripple and noises when using D.C. mains for H.T. supply or when using a low voltage machine for filament lighting.

Use filter circuit as shown in fig. 4. For low-pitched noises both inductance and capacity must be augmented. In this case an inductance of fairly high resistance is useful.

When the required H.T. voltage is only a *fraction* of the main supply, a potentiometer adaptation is serviceable as indicated in fig. 5. The voltage variation to be smoothed is then reduced to a fraction of that on the mains. The lamp and chokes of fairly high resistance.

One or more sections may be used according to magnitude of interference. The inductances should not have too high a resistance to avoid unnecessary D.C. volt drop. If a definite note is present add a rejector to the positive lead.

[1] *The Wireless World*, November 12th, 1924. See also *Experimental Wireless*, April, 1924, "Filter Circuits in Radio Telegraphy."

Interference.—

4. Hum when filaments are lighted from A.C.

Use rheostat with variable earth point on secondary of transformer as shown in fig. 6.

5. A.C. hum picked up by receiver.

Keep aerial and earth systems well away from A.C. wiring. Use earth mat or counterpoise. Run aerial, etc., as far as possible at 90° to A.C. mains. If receiver is screened, the metal must be fairly thick. Coils should be arranged astatically. Reaction and filter circuits are serviceable. A note filter in telegraphy will give excellent results.

6. C.W. telegraph or telephone signals. The interference may be due to the fundamental or a harmonic and the telegraphic signals may be inaudible.

(*a*) Rejector circuit in series with aerial tuned to interfering station.
(*b*) Frame aerial with rejector.
(*c*) Open or frame aerial with reaction or filter circuits.
(*d*) Superheterodyne with open or frame aerial and reaction. The beat frequency must be adjusted to avoid interfering wave.

7. Oscillation of nearby receiver.

In general the elimination of interference of this nature is secured by other than technical means at the jammed station.

8. Spark station.

As at (*c*) and (*d*) in No. 6. If the wavelength is in the neighbourhood of the desired signals, and the interference is strong, the adequate reduction of the spark is almost impossible where good quality telephony is concerned.

9. Key clicks from transmitter.

Reduce the rate of rise and fall of the aerial current during signalling. At the receiver see No. 6.

General Note.

In reducing interference always endeavour to avoid saturation, grid current, etc., *i.e.*, distortion in the valve circuits. In other words, the amplification throughout should be linear to avoid the introduction of alien frequencies concomitant with curvilinear amplification.

Low Losses.

In constructing circuits for selectivity, *i.e.*, immunity from interference, care must be exercised to get the resistances as low as possible and to avoid loss due to faulty condensers. The value of $\dfrac{\text{inductance}}{\text{effective resistance}}$ should be as large as is compatible with economical construction and the requirements of reception. For example, in the reception of telephony on, say, 2,000 metres, a series of very low resistance circuits would cause considerable distortion due to attenuation of the higher audio frequencies. A case of like nature might arise when using a superheterodyne with reaction on a beat wavelength of 2,000 metres. Under such a condition speech would be very hollow and difficult to interpret.

Atmospherics.

Where atmospherics are involved there is in general no remedy which can be applied if the disturbance is sufficiently strong. Atmospherics of moderate strength can be reduced appreciably by the aid of directional reception and filter circuits. It is well known that atmospherics are much more troublesome on long than on short

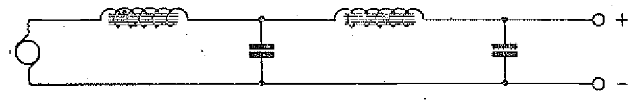


Fig. 3.—Another method. More sections should be added if required.

waves. This is possibly due to the energy of the atmospherics being located chiefly on frequencies in the transoceanic range, but there may be other reasons associated with the electrical condition of the atmosphere. Moreover, the signal strength at the receiver measured in volts per metre must be greater for long than for short waves to give equal readibility. Barring fading phenomena and high attenuation, the above is a good reason for using short waves. Put in another way, the situation is simply this: Amospherics can be so strong when using long waves as to necessitate a reduction in the speed of sending of 50 per cent. or more. The atmospherics cannot be reduced sufficiently by known means, and, therefore, in the future we will doubtless have recourse to strategical measures and use short waves—a happy and probably a relatively cheap solution of the problem, since the power input at the transmitter is much reduced, the aerial very much smaller and more efficient, due to its large radiation resistance.

Theoretical Considerations.

Any electric disturbance, whatever its wave form, whether periodic, quasi-periodic, or aperiodic, can be resolved by mathematical analysis, using a Fourier integral (not Fourier's Series) into an infinite number of continuous sine waves. These frequencies, which range from zero to infinity, are not integral harmonics. In general frequencies in the neighbourhood of these two extremes are unimportant. It is of interest to note, however, that in an impulse there is a gamut of wavelengths ranging from zero through the low frequency power transmission networks, the long waves used for transoceanic communication, the short waves of 100 metres or less, the heat rays, the ultra red, the visible light waves, the X-rays, and so on. After all, there is something to be said for the expression that an electric shock makes us "see stars." An electric impulse has, therefore, a frequency spectrum,

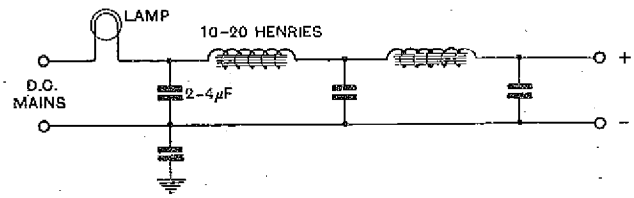


Fig. 4.—A filter for reducing commutator ripple and noises when using the mains for H.T. or filament supply.

but in general it is not of the visible variety because the component light waves in its spectrum are insufficiently intense and of too short duration to be seen.

The component sine waves of different frequencies into which the impulse can be analysed are, of course, only mathematical fictions, but the action on a radio receiver is equivalent to the series of waves, nevertheless. At any instant the various frequencies have certain phase

Interference.—
relationships, and it is the amplitudes and *initial* phase relationships which determine the shape of the impulse. Moreover, in examining the effect of an impulse on any form of radio receiver, the simplest procedure is to visualise a series of continuous waves of various frequencies, amplitudes, and phases inducing e.m.f.'s in the electric circuits.

The Effect of an Electrical Impulse.

The question now at issue is simply this: What effect has a series of continuous waves of different frequencies on the receiver? Before the impulse arrives the waves annul one another, so that there is no disturbance. On the arrival of the impulse the phases of the component oscillations are such that the resultant e.m.f. in the receiver is not zero.

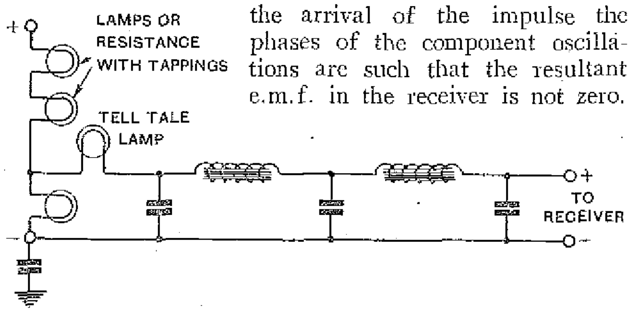


Fig. 5.—When the direct current mains are used as a source of H.T. for a receiver, the circuit shown here may be used. A high-resistance potentiometer may be used instead of the lamps.

We have now to consider the impulse as a disturbance travelling through space with the velocity of light, or as an inductive effect due to a variation in magnetic field, with, of course, its accompanying electrostatic induction according to the mode of generation of the disturbance. For example, we may regard a flash of lightning as yielding highly damped oscillations, the clouds, etc., in the upper atmosphere being the oscillatory circuit whose inductance, capacity and resistance are very variable, and yield peculiar wave forms. In fact, we might regard the clouds surrounding or even at some distance from a discharge as a series of oscillators of different natural frequencies. These are impulsed and yield a multitude of frequencies and wave forms. Electromagnetic waves are propagated from the oscillators in all directions, and the wave form at a distant receiver depends upon the modifications which are caused by propagation through space, *e.g.*, attenuation and the influence of the Heaviside layer. So far as attenuation is concerned, due to the earth losses en route, the ultra-high frequencies are affected most and are lost a short distance from the oscillator. The wave form varies with the distance from the transmitter, owing to the gradual absorption of the higher frequencies. In addition, there is the complex action of the Heaviside layer or electrical ceiling with its absorptive, reflective, dispersive, and refractive properties. The component frequencies are affected here also.

The wave form at any receiver can be taken as a curve showing the relation between electric intensity and time. The electric intensity is measured in some convenient unit, say microvolts per metre. Each component frequency (continuous oscillation) in the impulse has a maximum amplitude of so many microvolts per metre.

When the impulse incites the aerial the effect is identical to the arrival of a series of continuous waves. Each continuous wave "impulses" or gives the aerial a shock, just as a motor car starts with a jerk if the clutch is jammed hard home. The initial effect of a wave of any frequency on the aerial is therefore to make the aerial oscillate at its natural frequency *plus*, of course, its series of overtones.[2] As time progresses, the wave gradually induces a forced oscillation of its own frequency. The latter grows as the free oscillation dies away. This occurs with all the component frequencies of the impulse. Moreover, there is initially a predominant free oscillation of the aerial system. This is followed by the forced oscillations due to the component frequencies. But after the termination of the impulse the vector sum of these oscillations is zero, owing to their relative amplitudes and phases. Hence the effect of the impulse on an aerial not receiving traffic is to cause a current whose rate of rise is governed by the wave form of the impulse.

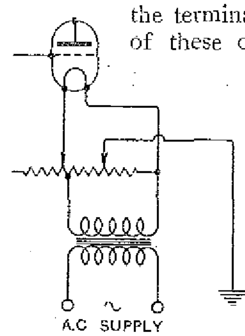


Fig. 6.—A method of reducing hum when the filaments are heated with alternating current.

When the impulse is of short duration it is transformed from something irregular to a damped oscillation having the decrement of the aerial. We appear, therefore, to have lost our multitude of continuous waves. This, however, is not so, because the damped oscillation can also be resolved into a series of waves, although the amplitudes and phases differ from those of the original impulse. When the impulse is prolonged, the atmospheric spectrum frequencies have time to induce forced oscillations, so that the current in the aerial is the sum of these and the damped oscillation due to impulsing.

[2] The various waves, of course, do not have their maximum values at the same instant, and there is, therefore, a series of free oscillations being built up in very rapid succession. The current at any instant is the vector sum of these and the forced oscillations.

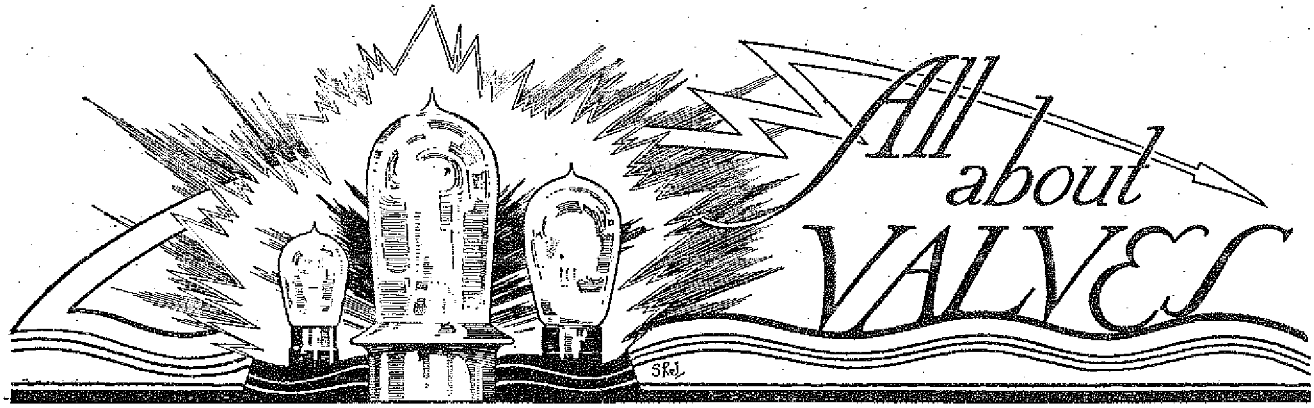
ANODE CURRENT FROM D.C. MAINS.

APROPOS of Mr. G. G. Blake's article on "Obtaining Anode Current from D.C. Mains," in *The Wireless World* of January 21st, the author now furnishes some useful data on the method of making up the choke coil, as follows:—

A few details as to the suitable construction of the choke may be helpful to those readers who wish to make use of the method of H.T. supply described in the article.

The choke is wound on a bobbin 2in. long and ⅝in. in diameter, over a soft iron wire core ⅜in. in diameter, the ends left long enough to enable them to be turned over the outside of the windings and form a closed iron core.

The windings consist of 3 oz. of No. 40 gauge double cotton or silk-covered wire (about 700 yards). The two ends of the coil thus wound should be protected from damage by small insulating sleeves; the ends of the iron core should then be bent over and overlapped. The entire choke is then finally bound round with silk ribbon.

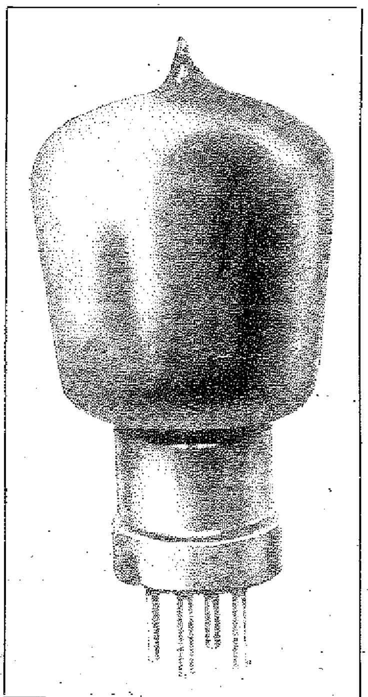


The "P.V.5" D.E.

THIS product of the Edison Swan Electric Co., Ltd., which we have recently tested, is rated as follows:—Filament volts, 5.0; filament amps., 0.25; plate volts, 50-150.

The "P.V.5" D.E. is a small power valve, similar in many respects to the B.4 and D.E.5, which have already been reviewed in these columns. Valves of this class are becoming increasingly popular, for it is realised that the quality of the reproduction is, after all, the first consideration. Bright emitter power valves were extremely heavy in their demands on the low tension battery, and probably this was, to a large extent, responsible for their restricted use. Modern advances in filament design have completely changed the position, and the use of small power valves is possible to the owner of even quite low capacity accumulators.

The plate and grid are of the "flattened" variety, usual in valves of this type, and this method of construction, coupled with a "V" shaped filament, produces a valve of low internal impedance.


The Ediswan "P.V.5" D.E.

At the normal filament voltage of 5 and when passing a current of 0.29 amperes, an emission of 36 milliamperes was obtained, giving a filament efficiency of approximately 25 milliamperes per watt; a usual figure for this class of filament.

The plate current curves give promise of excellent performance, and show the valve to be capable of handling a large input satisfactorily. For example, when a plate voltage of 150 is used, a swing of at least 20 volts can be applied to the grid without fear of distortion.

The magnification factor is very approximately 6, and this, combined with the low impedance and high emission, gives us a valve capable of handling a considerable amount of power.

We have made considerable use of this valve in the second and third stages of a low-frequency amplifier, and, when the plate and grid potentials are suitably adjusted, its performance has left nothing to be desired.

The values of grid bias in the table may be taken as the minimum to apply in conjunction with the respective plate potential of column 1.

Tabulated results of our tests on a typical valve of this type are given below:—

EDISON SWAN ELECTRIC CO.—Valve Type "P.V.5" D.E.

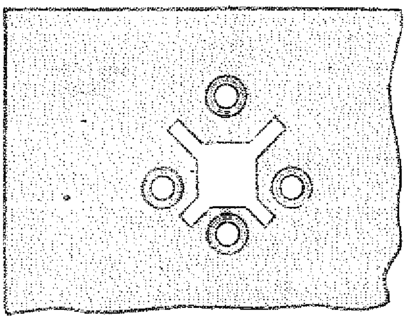
Filament volts 5.0. Filament current 0.29 amp.
Emission total 36 milliamperes. Filament efficiency 25 milliamperes per watt.

Plate Volts.	Plate Current at Zero Grid. Volts.	Grid Bias.	Plate Current. Milliamperes.	Amplification Factor.	Impedance. Ohms.
40	1.75	−1.5	1.2	5.9	11,000
60	3.6	−3.	2.0	5.9	9,800
80	6.0	−4.5	2.75	5.9	7,900
100	8.75	−6	4.2	6.0	7,300
120	11.8	−8	5.25	6.0	7,000
150	16.3	−10	7.4	6.0	7,000

A Section Devoted to New Ideas and Practical Devices.

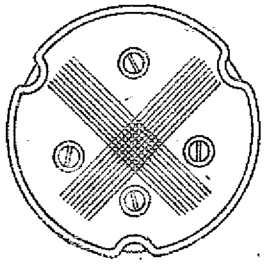
REDUCING LEAKAGE AND STRAY CAPACITY IN VALVE HOLDERS.

It is well known that the capacity and possibility of leakage presented between valve legs must be carefully guarded against, and especially so when constructing a short wave receiver. It might be mentioned that it is not advisable to fit large washers under the nuts which hold the valve legs in position, for by so doing the leakage path may be rendered very short. A most effective manner, however, for reducing stray capacity and eliminating leakage consists of cutting away the ebonite between the valve pins. This can easily be accomplished by linking up a number of holes with a small round file. Leakage can, of course, occur at the base of the valve, and to guard against this it is quite worth while making a number of scratch lines to divide up the pins in the manner shown.—A. G. W.



VALVE HOLDER

The panel is cut away between the valve sockets to reduce capacity and leakage.



BASE OF VALVE

Scratch lines on the base of the valve prevent leakage and improve the insulation between the pins.

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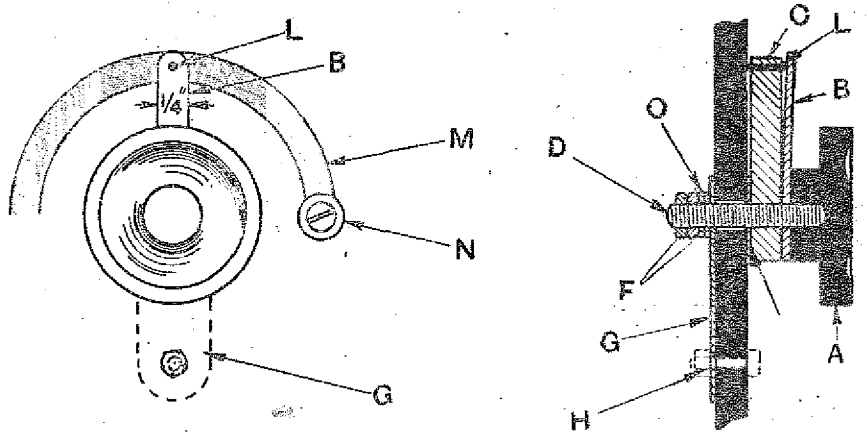
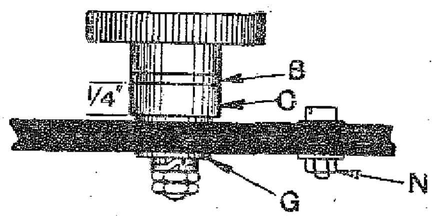
ANOTHER VARIABLE GRID LEAK.

A grid leak of simple construction is shown in the accompanying diagram. The resistance value is variable from a few thousand ohms to infinity, and the construction is no doubt self explanatory. It consists of the following parts:—(A) an ebonite knob, (B) spring brass, (C) brass arm shaped as shown with $\frac{3}{32}$in. hole at the end and screwed to take the bolt (D), (E) washer $\frac{1}{32}$in. in thickness, (F) a pair of locknuts, (G) a piece of strip brass from which connection is taken to the connecting screw (H), (L) a short piece of lead taken from a soft pencil, (M) a circular line, about $\frac{1}{4}$in. in width, forming the leak and made up liberally pencilling the ebonite surface, (N) screw and nut to pick up contact with the end of the pencilling and carry a piece of tin foil.



Front and sectional views, showing constructional details for making a variable grid leak

This variable resistance may also be found suitable for use as a variable anode resistance in resistance-coupled amplifying circuits.—H. M. T.



Side view, showing the assembling of knob and spindle.

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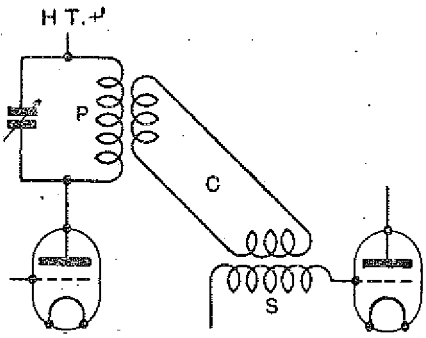
A NEW H.F. TRANSFORMER.

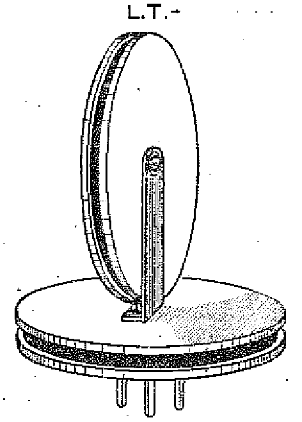
The high frequency transformer here described has given such good results that the writer considers it may prove of interest to other experimenters. The design was produced in the course of some experiments carried out to determine to what extent the transfer of energy in the conventional plug-in type of H.F. transformer was electromagnetic and to what extent electrostatic. The primary and secondary windings are wound on two grooved spools

Novelties from our Readers.—

mounted at right angles to one another, and the coupling is brought about by overwinding each bobbin with a few additional turns and linking across as shown at C in the circuit diagram, P being the tuned plate circuit, and S the secondary connected to the grid circuit of a subsequent valve.

For broadcast reception the dimensions of each of the bobbins may be $2\frac{3}{4}$in. diameter by $\frac{3}{8}$in. thick. The groove is $\frac{3}{16}$in. wide and $\frac{3}{8}$in. deep. The lower horizontal bobbin contains the primary winding. The windings used to provide the coupling consist of seven turns of No. 24 D.C.C. copper wire on the lower bobbin,





New form of construction for high frequency transformer.

bringing out the ends through holes drilled in the flange and joining up to a core of ten turns on the upper bobbin. These windings are covered with a single layer of Empire cloth, and the primary and secondary windings run on. The primary may consist of seventy turns of No. 28 D.C.C., and the secondary ninety turns of the same wire.—H. W. M.

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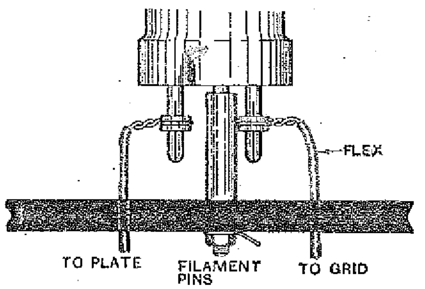
IMPROVING THE VALVE HOLDER.

Many of the valve holders met with at the present time are made of composition possessing doubtful insulating and dielectric properties. The use of moulded material for supporting the sockets of a valve holder does to a small degree increase the capacity between the electrodes, but there is also a danger of a biassing grid



A good method of avoiding capacity and poor insulation troubles.

potential being created if the insulating properties are not of the very best.

In the accompanying diagram a method is shown of using the usual type of valve socket to pick up connection with the filament and at the same time support the valve in a vertical position whilst connection is made with the grid and plate pins by means of small pieces of brass tube soldered to short flexible leads. The piece of tube can be bent to shape or sawn from the end of a valve socket.—J. E. S.

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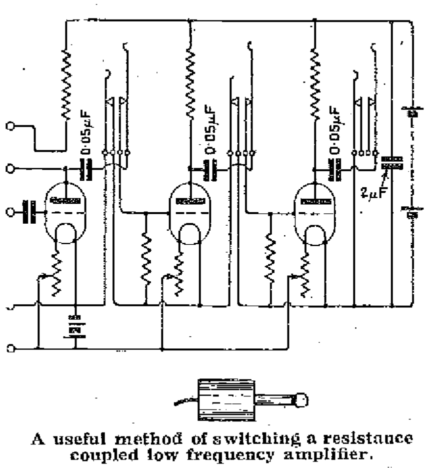
SWITCHING A LOW-FREQUENCY RESISTANCE COUPLED AMPLIFIER.

In any low-frequency switching circuit it is necessary to provide the correct plate potential to the various valves irrespective of how the switches may be operated. In the circuit shown here, it will be noticed that the



A useful method of switching a resistance coupled low frequency amplifier.

telephones or loud-speaker will be operated by the potential developed across the resistance connected in the plate lead of the last valve in circuit. If thought desirable, the various anode resistances may be connected up to the H.T. battery to give the requisite plate potentials, and, by using the switching arrangement shown, the correct potentials will be maintained when the plug is inserted into either of the three jacks.

The novelty of the arrangement will be seen to lie in the use of the grid condensers as the output feed condensers in each of the three amplifying circuits.—B. T. W.

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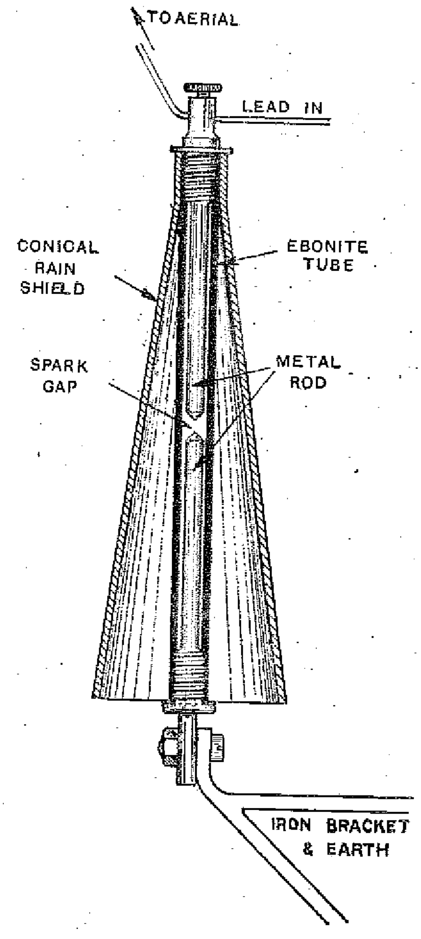
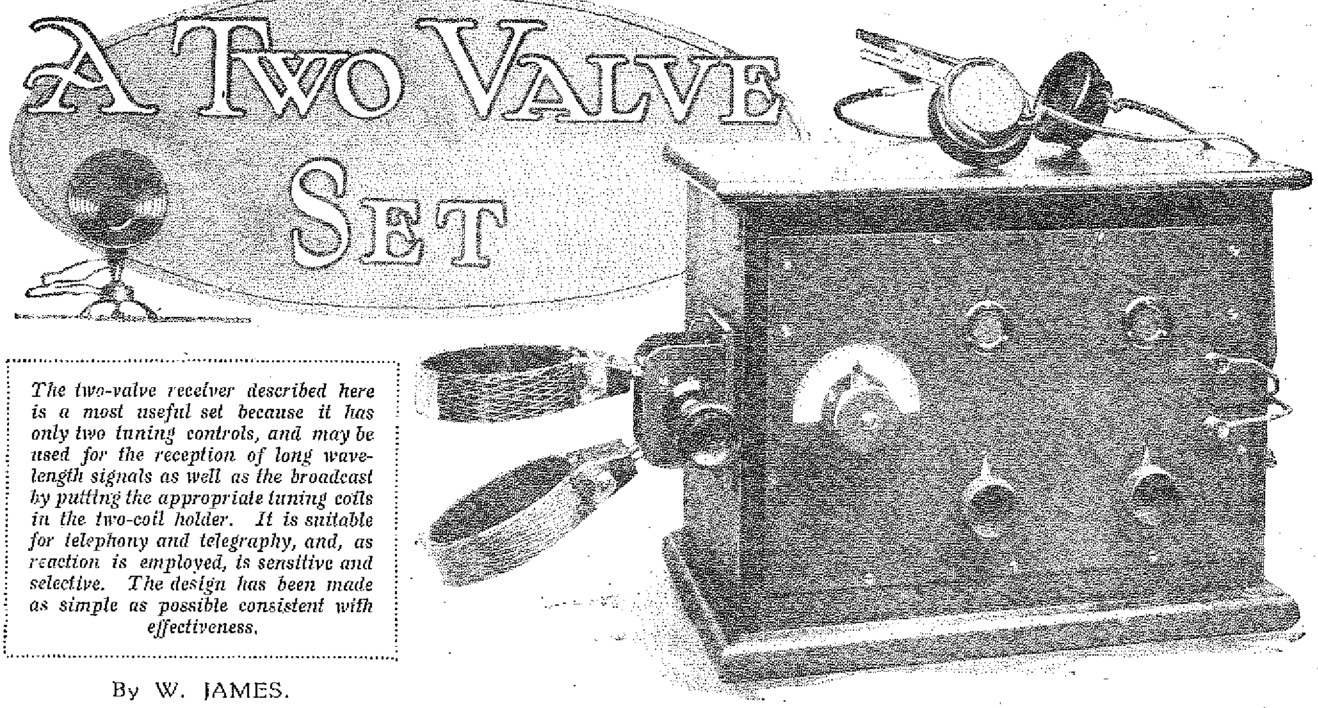


An effective lightning protector for use out of doors.

A LIGHTNING PROTECTOR.

The above illustration shows how to construct a lightning protector, which may be fitted out of doors, and which should prove efficient in preventing damage being done to the receiving apparatus by heavy lightning discharges.—J. P.

A Two Valve Set



The two-valve receiver described here is a most useful set because it has only two tuning controls, and may be used for the reception of long wavelength signals as well as the broadcast by putting the appropriate tuning coils in the two-coil holder. It is suitable for telephony and telegraphy, and, as reaction is employed, is sensitive and selective. The design has been made as simple as possible consistent with effectiveness.

By W. JAMES.

Introduction.

THIS two-valve receiver will operate a loud-speaker from the local broadcast station and the 1,600-metre station, and, under favourable conditions as regards the aerial-earth system and location, from several other broadcast stations as well. It has a valve detector and one note magnifier, and the reaction coil is coupled to the aerial coil. If the reaction coil is brought too near the aerial coil, the set will oscillate, and the energy radiated may cause interference; hence it is necessary to exercise reasonable care when tuning. The majority of receivers employ reaction in one form or other, and the benefits of reaction are such that the fact that the misuse of reaction may result in interference is negligible compared with the advantages derived from its proper use. A valve detector without reaction is not a great deal more sensitive than a good crystal detector; by adding reaction,

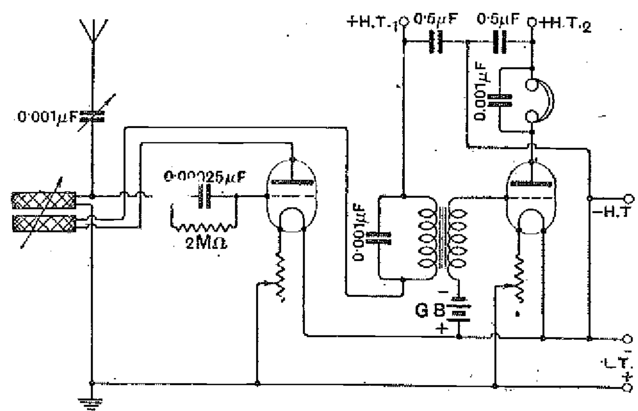


Fig. 1.—The theoretical connections of the set

however, the weakest signals may be magnified to such an extent that they are heard.

The wavelength range of the set is decided by the plug-in coils available. As the aerial tuning condenser is permanently connected in series with the aerial, the receiver is quite suitable for the reception of the shorter wavelengths—say, to 150 metres—and will also receive long wavelength signals when the appropriate plug-in coils are inserted in the coil-holder.

Those who are interested in the reception of continuous wave and other Morse signals will find this set quite suitable, the beat note being obtained by increasing the coupling of the reaction coil with the aerial coil.

Arrangement of the Set.

The set has an ebonite front panel upon which are mounted the aerial tuning condenser, the filament resistances, two valve windows, and the telephone terminals. Attached to the bottom of the front panel is a base of wood which carries the valve-holders, fixed condensers, grid condenser and leak, intervalve transformer, grid battery, and the terminal strip. A two-coil holder is fixed on the side of the containing case. The set is therefore of the enclosed type, and access to the valves is had by opening the lid of the set. This is quite a neat arrangement, the set being easily assembled and wired. All external connecting wires go to the terminal strip at the back of the set, and the telephones are attached to the terminals on the front panel.

Construction.

Front Panel.—The front panel is of ebonite, and measures 12in. × 8in. × ¼in. This is a standard size, and the reader will probably be able to purchase such a panel of good quality ebonite nicely trued up and finished

A Two Valve Set—

off. Those who have a piece cut for them should allow sufficient for filing to the correct size. If the ebonite has not had its "skin" removed, this should be done by carefully going over the panel with a medium-grade carborundum cloth and a little oil.

When the panel is finished off, mark it out from the layout given in Fig. 2. If the reader is not using components similar to those employed in the writer's set he will, of course, use the dimensions given merely as a

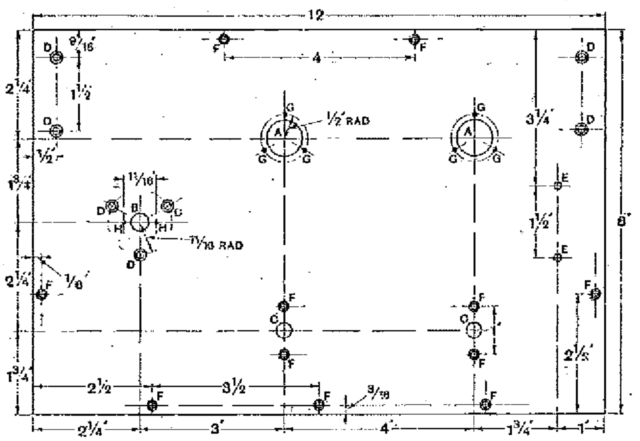


Fig. 2.—Arrangement of the ebonite panel: A=drill $\frac{3}{4}$ in. dia.; B=drill $\frac{3}{8}$ in. dia. to clear condenser spindle; C=drill $\frac{3}{16}$ in. dia. to clear rheostat spindle; D=drill $\frac{5}{32}$ in. dia. and countersink for 4BA screws; E=drill $\frac{5}{32}$ in. dia. for 4BA terminals; F=drill $\frac{1}{8}$ in. dia. and countersink; G=drill $\frac{5}{32}$ in. dia.; H=drill $\frac{3}{16}$ in.

guide and mark the position of the holes to be drilled according to the components by him. Templates of cardboard or paper are often supplied by manufacturers; these should be checked carefully with the actual parts, as it sometimes happens that the positions marked on

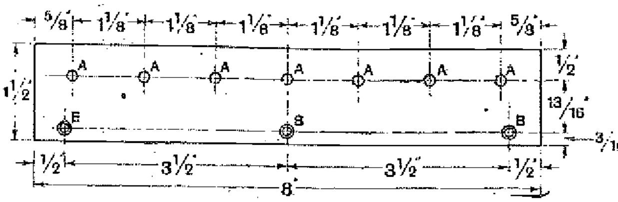


Fig. 4.—Details of terminal strip. A = drill $\frac{5}{32}$ in.; B = drill $\frac{1}{8}$ in. and countersink.

the templates are not in agreement with the actual parts. Having marked out the panel, carefully drill the holes, and then, when this work is done, mount the parts on the panel and see that the tuning condenser and filament resistances have a smooth action. Sometimes it is necessary to spend a little time in adjusting these components before satisfactory results are obtained.

The Base.—The base is a piece of mahogany measuring $11\frac{1}{2}$in. × 7in. × $\frac{3}{8}$in., and should be carefully cut to this

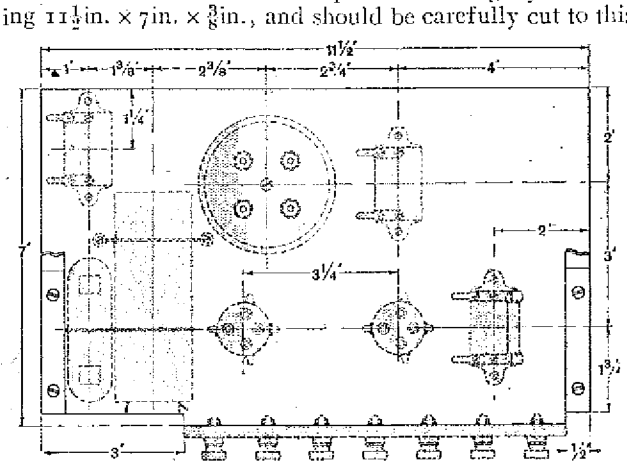
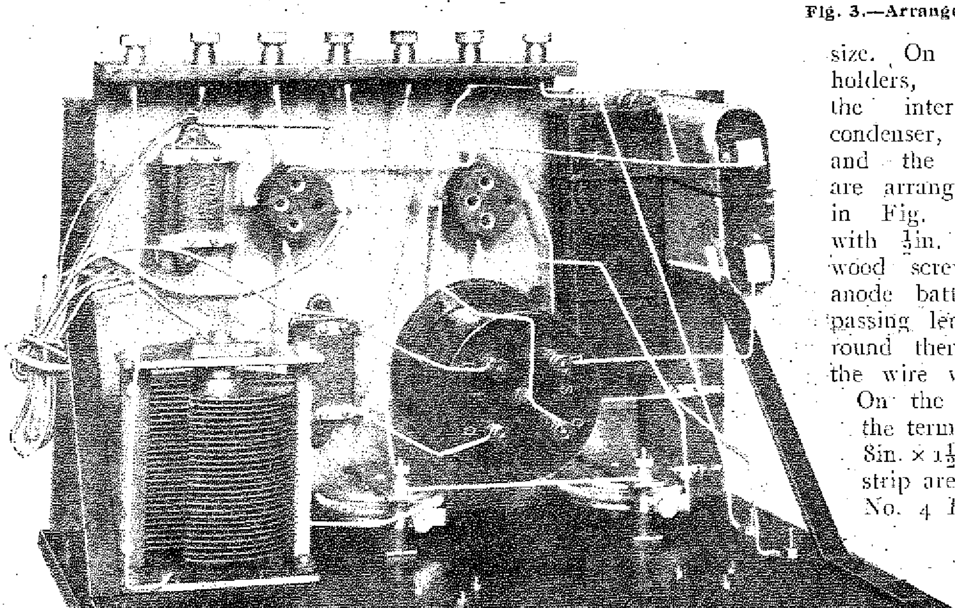


Fig. 3.—Arrangement of parts on base.

size. On it are mounted the valve-holders, grid condenser and leak, the intervalve transformer, by-pass condenser, anode battery condensers, and the grid battery. These parts are arranged on the base as indicated in Fig. 3, and are screwed down with $\frac{1}{2}$in. No. 4 round-headed brass wood screws. The grid battery and anode battery condensers are held by passing lengths of No. 16 gauge wire round them and securing the ends of the wire with screws put in the base. On the back edge of the base is the terminal strip of ebonite measuring 8in. × $1\frac{1}{2}$in. × $\frac{1}{4}$in. Particulars of this strip are to be found in Fig. 4; seven No. 4 B.A. brass terminals with connecting tags are mounted on this strip.

A pair of brass brackets is employed to hold the base and panel at right angles, and, in addition, the bottom of the panel is screwed to the edge of the base.



View of set from above, showing in particular the arrangement of the parts on the base and the wiring.

A Two Valve Set—

The Cabinet.—A drawing of the cabinet is given in Fig. 5 for the benefit of those readers who prefer one of their own construction to a bought cabinet.

The two-coil holder which accommodates the aerial and reaction coils is mounted on the side of the box in a position which is convenient for making adjustments. Four holes should be drilled in the side of the box for the connecting wires to the coil-holder to pass through.

Wiring the Set.

The wiring diagram of Fig. 6 gives the connections. There are not many connecting wires in such a set as this, and there is plenty of room for them to be put in without making intricate bends. However, proceed slowly with the wiring, carefully soldering the connections to make the wiring durable and present a pleasing appearance.

There are four flexible wires. These should be of rubber-covered wire, and are used to connect the coil-holder. The ends to be connected to the parts in the set should be put on first, and then, when the set is fitted in the cabinet, the free ends passed through the holes provided in the side of the cabinet and joined to the coil-holder. It is important that these wires be joined correctly.

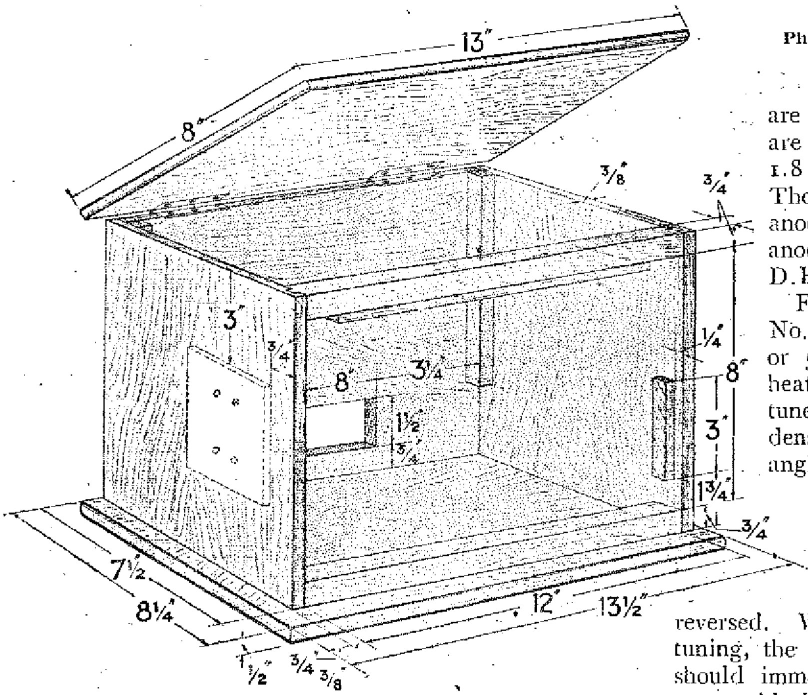
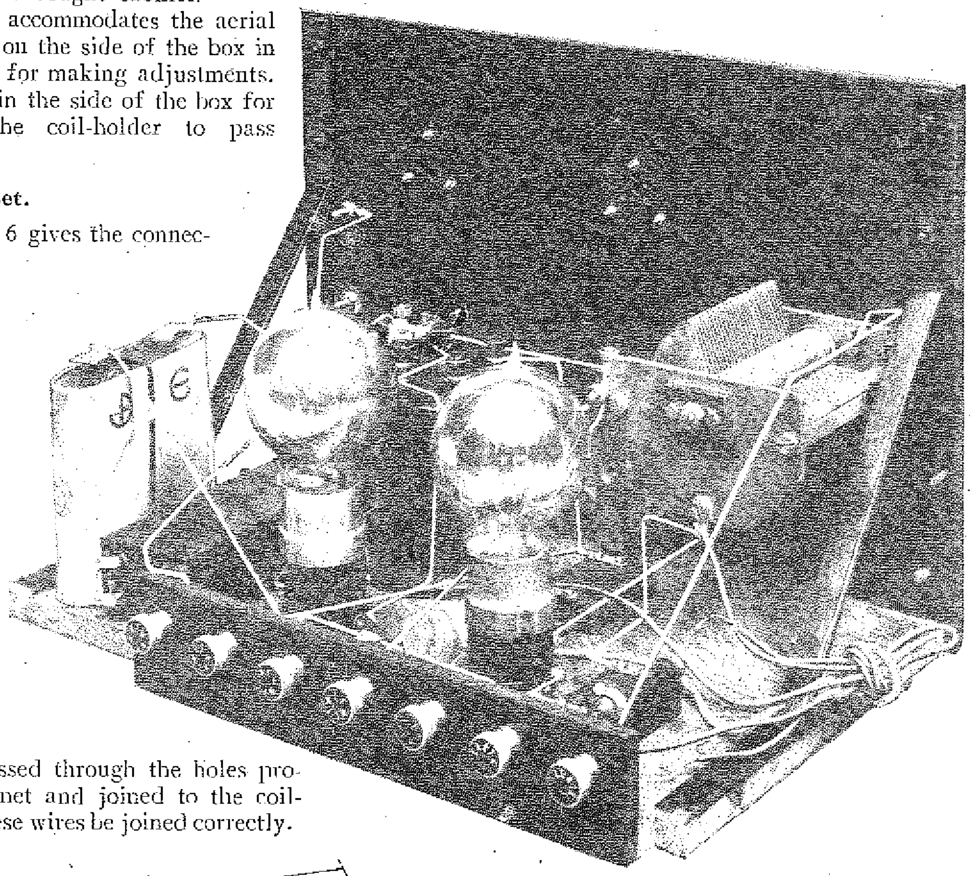


Fig. 5.—Sketch of cabinet, showing dimensions, position of slot in back for the terminal strip, and position of two-coil holder.

Operating the Receiver.

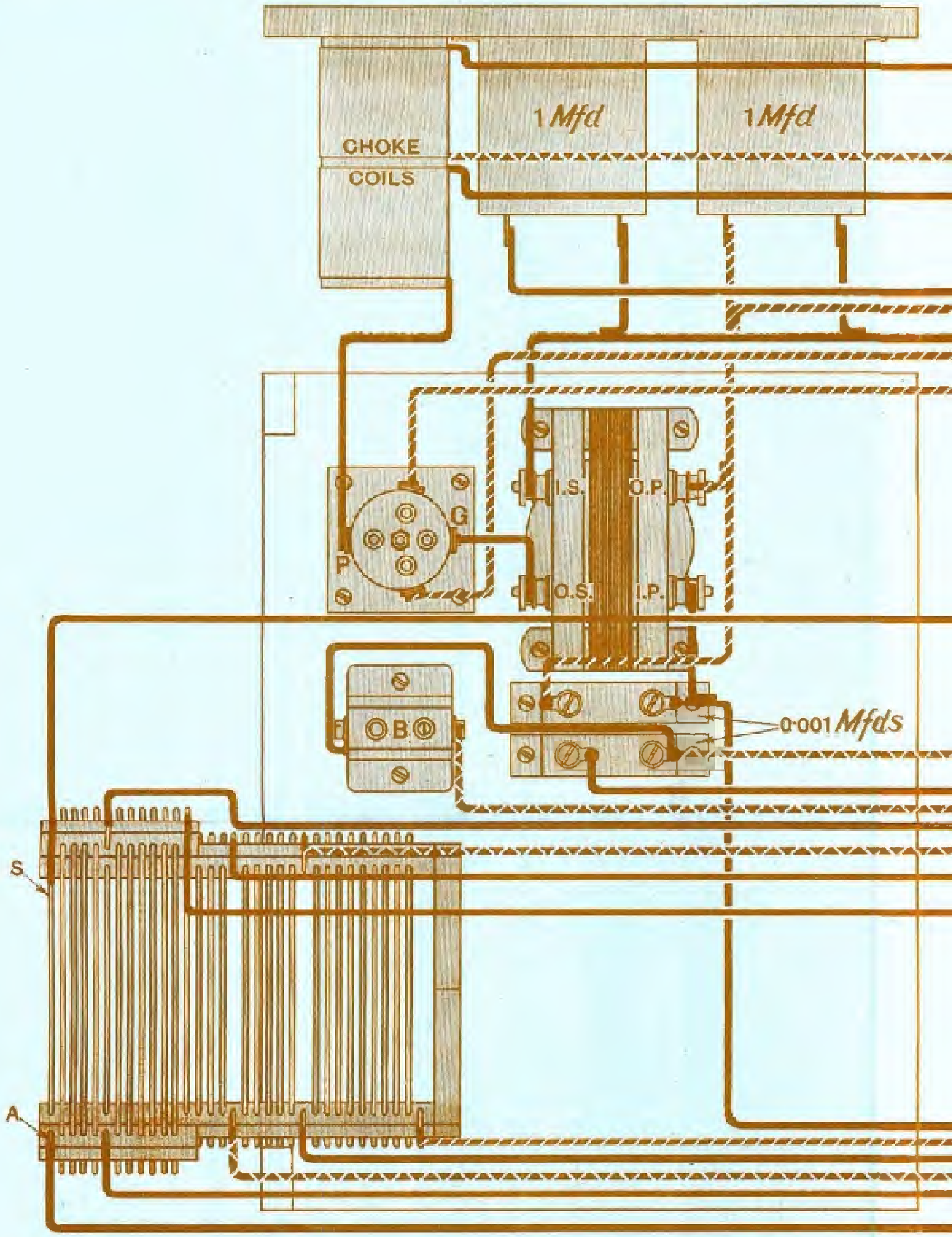
The writer employs a D.E.R. valve as the detector, and a D.E.6 valve in the note magnifier. These valves



Photograph of the back of the set. The four flexible wires on the right connect to the coil-holder.

are heated from a 2-volt accumulator and are rated at 1.8 volts 0.35 amperes and 1.8 volts and 0.4 amperes respectively. The D.E.R. valve works very well with an anode voltage of 50, and the D.E.6 with an anode voltage of 100, the grid bias of the D.E.6 being $4\frac{1}{2}$ volts negative.

For the reception of local broadcast put a No. 50 coil in the aerial socket and a No. 35 or 50 in the reaction socket. With the valves heated to the normal operating temperature, tune in a signal by adjusting the tuning condenser with the reaction and aerial coils at an angle of about 45°. When a station is heard, make a careful adjustment of the reaction coupling until the best quality is obtained. If the signal is weakened by bringing the reaction coil nearer the aerial coil, the connections to the reaction coil should be reversed. When a whistle or beat note is heard while tuning, the set is oscillating, and the degree of reaction should immediately be reduced. The writer does not agree with the practice of tuning in to "the silent point" and then endeavouring so to adjust the set that it

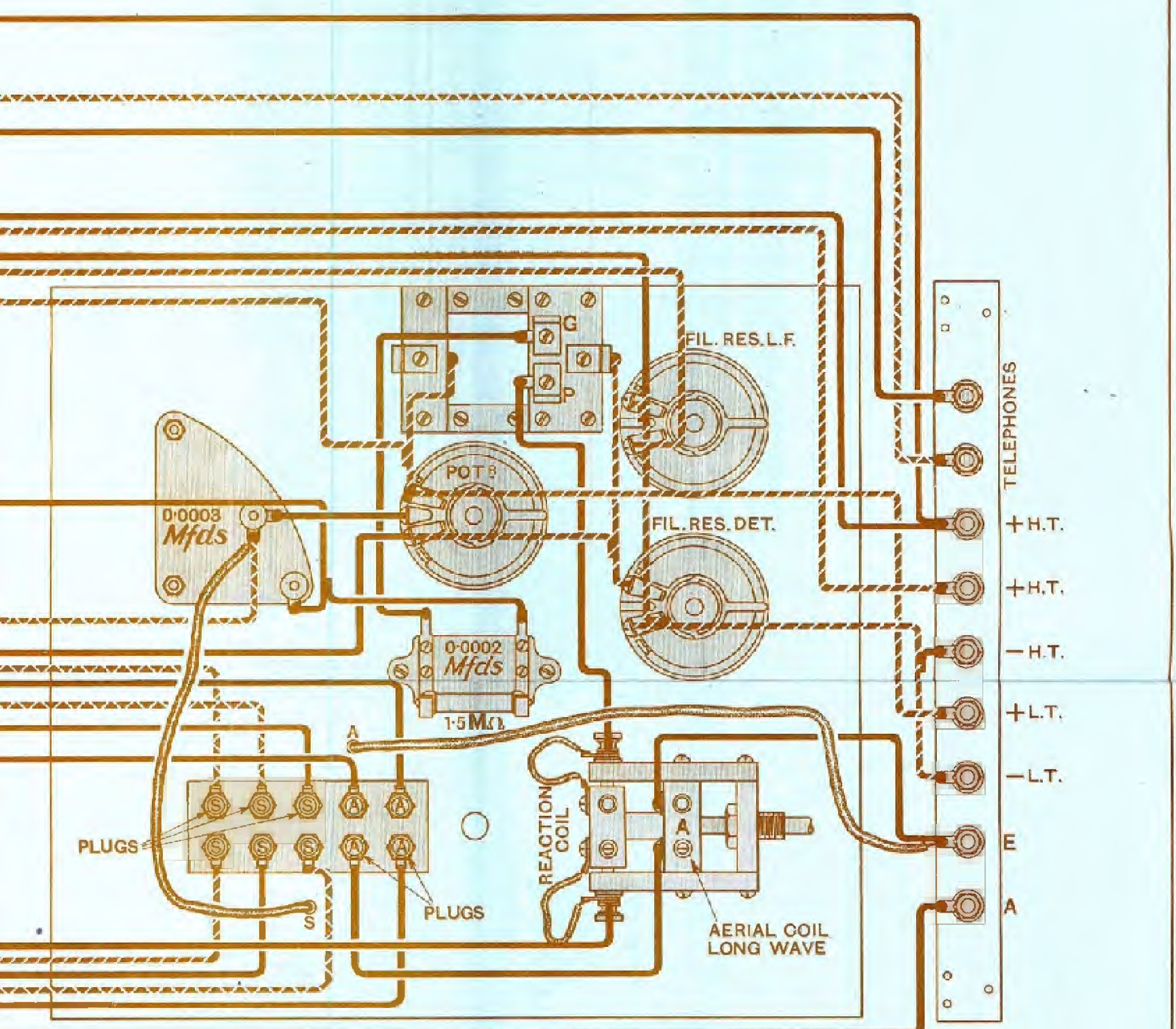


ALL RANGE RECEIVER.

DETECTOR VALVE AND NOTE MAGNIFIER SET.

The Wireless World and Radio Review

25th February 1925



FRONT PANEL 11″ × 10″ × 3/8″

BASE 10″ × 8″ × 3/8″

AERIAL INDUCTANCE 12 TURNS, LENGTH 1 5/8″ × 4 1/8″ DIAMETER

SECONDARY INDUCTANCE 33 TURNS, LENGTH 4 1/2″ × 3 1/2″ DIAMETER

FILAMENT RESISTANCES MAXIMUM ABOUT 10 OHMS FOR V.24, D.E.V AND R TYPE VALVES

WAVELENGTH RANGE ON 100 FT. SINGLE WIRE AERIAL (UNLOADED) 40 − 180 METRES

CHOKE COILS 165 TURNS OF Nº 38 S.S.C.

PLUG PANEL 4″ × 2″ × 3/16″

TERMINAL STRIP 10″ × 7/8″ × 5/16″

Printed in Great Britain by THE CORNWALL PRESS Ltd., 1-6 Paris Garden, London, S.E.1

PARTICULARS OF THE COMPONENTS EMPLOYED IN THE SET.

1 Ebonite panel, measuring 12 in. × 8 in. × ¼ in.
1 Ebonite strip, measuring 8 in. × 1½ in. × ¼ in.
1 Mahogany board, measuring 11½ in. × 7 in. × ⅜ in.
1 Tuning condenser, capacity 0·001 mfd. (Marconi Scientific Instrument Co.)
1 Fixed condenser, 0·00025 mfd., with grid leak clips (Dubilier).
1 Grid leak, 2 megohms (Dubilier).
2 Fixed condensers, capacity 0·001 mfd. (Dubilier).
2 Fixed condensers, capacity 0·5 mfd. (T.C.C.).
2 Valve holders.
1 Two-coil holder.
1 Intervalve transformer (Success).
2 Filament resistances to suit valves (Igranic, 4 ohms.).
1 Grid battery, 4½ volts (Ever-Ready).
2 Valve windows.
9 Terminals, No. 4BA.
1 Cabinet (obtainable from Pickett's).

A Two Valve Set—
is weakly oscillating. With this adjustment the set will oscillate and radiate when slight changes are made to the setting of the aerial tuning condenser or degree of reaction unless the greatest care is exercised. In any case, this form of reception results in unpleasant interference being caused to others.

To receive the 1,600-meter high-power station, put a No. 200 coil in the aerial socket and a No. 100 or 150 in the reaction socket of the coil-holder.

For other wavelengths, the reader should consult the tuning tables supplied by the manufacturers of coils.

It will be found that when the tuning condenser is set at a small value, the strength of the signals is not so great as when a smaller coil is used and the condenser set at a correspondingly higher value. The degree of reaction required to bring the set to just below the oscillating point also depends on the setting of the aerial condenser. As the value of the condenser is reduced, less reaction is usually required.

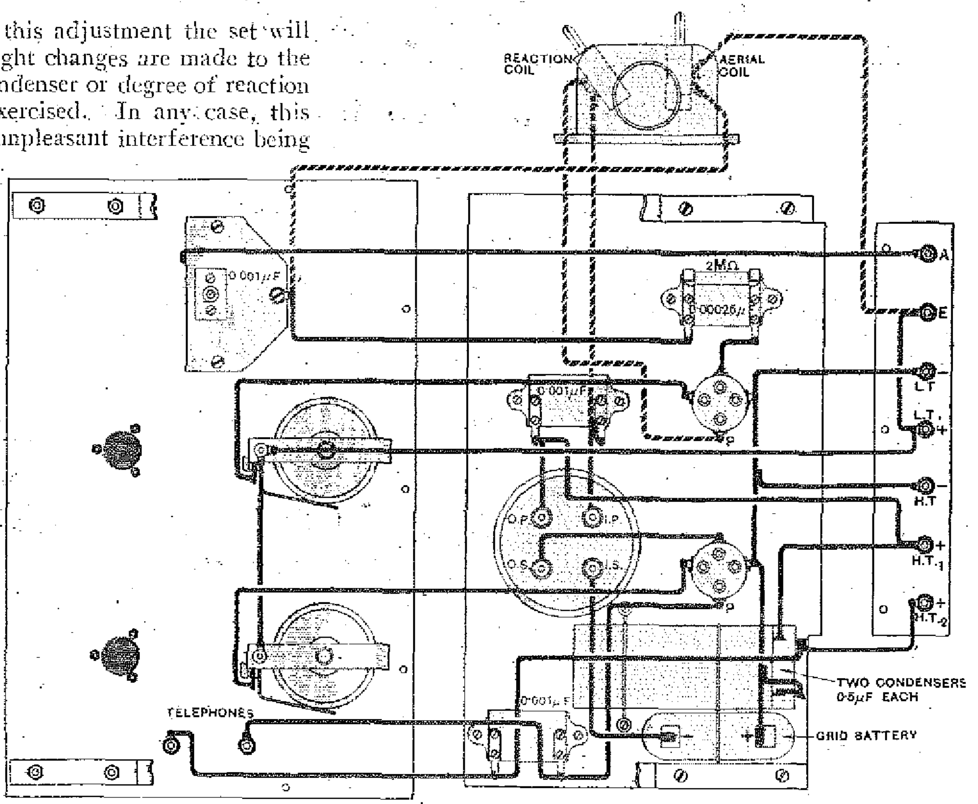


Fig. 6.—Wiring diagram.

The reader can also find by experiment that the selectivity of the set depends on the relative values of the aerial tuning condenser and tuning coil. When the condenser is adjusted to a small value, the set is usually more selective than when a larger capacity and smaller coil are employed.

THE WIRELESS CROSS-WORD PUZZLE.

THE extreme difficulty of constructing a cross-word puzzle embracing exclusively wireless terms must have been realised by many readers. Of the selection received at this office by the first post on Wednesday, February 18th, the majority were valiant efforts of imagination, in which every possible device was introduced into the clues to establish even a remote relationship with wireless science. Call signs and abbreviations were a providential stand-by.

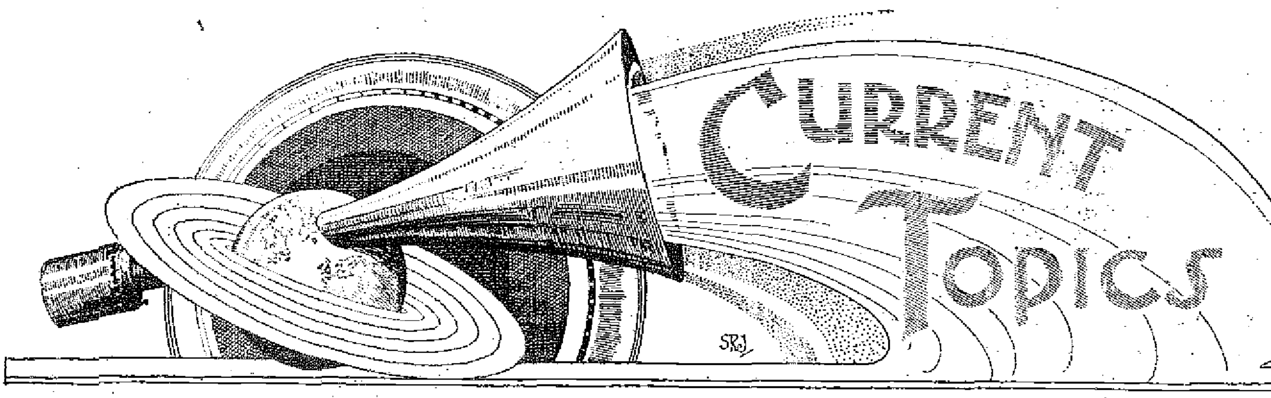
After careful consideration, we have decided to award the First Prize of Two Guineas to the Rev. R. Y. Holmes, Monkokehampton Rectory, Winkleigh, N. Devon, for a meritorious effort embodying a highly original design. The Second Prize of One Guinea goes to Mr. A. W. Binns, 45, Newbridge Street, Wolverhampton. The following is the solution of the Cross-word Puzzle appearing in *The Wireless World* of February 11th:—

ACROSS.

1, ARRL; 2, Pen; 3, ED; 4, UA; 5, FRS; 6, Base; 7, Unit; 8, HC; 9, OKS; 10, Mass; 11, Echo; 12, Broadcast; 13, Radiation; 14, ACC; 15, NT; 16, PRO; 17, TT; 18, ATS; 19, Art; 20, AAA; 21, Facts; 22, ATI; 23, NB; 24, Neon; 25, Africa; 26, Carbon; 27, Tyro; 28, II; 29, EA; 30, IEE; 31, RSGB.

DOWN.

1, Aperiodic antenna; 4, URSI; 5, Fan; 6, Bulb; 8, Home; 13, Range; 18, AAAAAA; 27, TR; 28, IRQ; 32, RED; 33, RN; 34, BEF; 35, Or; 36, A set; 37, React; 38, ATI; 39, Cat; 40, Short; 41, DC; 42, Attract; 43, IP; 44, Noise; 45, SI; 46, GEE; 47, Beam transmission; 48, NI; 49, YB; 50, CKAC; 51, SSH; 52, Static; 53, Soft.



Events of the Week in Brief Review.

High-Power Austrian Broadcasting.

At the end of this month a 10-kilowatt broadcasting station will, we understand, be in operation at Gratz, Austria. Testing is at present taking place on 700 metres.

Italy Bestirs Herself.

Italy, for so long behind other nations in the matter of broadcasting, will shortly possess a system embracing practically all the country, if present plans are proceeded with. A station is now under construction at Milan, and a broadcasting scheme under discussion provides for stations at Palermo, Naples, Florence, and Venice.

It seems rather remarkable that the "land of song" should hitherto have been so badly served.

"Leviathan" to Broadcast Again.

During her voyage from New York to Southampton, from February 28th to March 6th, the *Leviathan* will broadcast performances by the ship's bands every night after the British stations have closed down. Songs and talks by eminent passengers will also be included in the programmes. Transmission will probably be on a wavelength of 317 metres, although it will vary at times from 200 to 546 metres.

"S.B." Confuses French Listeners.

A complaint that the British broadcasting stations are "too easily identified" is made by *La T.S.F. Moderne*, which writes :—

"You hear 'London calling' when the transmission is actually that of Bournemouth. This is because very often the English stations transmit simultaneously."

Most annoying!

Modulation Experiments in Berlin.

Experiments with a new system of modulation are being conducted from the Telefunken station in Berlin after the conclusion each evening of the programme from the Vox Haus station, states our contemporary *La T.S.F. Moderne.*

A wavelength of 290 metres is employed, with a power of 100 watts.

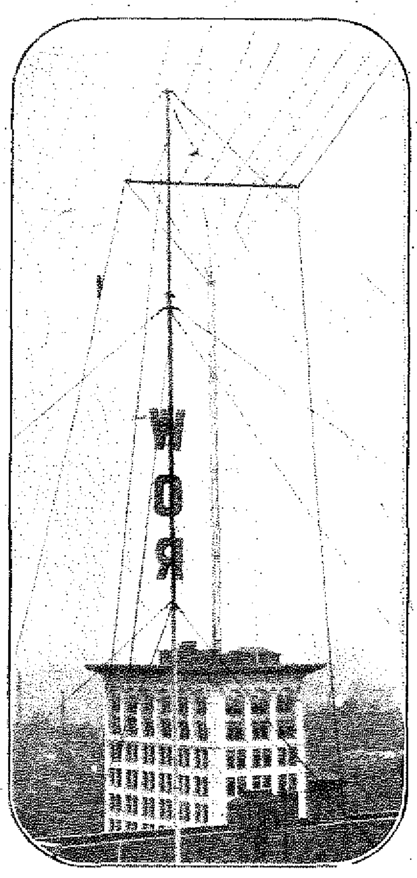
New Norwegian Broadcasting Station.

A broadcasting company has been established at Oslo (Christiania), and will begin working almost immediately, in conjunction with the Marconi Company. At present we have no details concerning power, wavelength, and times of transmission.

Amateur Relays Official Message.

An amateur transmitter was instrumental in conveying an important official message from Mosul, Iraq, to the Air Ministry, in London, on Friday, February 13th.

At 11.15 on the evening in question Mr. G. L. Morrow (6UV), of Berkhamsted, Herts, picked up a CQ call sent out by GHH, the R.A.F. station at Mosul. On immediately replying, 6UV was asked if he could communicate an urgent message to the Air Ministry. He replied "Go ahead," and the message was transmitted. Mr. Morrow then telephoned to the Air Ministry from the local police station, and soon after twelve was able to despatch a reply to Mosul.



AT NEWARK, N.J. Conventional standards are unknown in the design of American broadcast aerials, which abound in all shapes and sizes. WOR, seen in the photograph, is frequently heard on this side of the Atlantic.

Six Watts Daylight Transmission.

A notable transmission was carried out by Mr. E. J. Pearcey (2JU), of Fulham, London, on February 1st and 8th, when he worked in broad daylight with 2FN, at Nottingham, using an input of only six watts with an L.S.1 valve. 2FN reported signals as "almost strong" on a single valve.

That Souvenir Habit.

A pair of miniature Chilian stirrups carved in wood is being offered by Major R. Raven Hart (9TC) to the first amateur who succeeds in working Chile from Canada, Cuba, and from each district in the United States.

Pigeons and Wireless Aerials.

No evidence has been received by the Postmaster-General regarding injuries to pigeons through collision with wireless aerials, but he has asked the National Homing Union to furnish information so that the matter can be given further consideration

CB8 or DA8?

CB8, the well-known Argentine amateur, was recently reported to have changed his call sign to DA8, but reports have continued to arrive giving the original call sign, and much confusion has arisen.

We understand from *Q.S.T.*, the monthly magazine of the American Radio Relay League, that Mr. Braggio uses the sign DA8 for local telephony but has retained CB8 for international working.

Beam Wireless for the Dominions.

Bodmin and Bridgwater are the sites officially chosen for beam stations communicating with Canada and South Africa.

The transmitter will be housed at Bodmin, the receiving apparatus being erected at Bridgwater.

Similar stations, states the Postmaster-General, will eventually be erected in India, Canada, Australia, and South Africa, forming part of the scheme for a Dominions wireless system.

DX in Bolivia.

Until recently Bolivian amateurs have been silent so far as transmission is concerned. We understand that several amateur transmitters are now working, using *dc* for an intermediate pending the allocation of an initial.

"Two-way Reception" in Australia.

Directional experiments carried out by a Charleville amateur, states a Reuter message from Melbourne, have shown that American signals reach Australia both from east and west, the former being stronger.

More Transatlantic Telephony.

For a period of twenty-five minutes Mr. J. Ridley (5NN), of Blackheath, maintained a wireless telephone conversation with U1BCR on February 11th, speech being strong and free from disturbance. Prior to this test, states Mr. Ridley, excellent telephonic communication was maintained with Danish 7EC.

Broadcasting Advertisements.

The idea of sandwiching advertisement matter between items in broadcast programmes is distasteful to the British public, but such a scheme has been meeting with some success in Vienna. A business firm in that city recently broadcast an appeal for stenographers. A commercial letter was actually dictated before the microphone, taken down in shorthand by stenographic aspirants, and the typed copy sent in with applications on the following morning.

"S.B." on a Large Scale.

Arrangements are being made to enable the whole of America to listen-in to the Inaugural Ceremonies which are to take place on March 4th at Washington, D.C. This will be accomplished by linking up the majority of the more powerful broadcasting stations, including WEAF, WRC, WJZ, and WGY. In addition to the broadcasting of the event, a public address equipment will be installed at the Capitol for the benefit of the vast number of people who will witness the ceremony.

Who is 1BL?

A station with the above call sign, operating on about 85 metres and calling CQ, has been heard on two recent occasions by a Blackheath reader. It is thought the signals may be of Chilian origin. Can any reader supply the desired information?

Russian Amateurs Get Busy.

Another Russian amateur has made himself heard in Britain. NRL, who gave his address as Radio Laboratorium, Nijni-Novgorod, was picked up at 8.25 p.m. on January 30th by Mr. Edington Sutton, of Wimbledon. At the time he was transmitting a CQ call on 80 metres, and was apparently anxious to receive QSL cards.

As reported in our issue of February 4th, Mr. Marcus Samuel, of St. John's Wood, London, received signals from R-1FL, another Nijni-Novgorod amateur, on January 19th.

Spain's New Broadcasting Stations.

Popular enthusiasm for broadcasting is spreading in Spain and the announcement is made of the erection of two more stations at Bilbao and Cadiz respectively. Both stations, which will operate on a power of 500 watts, are being constructed by a French company.

New Time Signals.

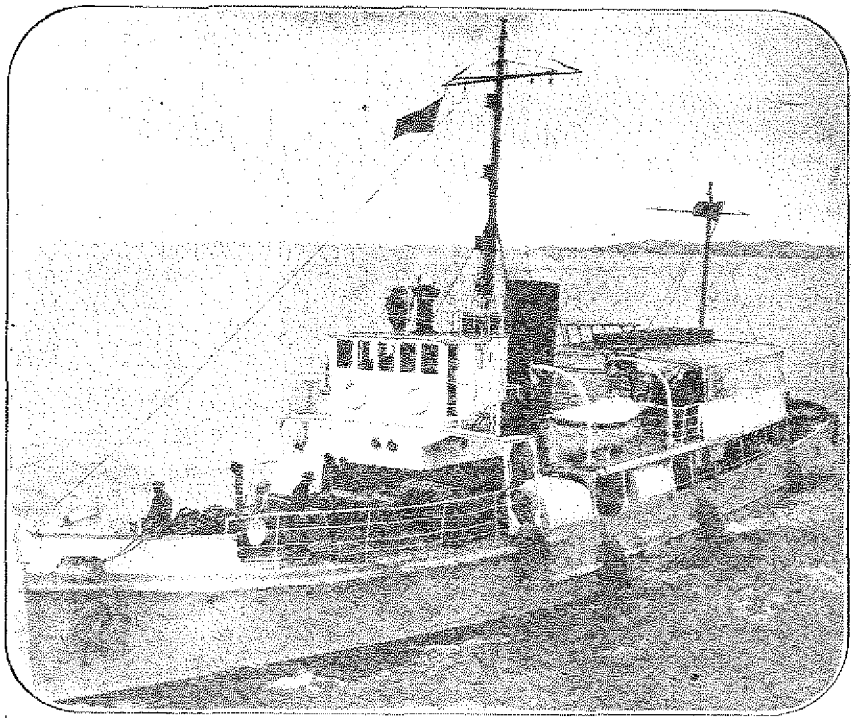
Amateurs who are in a position to tune up to 23,400 metres may be interested to learn that a new series of time signals is being transmitted daily on this wavelength (C.W.) by La Fayette (Croix d'Hins) with the call sign LY.

The signals will be automatically transmitted by the standard clock of the Paris Observatory, and will continue from 7.54 a.m. (G.M.T.) until 8 a.m.

From 8 o'clock onwards, for a period of a quarter of an hour, a series of "scientific" or "vernier" signals will be sent out. A complete schedule of the transmissions is given in the Admiralty Notice to Mariners, No. 144, of the present year.

Misuse of Call Sign.

Mr. W. A. Ward (2IR), of Sheffield, reports that illicit use is being made of his call sign in the Portsmouth area. The call sign is allocated to his portable station, which is not at present in use.



THE LAST WORD IN NAUTICAL WIRELESS. The new landing tender, "Hamilton," built for service in the harbour at St. George, Bermuda. Its equipment includes the latest types of wireless apparatus for communication with incoming vessels.

Portuguese Amateur Transmitters.

Four amateur transmitters have begun work in Portugal, states our Paris correspondent, and are using the call signs 1PAA, 1PAB, 1PAC, and 1PAE. 1PAB transmits on 130 metres between 11 p.m. and midnight. 1PAE works on 150 metres, but no other particulars are forthcoming.

ATMOSPHERICS.

"On Tuesday (7.30) Miss Carrie Tubb and other vocalists will be simultaneously broadcast."—Daily paper.

Not so distressingly disintegrating as it sounds.

oooo

A loud speaker has been designed in the form of a "beflounced and befrilled lady."

Some will regard this as a very shallow disguise.

oooo

Although the Victorian amateur whose telephony reached these shores keeps early hours, he should not be described as an Early Victorian.

oooo

Refrigeration is to be broadcast in America. We have an idea that certain broadcast transmissions in this country have already produced a similar effect.

oooo

". . . with all these cares weighing so heavily on the shoulders of your favourite announcer, is it any wonder that at times he is inclined to be a little 'crabby'?"—Radio Bug, Winnipeg.

But suppose the listener gets "crabby" and closes down? How would the announcer like that?

NEWS from the CLUBS

Secretaries of Local Clubs are invited to send in for publication club news of general interest. All photographs published will be paid for.

Tottenham Wireless Society.

"The Theory, Construction, and Use of Transformers," formed the title of an interesting lecture delivered on February 4th by Mr. A. G. Tucker. Most of the leading manufacturers contributed to the success of the evening by the loan of samples of their apparatus.

The lecturer went very fully into the theoretical principles of both high and low frequency transformers. Samples of windings were examined and discussed, and useful information was furnished on the assembling of the various types of instrument.

A large number of L.F. transformers were then tested by Mr. F. J. A. Hall, but owing to lack of time the completion of the test had to be postponed until the next meeting.

Hon. Secretary: Mr. A. G. Tucker, 42, Drayton Road, Tottenham, N.17.

Barnet and District Radio Society.

There was a large attendance of members at the Society's annual general meeting, held on January 29th.

A satisfactory financial statement presented by the treasurer, Mr. C. Randall, showed a substantial balance on the right side. As a large balance is not necessary to carry on the Society's work, it was decided to utilise part of the money to purchase additional books for the library and new apparatus for experimental work.

Mr. Watson Baker was re-appointed president, and Messrs. C. Randall and J. Nokes were re-elected treasurer and secretary respectively.

Instead of forming a separate branch for junior members, it has been decided to admit persons under 18 to full membership at an annual subscription of 2s. 6d. instead of 5s.

Some attractive features have been arranged for 1925, and prospective members should apply without delay to the hon. secretary, Mr. J. Nokes, Sunnyside, Stapylton Road, Barnet.

Streatham Radio Society.

A lecture and demonstration on the transmission of infra red rays was given by Mr. C. H. Roddis on January 28th. The experiments were most successful, reception of the invisible beam emitted from a torch from one end of the hall being clearly received on a one-valve set controlled by a selenium cell.

On February 11th Captain Plugge delivered an interesting lantern lecture descriptive of the Continental broadcasting stations.

Hon. secretary, Mr. N. J. H. Clarke, 36, Salford Road, S.W.2.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 25th.

Streatham Radio Society.—Lecture: "5RZ." By Mr. A. G. Wood (5RZ).

Radio Research Society, Peckham.—Lecture: "Primary Cells."

Manchester Radio Scientific Society.—Open evening.

THURSDAY, FEBRUARY 26th.

Luton Wireless Society.—At 8 p.m. At the Hitchin Road Boys' School. Lecture and experiment for beginners.

Sheffield and District Wireless Society.—At 7.30 p.m. At the Department of Applied Science, St. George's Square. Lecture: "Some Problems in Efficiency." By Mr. W. Burnet.

MONDAY, MARCH 2nd.

Dorking and District Radio Society.—Lecture: "Care and Maintenance of Accumulators." By Mr. G. E. Taylor.

WEDNESDAY, MARCH 4th.

North Middlesex Wireless Club.—At 8 p.m. At Shaftesbury Hall, Bowes Park, N. Annual general meeting.

Woolwich Radio Society.

The society's monthly magazine, "The Oscillograph," makes its first birthday bow with the February issue, which is packed with entertaining and instructive matter dealing with the work of this very active society. The idea of a club magazine was fostered by Mr. Fraser, to whom is due the establishment of "The Oscillograph" as an officially recognised department of the society's work.

Mr. G. Leslie Morrow (5UV), the amateur who successfully relayed an official message from Iraq to the Air Ministry, London, is seen on the left in this photograph.

TRANSMITTING NOTES.

Long-distance Telephony.

The past fortnight has been exceptionally favourable for long-distance telephony, and full advantage has been taken of this by G2OD, whose fine work in conjunction with A3BQ has received well-merited praise. We may expect further developments in this direction very soon.

Thanks from New Zealand.

The writer has received long letters from Messrs. Slade and Dillon Bell thanking British amateurs for their letters and reports. They regret that they cannot reply to all these individually.

The London Amateur Convention.

Definite news has been received from the A.R.R.L. stating that after the Paris Convention the Americans will have to sail back on April 25th. It has therefore been decided to hold the First British Convention in London on April 24th. It is hoped that all interested will keep this date open as we are anxious to extend a warm welcome to our brother amateurs from across the Atlantic and other parts. Full particulars of the Convention will be circulated in due course. It is also hoped to give a dinner in honour of Mr. Hiram Maxim, President of the A.R.R.L., on April 23rd. A fund has been opened for the entertainment of our overseas friends, and it is hoped there will be a ready response.

Tests from NKF.

British amateurs are requested to listen on 54 metres on Sundays for special tests from NKF (Washington) on 1,400 metres.

Letters Waiting.

QSL cards and letters have been received for G6HW, G5OK and G6GH, and these transmitters should apply for them to the writer.

The Paris Conference.

Unfortunately the appeal to members of the T. and R. Section to form a party to proceed to the Paris Conference in April has met with a poor response. Applications must be received from at least twelve more members before special facilities can be arranged. Incidentally the date of the Conference has been changed to April 14th-19th.

All communications regarding the above should be addressed to Gerald Marcuse, hon. secretary, T. and R. Section, Radio Society of Great Britain, 53, Victoria Street, London, S.W.1.

NEWS FROM THE STATIONS.

The "Pirate" Question Again.

The new Wireless Telegraphy and Signalling Bill ought certainly to send the wireless dovecotes fluttering, and it does seem terrible if, as some papers have bluntly asserted, the "pirate" is now subject to a penalty of twelve months' imprisonment. It is true, of course, that no such drastic penalty would ever be devised, but if penalties are to be devised at all they ought to be in the realm of a fine of forty shillings, or something like that.

oooo

"Right to Search."

Then the "Right to Search" Clause is something that cannot be allowed to pass without further explanation. Of course, in wartime if a person were suspected of concealing wireless apparatus for the purpose of interfering with signals some such powers would be necessary, but if the police or other officials were to be given powers to search every house to see if there was a crystal set, then obviously the whole system of broadcasting would come to a standstill, for that is something that no Englishman, much less a Scotsman, would for a moment tolerate.

oooo

A Drastic Remedy.

In fairness to the B.B.C., it must be stated that they have nothing whatever to do with this new Bill. They have not been responsible for the framing of any of its provisions. All that they have ever suggested to the Post Office is that the Post Office should take some means of dealing with those people who wilfully refrained from taking out their licences. To suggest twelve months' imprisonment for a "pirate" is almost as drastic a remedy as cutting off a little boy's head to cure him of whooping cough.

oooo

Public Goodwill.

The British broadcasting enterprise has been built up on the goodwill of the British public. Whenever an appeal to the honour of the public has been made they have in the main responded magnificently. One has only to recall the wonderful response of the so-called "pirates" when a licence was devised covering their particular needs some eighteen months ago to realise that the heart of the British public beats true, and it will be an ill day for the B.B.C. if ever they alienate the goodwill of the people, which they have in such abundant measure just now.

oooo

2EH in Trouble.

Poor old Edinburgh seems to be having a hectic time with its wireless station just now. So many complaints were received about the transmission that the B.B.C. increased the wavelength from 328 to 465 metres This did not create satisfaction, so they went back to 328 metres again.

oooo

A Land Line Incident.

Mr. Arthur R. Burrows, Director of Programmes of the B.B.C., had a most exciting Sunday afternoon on the occasion of the recent heavy snowstorms in Scotland. He learned that all communication was severed with the "Land o' Cakes," and he wondered how he was going to get in touch with Glasgow to tell them that their line was broken down. So he sent out an S.O.S. message from Chelmsford asking any listener who picked it up to communicate with Glasgow station.

oooo

Independent Caledonia.

As a matter of fact, however, there was no need to worry, because Scotland is well able to do without London any old time, and they just carried on with other programmes.

It sometimes happens that the land line to Glasgow does break down, and Glasgow have no difficulty in picking up Chelmsford wirelessly and relaying it.

oooo

A Howler.

If Chaucer's pilgrims survived to this day they would tell with gusto a tale from Maidstone, where the electricity failed recently and the post office had to work by candle-light. A clerk, in the semi-darkness, accidentally issued a dog licence in lieu of a wireless licence, and ever since that the applicant's wireless set has been howling continuously.

oooo

B.B.C. and Amateur Drama.

The B.B.C. are seeking fresh woods and pastures new in the theatrical world. They have started an Amateur Dramatic Club of their own, and they hope to give a play in one of the suburban theatres some time in April. This will not be broadcast, but the idea suggests that, failing accommodation with the theatres, the B.B.C. could run a theatre of their own.

oooo

The Director of Programmes.

Some people have the idea that since Mr. George Grossmith has been appointed to advise on the programmes side of the B.B.C. Mr. Arthur Burrows is not taking the same active interest that he was. Nothing could be further from the facts. Mr. Burrows continues—as he has been since the formation of the company—Director of Programmes of the B.B.C. He is almost the only official on the programmes side that has not changed his function since broadcasting began.

oooo

All Day and All Night.

He is now even more intimately associated with the Programmes Department than ever before. Not content with working all day, he listens nearly every night to some station or other, and makes critical suggestions on the programmes provided.

oooo

Ministerial Talks.

The Ministry of Agriculture and Fisheries food prices bulletin will be read every Friday at 6.35 p.m. in future, instead of on Thursdays as previously stated. This is in order that the bulletin may be followed by the Ministry of Agriculture's talk at 6.40 p.m. on alternate Fridays. Both bulletin and talk will be simultaneously broadcast to all stations of the B.B.C.

oooo

No Inspectors Need Apply.

Some people are nothing if not enterprising and ahead of the times. Since the announcement of the new Wireless Bill the B.B.C. have received quite a number of applications from people who are anxious to act as inspectors under the new measure. Needless to say, these have been politely informed that there is nothing doing.

oooo

Cross-words Broadcast.

On Friday, the 27th February, Bournemouth Station will transmit the first radio crossword puzzle. This is in the form of a competition, and entries must reach the Bournemouth Station not later than the last post on February 28th. A diagram is published with the *Radio Times*, and the announcer will read out the clues, which will be followed by a song or an instrumental piece which will contain the cross puzzle word. In the case of an instrumental piece the word will be found in the title, and in the case of a song the word will be slightly accentuated by the singer. A short space of time will be allowed between each word for competitors to enter them on the diagram. After the crossword puzzle there will be half an hour of popular overtures by the Wireless Orchestra.

oooo

End of the World.

A letter has recently been received by the B.B.C. from a man who says that on the night when the Adventists were expecting the end of the world to come two gentlemen were listening-in for America in Liverpool. Being unable to get it, they came to the conclusion that the end of the world had come on that side of the Atlantic.

oooo

Engineers Testing.

In order that the B.B.C. engineers may have a clear evening for line tests once a week, Friday evenings from 10.30 onwards have been allocated as from March 6th, during which period all stations must close down.

The late night rota will, therefore, be amended as from the week beginning March 1st, and these transmissions will take place on Monday evenings from 10.30 to 11.0. During these periods all stations, except the station working late, must close down.

oooo

The Late Night Rota.

The scope of the late night rota will be extended. It will include all relay stations in addition to all main stations, and will in future be as follows :—

Glasgow, March 2nd ; Sheffield, March 9th ; Cardiff, March 16th ; Edinburgh, March 23rd ; Manchester, March 30th ; Dundee, April 6th ; Birmingham, April 13th ; Leeds-Bradford, April 20th ; Aberdeen, April 27th ; Plymouth, May 4th ; Newcastle, May 11th ; Swansea, May 18th ; 5XX, May 25th ; Liverpool, June 1st ; Bournemouth, June 8th ; Hull, June 15th ; Belfast, June 22nd ; Stoke, June 29th ; London, July 6th ; Nottingham, July 13th.

Notice will be given in the *Radio Times* every week of the station taking late duty.

oooo

Special Arrangements.

In the event of the regular programme for some reason lasting beyond 10.30 (such as an extra S.B. Night), the station taking late duty will transmit for half an hour after the other stations have closed down. In the event of an ordinary programme lasting after 11.30, the late night transmission will be curtailed so as to end at 12 o'clock. In the event of the ordinary programme lasting till 12 o'clock, the late night transmission for the week will be cancelled.

oooo

Fairy Tales that Misfire.

The B.B.C. Children's Hour is being recast. It seems that fairy tales are not so easily swallowed by youngsters who have got used to listening.

As a matter of fact, the B.B.C. must have broadcast nearly all the fairy tales in all the languages which are worth broadcasting already.

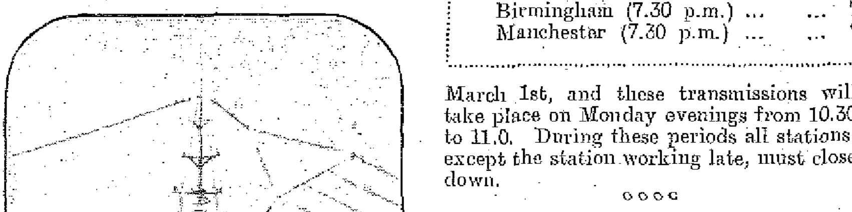
oooo

Why not G.K.C.?

One wonders why it is that the B.B.C. have never broadcast some sparkling conversation by people like Gilbert K. Chesterton, who is busily writing an "Ox-Trot" in praise of beef for the B.B.C. to broadcast.

FUTURE FEATURES.

Sunday, March 1st.	
London and 5XX (3 p.m.) ...	St. David's Day Programme. S.B. to other Stations.
Bournemouth (9 p.m.)	J. H. Squire Celeste Octet.
Cardiff (8.15 p.m.)	Welsh Service, conducted by the Arch Druid.
Manchester (3 p.m.)	Welsh Programme.
Newcastle (7.30 p.m.)	Philharmonic Concert, relayed from the Palace Theatre.
Monday, March 2nd.	
Glasgow (7.35 p.m.)	"Jeanie Deans" or "The Heart of Midlothian" (Sir Walter Scott).
Belfast (7.35 p.m.)	Songs and Folk Music.
Tuesday, March 3rd.	
5XX (7.30 p.m.)	Excerpts from Shakespeare.
All station except 5XX (7.30 p.m.)	"The Sea."
All stations except 5XX (10 p.m.)	"The Country."
Wednesday, March 4th.	
London and 5XX (7.30 p.m.) ...	Sullivan Programme.
Birmingham (7.30 p.m.)	A Jubilee Celebration and Ballads.
Cardiff (7.30 p.m.)	Symphony Concert, relayed from Bristol. Conductor : Eugene Goossens.
Thursday, March 5th.	
London (7.35 p.m.)	Chamber Music Evening. S.B. to other Stations.
Manchester and 5XX (7.35 p.m.)	The Hallé Orchestra.
Friday, March 6th.	
London and 5XX (7.30 p.m.) ...	Italian Night.
Glasgow (7.30 p.m.)	Birthday Programme. S.B. to other Stations.
Saturday, March 7th.	
Birmingham (7.30 p.m.)	The Opera, "Faust" (Gounod).
Manchester (7.30 p.m.)	"A Night in Hawaii."



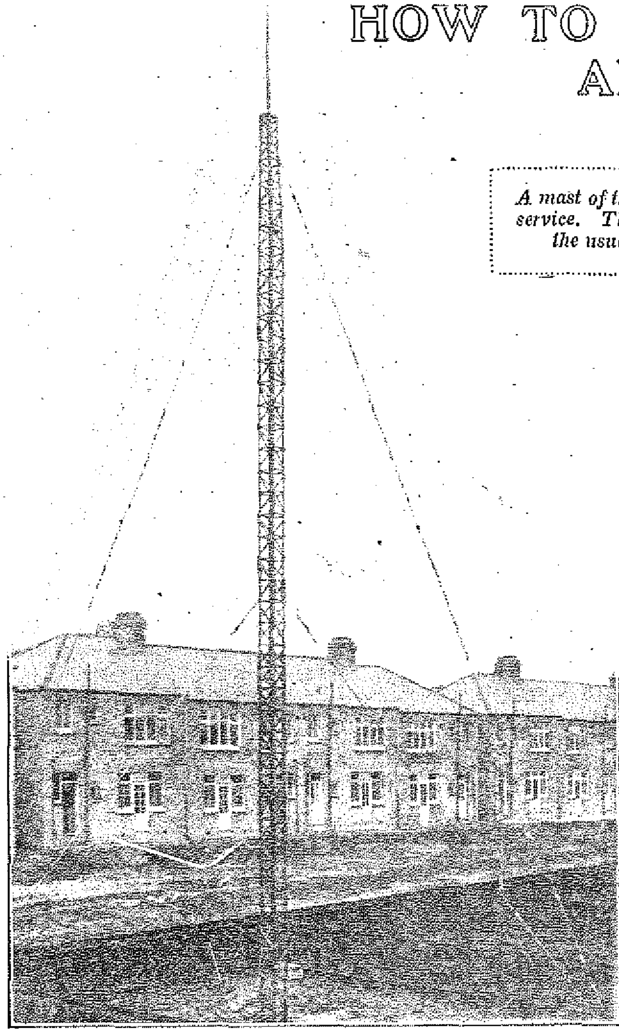
JAPAN CALLING.

An incongruous blend of Eastern and Western civilisation is revealed in these photographs of the mast and studio at the Tokio broadcasting station. Fragile though it appears, the mast is scientifically constructed and of considerable strength.

HOW TO BUILD AND ERECT AN AMATEUR MAST.

By F. J. AINSLEY, A.M.I.C.E.

A mast of the type described here looks well and will give many years of service. The design is such that the mast may be built by anyone having the usual household tools and the skill of the general handyman.



One of the masts at the station of Mr. F. H. Haynes (2DY). It is built to the design given in this article though the height has been extended to 60 feet.

THE problem of how to build and erect an aerial mast 50ft. high has no doubt faced many amateurs. Although it is not an expensive matter to construct such a mast, the erection presents some difficulties in the absence of somewhat elaborate erection gear or previous experience.

In this article a design is put forward for a 40ft. stayed lattice timber mast which is of such construction that the amateur may easily extend the height to suit his own requirements.

The design embodies the following features :—No skill is required beyond that of the general handyman; it is light, cheap and effective, and a considerable proportion of the work may be carried out indoors. The mast when completed will repay the amateur for the trouble he has taken. After erection it can be climbed as if one is ascending a ladder.

The accompanying table serves as a guide to the amount of stay base and height of the stay attachment, which are also indicated in Fig. 1.

In the designer's opinion the amateur will be well advised not to exceed a 40ft. mast unless he is prepared to take a certain amount of risk during erection and some little trouble in preparing the erection gear, although in proper hands a taller mast can be erected, as may be seen by the photographs.

General Design.

The general design consists of four leg members (set at the corners of a square) braced together both horizontally and diagonally to form a complete structure. The mast is held in position by four stays, secured towards the upper part of the mast, and to suitable anchor stakes driven into the ground. It rests on bricks, and is held in position at the base by four foundation posts.

Selection of Timber.

The first consideration is the available space at hand for the construction of the mast, erection and stay anchors. A decision with regard to height may then be made, and the amount of timber required estimated. The selection of the timber is the next important item. This must be good yellow deal. There are various kinds of deal; two commonly known are white and yellow. White deal must be rigorously avoided.

Timber yards usually keep a good stock of yellow deal. It is yellow in colour, from straw to a deeper tint when cut, has a good grain, marking yellowish brown and a clean, smooth surface when planed. It is free from cracks (known as shakes), but has some knots, which unless dry or loose are not detrimental to its strength. The external appearance may appear to be dark or blackened, through exposure to the atmosphere; this is of no consequence.

Unless you especially ask, the timber will be what is termed sawn timber; but it can be procured planed at a slight extra cost. The dimensions shown in the figures are the finished or required size. Thus, when ordering, state for the leg members, timber to hold up to $1\frac{1}{2}$in. square, otherwise you will receive it $1\frac{3}{8}$in. square, the deficiency having disappeared in the saw cut.

Generally the inexperienced eye cannot distinguish externally the classes of timber, but one is quite safe in purchasing from an established firm of timber merchants and asking for good yellow deal.

Height of mast. Feet.	Stays.		Base. Feet.
	Height. Feet.	Length. Feet.	
50	48-28	52-36	24
45	39	42	19
40	34	37	17
35	30	32	15

How to Build and Erect an Amateur Mast.

The purchaser must also state that the timber must be straight and square, free from sap, shakes, large or loose knots, twists, warps or wavy edges. Good quality timber is always sold to these requirements, so that nothing special is asked for in the above remarks.

The straightness of the 1in. × ¾in. bracing is not essential, as it is cut into short pieces; but the leg members must be true and square.

The drawings showing the design are self-explanatory. Fig. 2 shows the general arrangement, and gives the position of the leg joints and stay attachment.

Figs. 3A, B and C give the details of the base and method of securing the cross bracing, which continues in like manner to the stay attachment, details of which are found in Fig. 4.

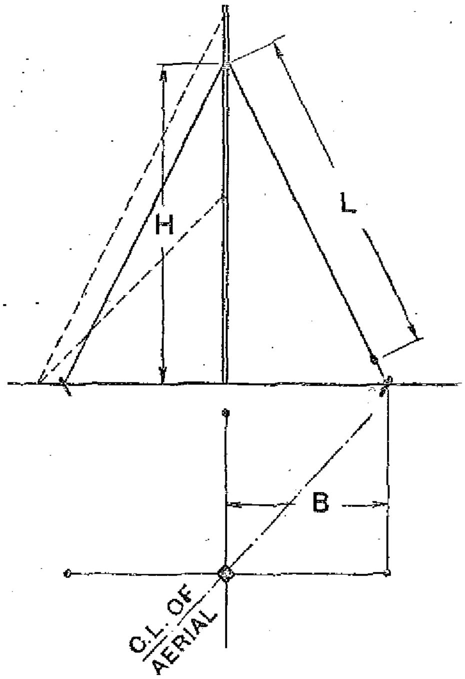


Fig. 1.—Layout of aerial. H=Height of stays; L=Length of stays; B=Length of base.

Care should be taken to slightly stagger the bracing on two adjacent faces, so that the wood screws do not foul.

The mast is slightly tapered at the top for the sake of appearance, and it is quite a good plan to adopt.

Method of Construction.

Cut the leg members to the correct length and make halved joints. Two consecutive members should be screwed together to test for straightness and given some distinguishing mark, so that the same two pieces may be assembled again in a similar manner. The lower and upper leg members may be left slightly long and the four legs sawn to the same level on completion of the mast. Next cut all the horizontal members to the correct length, 12in., mark off, and drill and countersink a hole ¾in. from each end for the screws.

The drilling and countersinking of the screw-holes is

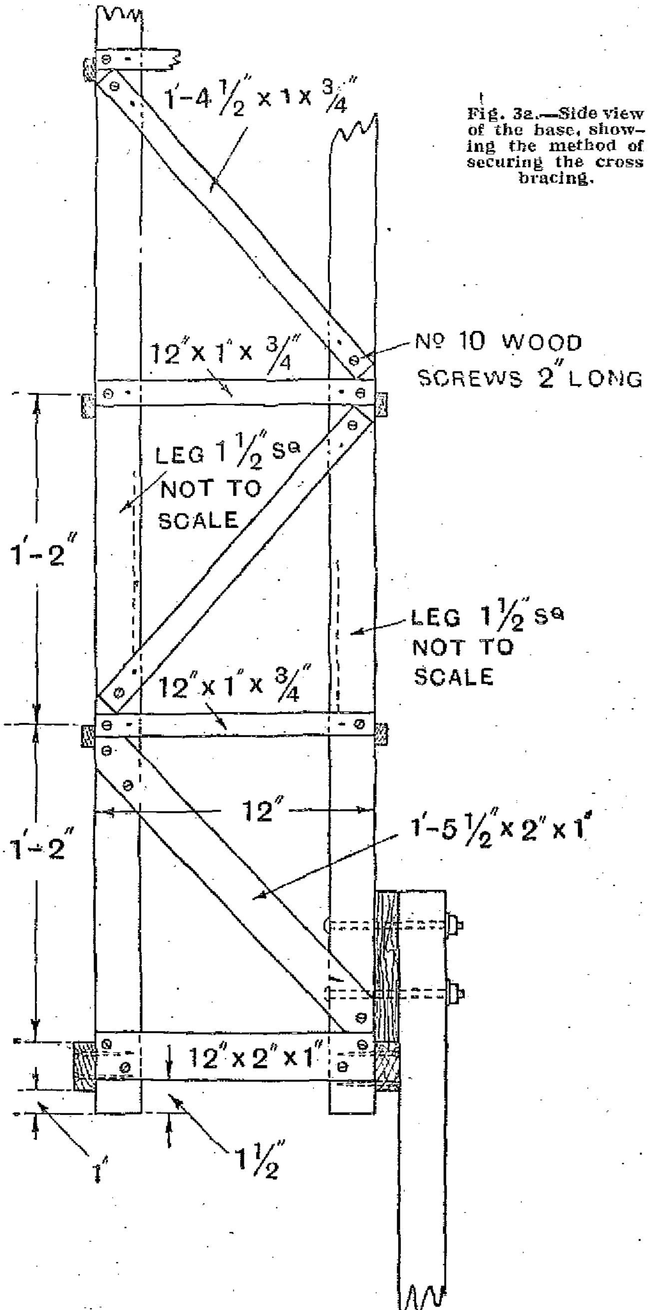


Fig. 3a.—Side view of the base, showing the method of securing the cross bracing.

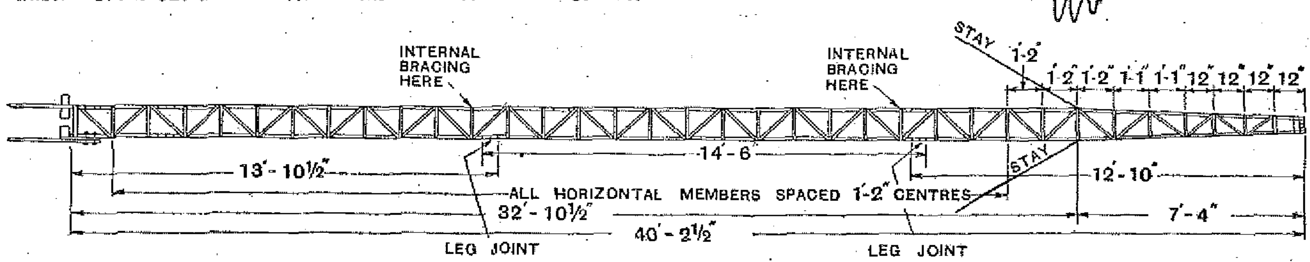


Fig. 2.—The general arrangement of the mast.

How to Build and Erect an Amateur Mast.

most important. The holes in all cross members should be just large enough to push the screw into, and the countersink just sufficient to receive the screwhead flush.

It is well to remember that the mast depends entirely on the screwed joints for strength and stability, provided good timber is used.

The leg members must also be drilled, but with a smaller drill (one ⅛in. dia.) to a depth of about three-quarters the amount the screw enters the leg.

Now take two leg members and mark off at intervals of 1ft. 2in. and secure the horizontal members. Set this frame square and nail a batten diagonally across the legs; this locks the frame, and the correct length may now be ascertained for the diagonal members. One diagonal may be used as a template to mark off and cut others; but it is advisable to test for length and the position of screw-holes in the diagonals occasionally.

When two opposite sides of the lower portion of the mast have been made they are set on edge and the remaining sides filled in with bracing.

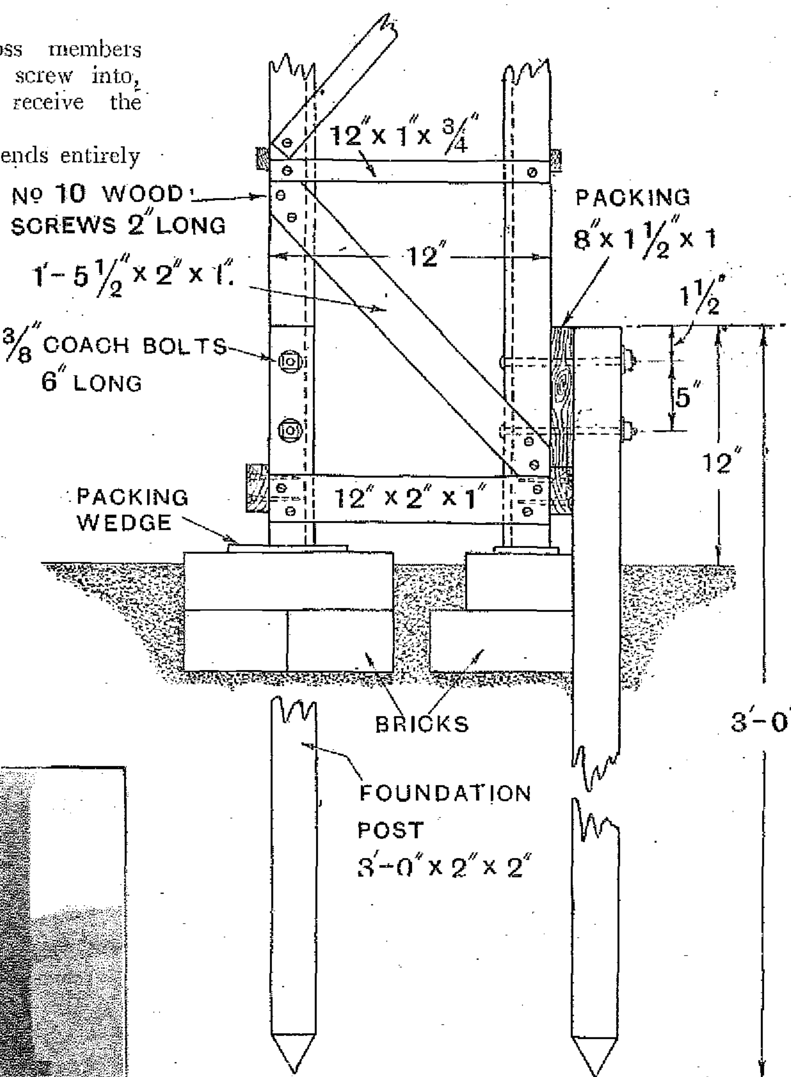
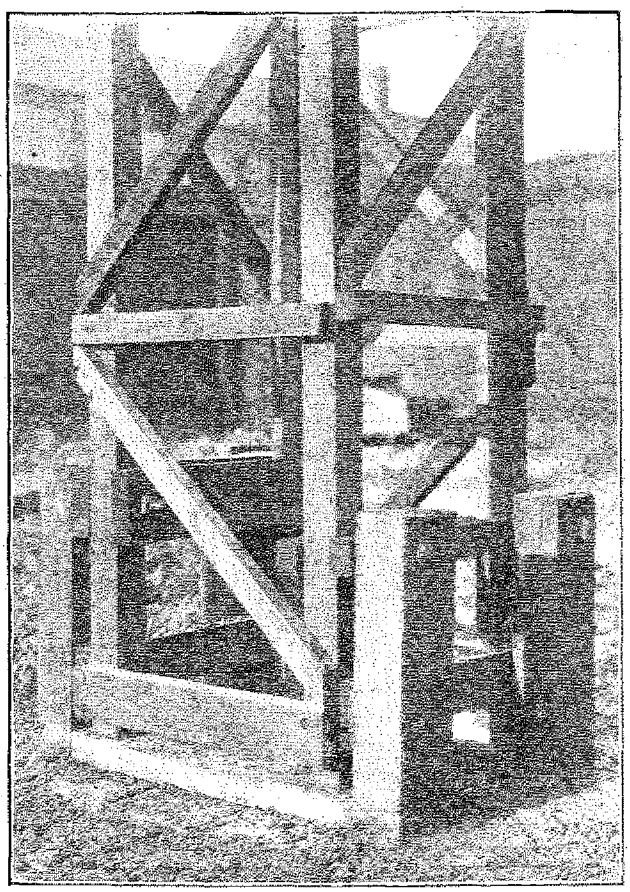


Fig. 3b.—Front view of the base.



The base stands upon a brickwork foundation, and is held in position by four foundation posts.

It is the better plan to complete each section of the mast separately for the convenience of movement; in this case care must be taken to see that the horizontals are all the same length, so that the leg members are in line; also that the horizontals are parallel, otherwise they look unsightly when the mast is erected.

At the stay junction 2in. × 1in. timber is used for the horizontals and the upper portion of the mast tapered, as may be seen from the figures. When the 2in. × in. horizontals have been secured, spring the leg members in and then attach the top cross pieces, and afterwards the intermediate horizontals, which are cut to the required length. Finally, fit the diagonals. Care must be taken to keep the tapered portion symmetrical with the parallel part of the mast.

Stays.

The stays must consist of wire rope,[1] not jute, flax,

[1] The expression "wire rope" will be used for galvanised steel wire ropes, and expression "rope" for jute, flax, hemp or manilla ropes. Common ropes are made of jute. The term "galvanised iron wire" is commonly used, but the wire is nearly always mild steel.

How to Build and Erect an Amateur Mast.

hemp or manilla, as these become tight and slack with weather conditions and soon weaken and break. The wire rope should be six strands of about No. 20 gauge galvanised steel wire. Most ironmongers sell a stranded

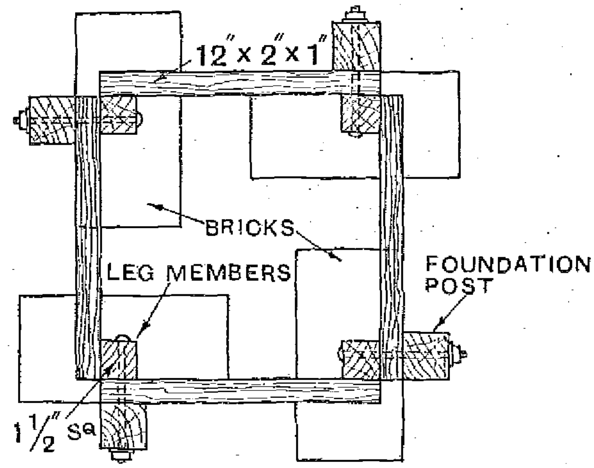


Fig. 3c.—Plan of the base.

wire rope for clothes lines, which can be purchased in 100ft. coils; this is quite suitable for mast stays, and has the advantage of cheapness. The stay lengths are given in the table, but each stay should be cut, say, 2ft. short and about a 6ft. length of rope attached. This is a great

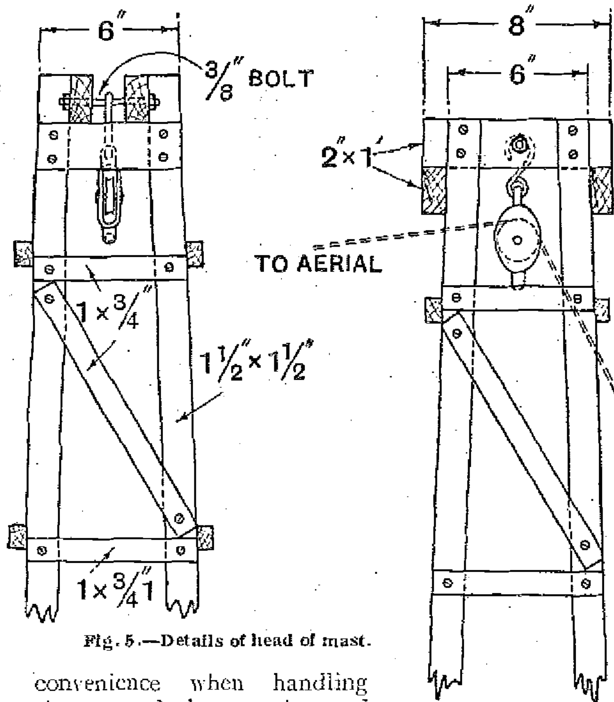


Fig. 5.—Details of head of mast.

convenience when handling the stays during erection and making fast. When the mast has been erected the rope can be replaced by galvanised wire of about No. 16 gauge, as shown in the illustration of stay anchors.

The attachment of the stays to the mast is best arranged for by binding the wire round the leg members, as illustrated in Fig. 4, and seizing the wire back on itself. Splicing a rope is not every man's job, so that seizing may be resorted to.

Take two strands of the wire and thread them through the rope before binding up the ends, repeat this process with all the strands, and let the length of the binding or seizing be at least 2in.

At least one stay should embrace the four legs of the mast. It is perhaps better to use a spare piece of wire rope and pass it round the mast, over the 2in. x 1in. horizontals, where it can be held in position by means of staples or nails. It is important that this should be done to prevent any one leg member being torn away from the mast during the process of erection.

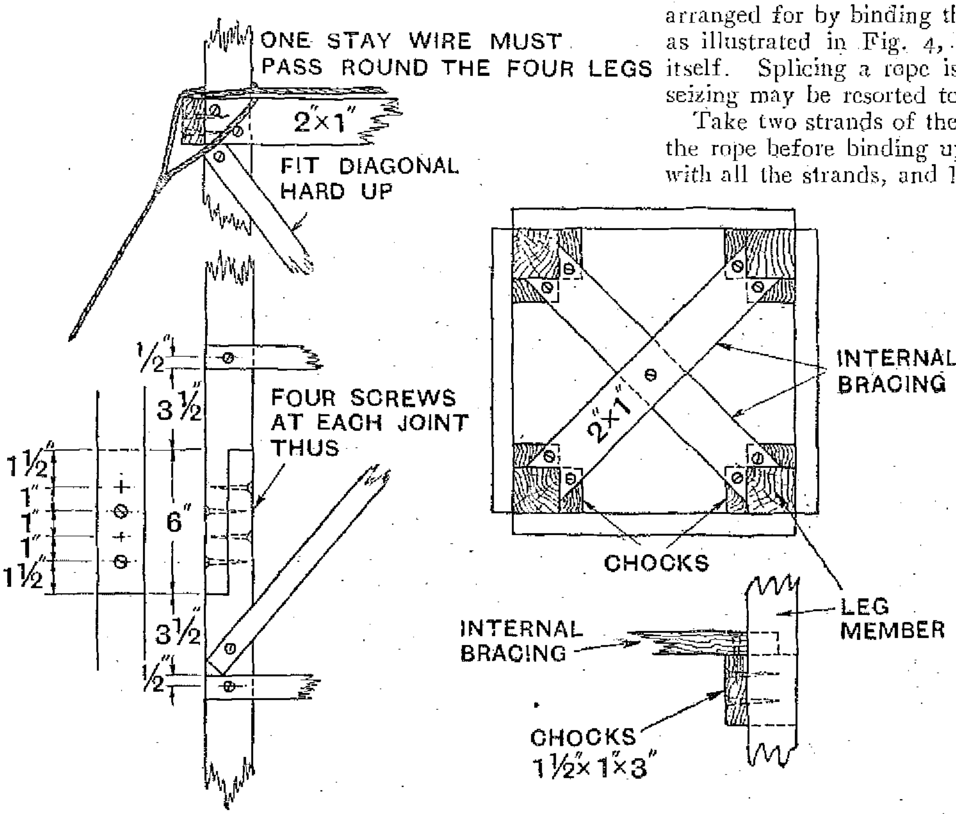


Fig. 4.—Details of the stay attachment.

Anchors.

These consist of timber stakes as illustrated in Fig. 6, having a cross section of 3in. x 2in. and being 3ft. to 3ft. 6in. long. They may be of hard wood, oak or beech, but yellow deal is quite efficient and more easily procured. The size of the stakes may appear large, but it is as well to remember that they have to withstand the process of rotting when placed in the ground. To avoid splitting them when they are driven in, a few turns of

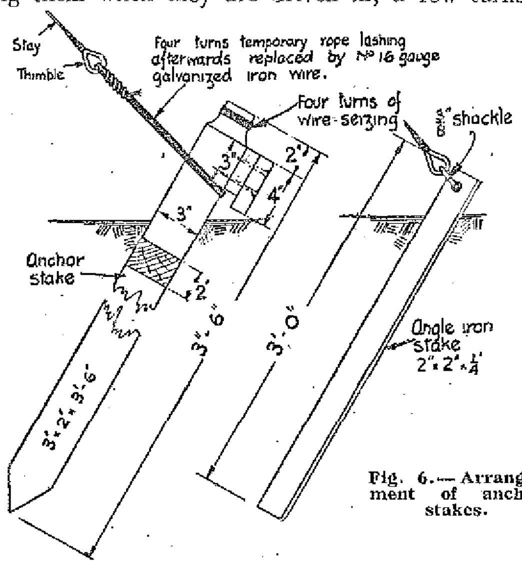


Fig. 6.—Arrangement of anchor stakes.

wire round the top of each is advisable. When in the ground each stake should resist the efforts of two men to move them any appreciable amount sideways. They should be set at an angle of 60° with the ground level and point away from the mast.

Foundations.

The mast is arranged to stand on bricks to prevent it sinking into the ground, and is held sideways by means of four timber posts. The bricks should be arranged in position before erection and the posts driven in after the mast has been erected.

Keep a careful watch to see that all four legs rest evenly on the bricks. This is best achieved by having a broad wood wedge under each leg, which can be tested by tapping with a hammer.

For the first few days after erection it is advisable to tap these wedges and drive them home if necessary.

Painting.

It is essential that all timber work should be given a coat of some preservative before erection. The best plan *is to creosote it, or use solignum. This, however, is* more expensive, but has the advantage that it can be purchased in several colours. Creosote is practically dark brown to black. A light brown solignum looks well.

If a white (painted) finish is desired, the timber should be planed and given a coat of red lead paint first; this process is rather expensive and troublesome, so that the creosote or solignum process is no doubt the one to adopt.

Erection.

For masts not exceeding 40ft. in length the following method may be employed. First see that the aerial halyard is properly attached at the masthead and free to run through the sheave block. Secure it near the base of the mast and coil up any free end; it does not want to be hanging about during erection.

The base of the mast is set near the foundation bricks in such a manner that the aerial halyard passes through the correct side of the mast. The upper end is then raised as high as possible and propped up by means of two props or ladders, one on each leg. Fig. 7 shows the general scheme of things. When the mast has reached *about* 40° *it can* be hauled up by pulling on two of the stays.

The tail rope on each stay should reach to the anchors and a turn be taken round them. This will hold the mast while the two ladders or props are worked along under the mast. They are then used to push the masthead upwards two or three feet, after which the stay ropes must be hauled in and secured again to the anchor stakes. By repeating this process once or twice the masthead will be raised sufficiently to complete the lift by means of the stays only.

When the mast is nearly vertical, secure the two back stays, or if they are secured to their anchors before erection, adjust them. They will now act as a check in case the mast tends to go right over.

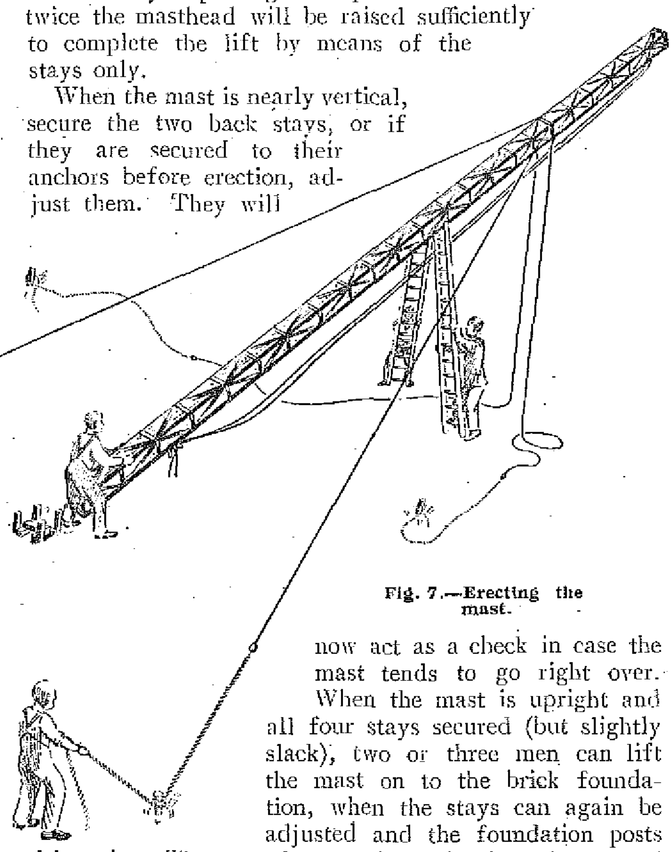
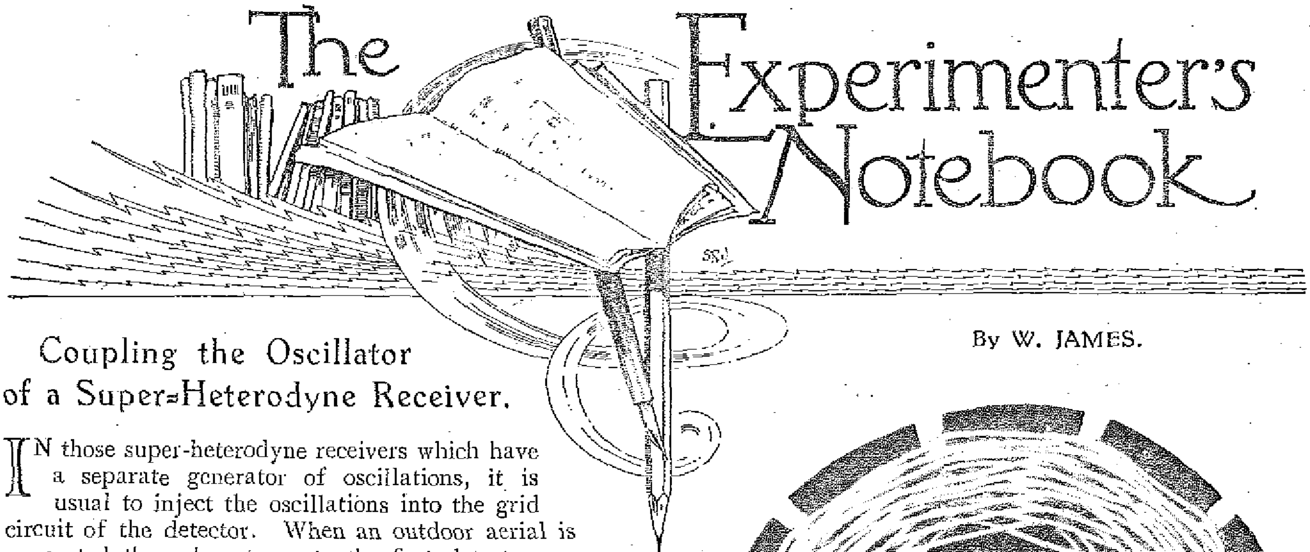


Fig. 7.—Erecting the mast.

When the mast is upright and all four stays secured (but slightly slack), two or three men can lift the mast on to the brick foundation, when the stays can again be adjusted and the foundation posts driven in. These need not go very far into the ground —about 18in. is sufficient. The mast legs and foundation posts are then drilled and bolted up and wire attached to the stay ends in place of the temporary rope tail pieces. The job is then completed.

In all cases arrange to bring the aerial halyard over the mast to an anchor stake, which is placed on that side *of the mast away from the aerial and at an equivalent* distance to the other anchor stakes.

The Experimenter's Notebook



By W. JAMES.

Coupling the Oscillator of a Super-Heterodyne Receiver.

IN those super-heterodyne receivers which have a separate generator of oscillations, it is usual to inject the oscillations into the grid circuit of the detector. When an outdoor aerial is connected through a tuner to the first detector, or even when a frame aerial is used, the locally generated oscillations may be of sufficient strength to cause an objectionable amount of energy to be radiated.

The use of a "blocking valve" as a means of reducing interference was discussed in these notes recently;[1] there is, however, another scheme which is of practical importance. Referring to Fig. 1, which gives the connections, it will be seen that in the anode circuit of the detector is a coil, L_1, and the primary winding of the transformer T_1. The oscillator has the usual tuned grid circuit L_2C_2, and reaction coil L_3; C_3 is a large capacity bye-pass condenser.

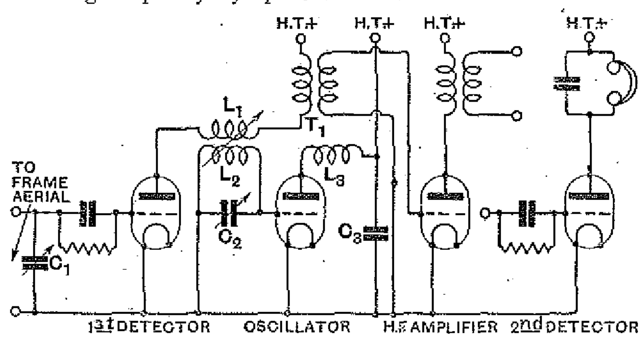


Fig. 1.—Arrangement of a super-heterodyne receiver in which the oscillator is coupled to the first H.F. transformer.

Coils L_1 and L_2 are coupled, hence oscillating currents are induced into the anode circuit and combine with the currents already there.

This is a good, practical way of connecting the oscillator, and will no doubt be tried by those having a receiver of this type. It is important to bear in mind that the oscillator should be adjusted to give stronger oscillations than when the more usual method (coupling the oscillator to the grid of the first detector) is employed.

Basket Coils.

Winding with a Mixed Pitch.

It is sometimes desirable to place coils close together to have a tight coupling. A special form of basket winding, which gives a coil which is bulky on one side, may then be employed. Such a coil is illustrated in Figs. 2 and 4, and can be wound from the diagram of Fig. 3. The wire is passed through the first slot and along the back of the coil to the third slot, through this slot to the front of the coil, along to the next slot, through it, and so on, until, when one turn is wound, the wire lies in the first, third, fourth, sixth, seventh, ninth, and tenth slots. The position of the wire when one, two, and three turns are wound is indicated in the figure.

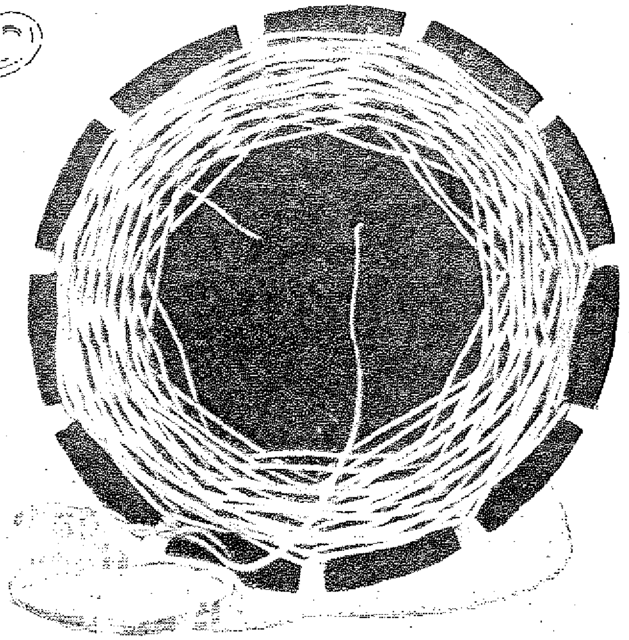


Fig. 2.—The bulky side of a basket coil wound with a mixed pitch.

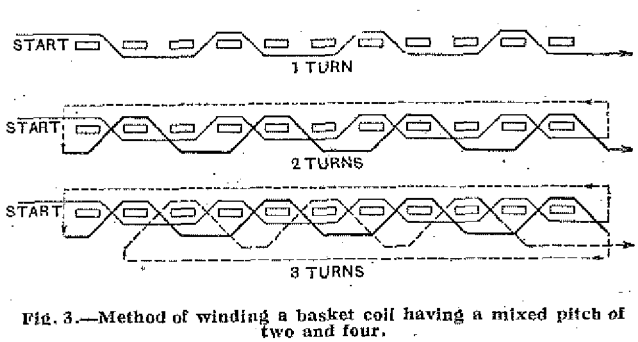


Fig. 3.—Method of winding a basket coil having a mixed pitch of two and four.

[1] The issue of January 14th, 1925.

The Experimenter's Notebook.—

This method of winding results in a coil which has twice as much wire on one side as the other. It has a mixed pitch of two and four.

Self-Supporting Coils.

The basket coil illustrated here, and those in the last two issues of this journal, are wound on treated cardboard formers. Such coils are therefore quite firm and strong, and are easily mounted in a receiver, though the relatively large volume of solid material in the coils has the effect of making the electrical losses higher than when the coils are self-supporting.

Basket coils which are self-supporting are wound on a circular former having a number of removable pegs. The coils are wound in exactly the same way as the coils described above, and when the winding is finished the pegs are taken off the former and the coil removed.

Coils wound in this way are, of course, not so robust as those wound on cardboard, but have quite a long life provided they are handled with care.

It is necessary to wind the coils carefully and not to pull the wire too hard as it is being put on, or it may be found that turns become short-circuited. The effect of short-circuited turns is to reduce the inductance of the coil, and usually to materially increase its high-frequency resistance. A coil with short-circuited turns will not tune sharply, and, even though reaction is used, the signal strength is not so great as when a good coil is employed.

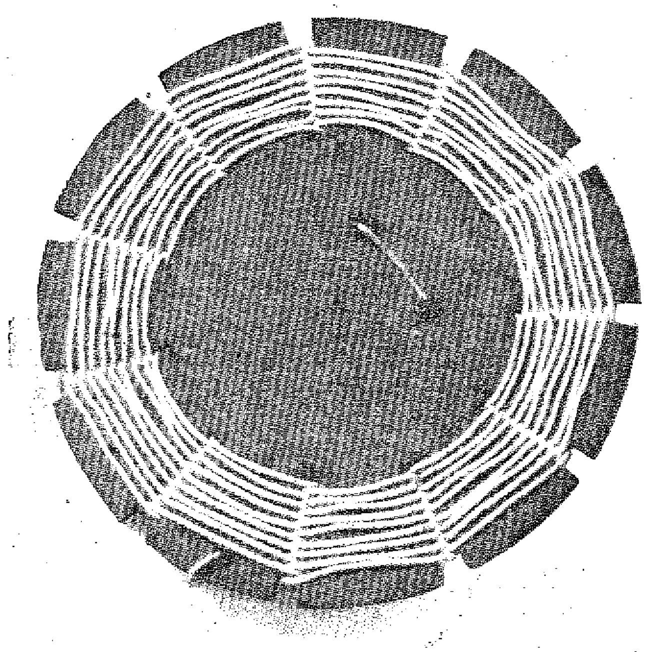


Fig. 4.—The reverse side of the basket coil shown in Fig. 2.

CALLS HEARD.

Teddington, Middlesex. (To Jan. 15th.)
British:—2GB, 2JF, 2WJ, 2YT, 6TD. *French*:—8AAA, 8DE, 8ÉE, 8ÉP, 8ÉN, 8ÉU, 8FC, 8FL, 8GI, 8GM, 8GP, 8HSD, 8II, 8JV, 8NK, 8PS, 8SG, 8SSU, 8UU, 8WK, 8XP, 8XU. *Belgian*:—4YZ, 4AU. *Dutch*:—0II, 0ZN. *Swiss*:—9AB, 9AD. *Italian*:—1AM. *Finnish*:—3NB. *Swedish*:—SMXX, SMZV, SMZZ. *American*:—1AAR, 1AR, 1AH, 1ALL, 1APK, 1ARY, 1ATJ, 1AWW, 1BES, 1BM, 1BQ, 1BSD, 1CI, 1CMP, 1CRU, 1ER, 1GA, 1GS, 1KW, 1PY, 1SW, 1XAM, 1YB, 2AG, 2BC, 2KX, 2MC, 3AB, 3ABW, 3ADB, 3APU, 3BNU, 4IO, 4KU, 4JJ, 8AM, 8BNH, 8NB, 8TR, 8UF, 8XK, 9BHT.
(0-v-1.) P. F. PEARTON.

Karlskrona, Sweden. (Jan. 1st to 24th.)

British:—5MA, 6TD, 6FG, 6FM, 2LZ, 6RN, 2WJ, 2SH, 2OD, 2CC. *French*:—8RG, 8KZ, 8AB, 8GL, 8NOO, 8NS, 8GP, 8SSU, 8SG, 8TK, 8NK, 8ÉU, 8GG, 8CZ, 8CT, 8BF, 8RCR, 8II, 8WK, 8GVR, 8CV. *Dutch*:—0BA. *German*:—0CDJ, 0AB, 0ZA. *Italian*:—1DO, 1FP, I1AM, 1CF, I1MT, 1RT, 1CX, I1AA. *Swedish*:—SMZZ, SMPL, SMXX, SMZT. *Belgian*:—4UC, 4AX, 4AC, 4AS *Finnish*:—2NCA, FN2n, FN2NM, FN2NN, FNV. *Danish*:—7EC, 7NC, 7QF, 7RG, 7ZM. *American*:—1PE. *Canadian*:—1AU, 1AF. *Argentinian*:—R1FL.

(Reinartz 0-v-1.) E. SEGER (SMXV).
(Transmitting every Saturday 10-12 p.m. G.M.T. on 85 metres.)

Lowestoft, Suffolk. (To Jan. 15th.)

Dutch:—0AD, 0BQ, 0BA, 0FP, 0GC, 0KC, 0LL, 0MS, 0OX, 0RE, 0RW, 0TV, 0XQ, 0ZA, 0ZN, P2. *Swedish*:—SMRM, SMYV, SMYY, SMZS, SMZV, SMZY. *Danish*:—7EC. *Belgian*:—4AU, 4X, 4CD, 4QS, 4RS, 4TJ, 4UC, 4WT. *Swiss*:—9AA, 9AB, 9AD, 9AR. *German*:—1CF.

Lists submitted for publication in this section should be as short as possible. They should contain only calls heard within the previous fortnight and believed to be of reasonably distant origin. Compliance with these conditions will considerably enhance the value of the section from all points of view.

Finnish:—2NM, 2NN, 2NCB, 3NB, 3NBA. *Italian*:—1CM, 3AF, 3AM, 3CM. *Spanish*:—EA, R3.
P. L. SAVAGE (2MA).

Lytham, Lancs. (To Jan. 11th.)

British:—2AW, 2AWO, 2CC, 2DX, 2FU, 2JF, 2JU, 2KF, 2KW, 2KZ, 2LZ, 2NM, 2OM, 2SH, 2TF, 2VS, 2WD, 2WY, 2XI, 2YQ, 5HS, 5KC, 5KM, 5LF, 5LS, 5MA, 5MO, 5NN, 5OK, 5PZ, 5QV, 5RZ, 5SZ, 5TZ, 6AH, 6FA, 6FG, 6GH, 6KK, 6LJ, 6MP, 6MX, 6NF, 6PP, 6QB, 6RY, 6UV, 6XG.
H. M. SWANN.

Port Erin, Isle of Man.

American:—1CME, 2RK, 1ARY, 3CHG.
0-v-0.) C. G. CLAGUE.

Acocks Green, Birmingham. (Jan. 11th to 18th.)

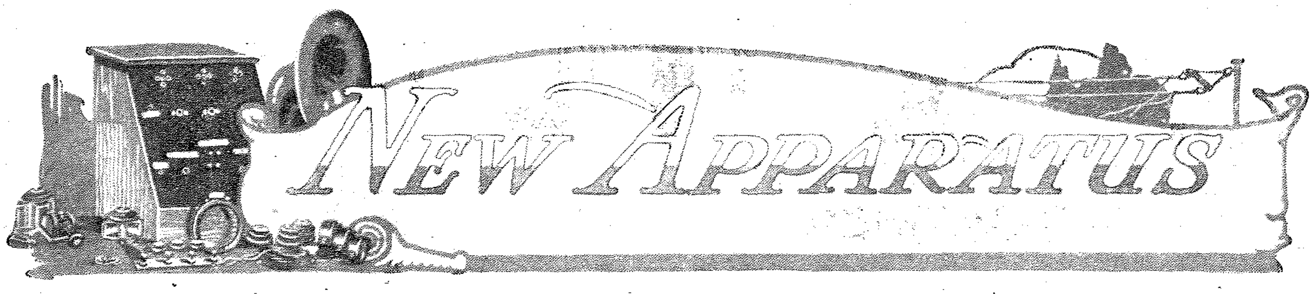
British:—2PC, 5GU, 6MP, 5PD, 2AM, 6RY, 6NF, 6TD, 2NB, 5UL, 5TZ, 6FG, 2LZ, 5QV. *French*:—8AB, 8EU, 8GP, 8PL, 8FJ, 8SG, 8EV, 8WAL, 8EN, 8GG, 8FK, 8RG, 8CN.
(0-v-1.) F. J. TAYLOR.

Weybridge, Surrey. (Jan. 1st to 19th.)

French:—8AB, 8AU, 8AZ, 8BC, 8BG, 8BN, 8BO, 8CF, 8CM, 8CN, 8CT, 8DE, 8DF, 8DI, 8DL, 8DM, 8DP, 8DR, 8DU, 8EE, 8ÉM, 8ÉN, 8ÉU, 8FG, 8FJ, 8FOK, 8FS, 8FU, 8GF, 8GG, 8GI, 8GK, 8GO, 8GP, 8GS, 8GVR, 8HGV, 8HS, 8HSD, 8HSG, 8IB, 8JB, 8JC, 8JVX, 8MJ, 8MJM, 8MOO, 8NA, 8NS, 8OK, 8PC, 8PL, 8PS, 8QG, 8RG, 8RV, 8SG, 8SM, 8SPR, 8SSC, 8SSU, 8SSV, 8SZ, 8TK, 8UK, 8VSG, 8VTI, 8WAF, 8WU, 8XH, 8RGT.
(0-v-0.) L. C. SNOWDEN.

Liverpool. (Jan. 3rd to 18th.)

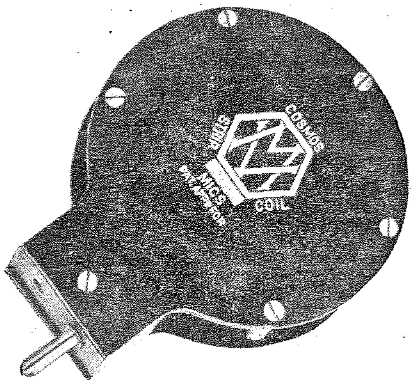
British:—2DX, 2FM, 2GY, 2II, 2KW, 2NB, 2PC, 2UV, 2XI, 5BV, 5CR, 5DA, 5DN, 5MA, 5MO, 5PD, 5PZ, 6AL, 6MP, 6RW, 6TD, 6UV.
(0-v-2; indoor aerial.)
G. O. RAWSTRON.



NEW APPARATUS

"COSMOS" COILS.

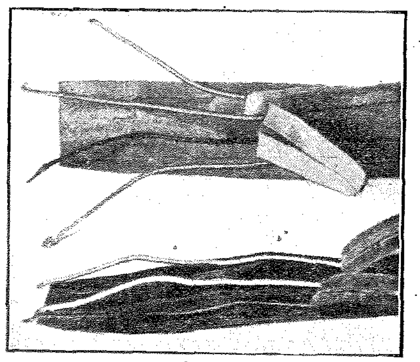
A vast variety of methods have been introduced with the object of producing robust inductance coils of high efficiency.



A durable plug-in inductance.

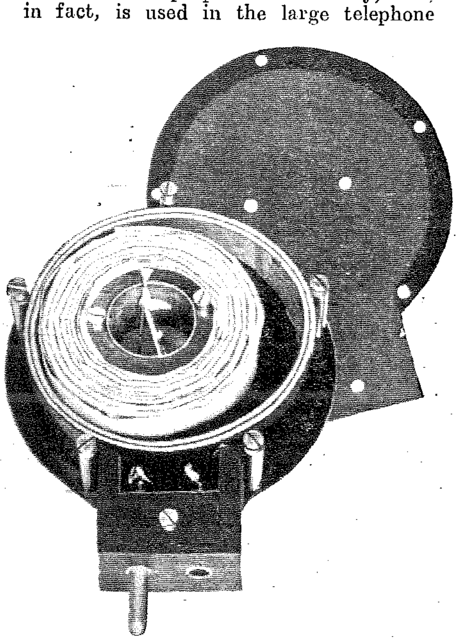
The aim in design is to keep the self-capacity of the winding as low as possible and to employ an insulating material between the turns which gives rise to a very small dielectric loss. Paper is well known to possess good insulating and dielectric properties when dry, and, in fact, is used in the large telephone cables for insulating the numerous conductors in preference to indiarubber or waxed cotton.

The "Cosmos" coils are manufactured by Metropolitan Vickers, and the form of construction makes use of spool of strip paper such as is often employed for the invisible wiring of bell circuits, etc., and in which a number of conductors are spaced apart. The finished spool will thus consist of several concentric spirals which are linked through at the ends to form a continuous winding. A very small dielectric stress is thus created from layer to layer, and the potential is presented laterally across the coil. The spacing, however, between the conductors carried in the paper is liberal, and consequently this coil may be expected to be one possessing extremely high efficiency. Another good feature is that the finished coil is particularly robust,



The paper supported wires used in the construction of "Cosmos" coils.

no special care being needed in handling it, and there is no chance of the winding being either disturbed or injured.

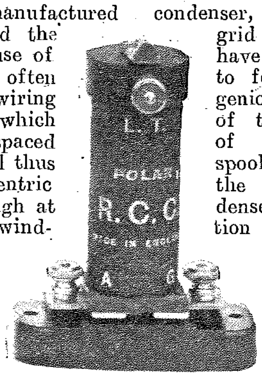


Interior of the "Cosmos" coil. The turns are paper supported, producing a very low dielectric loss.

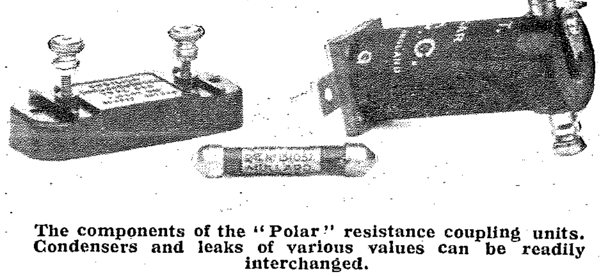
A RESISTANCE-CAPACITY UNIT.

Although intervalve transformers are available in great variety, it is somewhat surprising that until the appearance on the market of the component shown here there was no unit available for coupling valve circuits, making use of the resistance-capacity method.

For resistance-capacity coupling a condenser, an anode resistance and a grid leak are necessary, and these have been incorporated together to form one unit in a most ingenious manner. The terminals of the condenser, which is one of Dubilier's new type 610, spool of resistance wire and at the same time one of the condenser terminals, makes connection with the grid leak, through a reliable spring contact. The grid leak is accommodated in the interior of the spool of wire, and is retained in position by means of a small clip. Thus all three components can be easily taken apart so that grid condensers and leaks of values suitable for high or low frequency amplification can be fitted. The anode resistance, being a wire wound spool, can be relied upon to be accurate and constant in value and capable of carrying current such as are usually met with in the plate circuits of power amplifying valves.



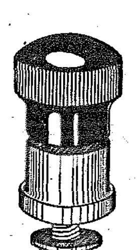
The "Polar" demountable resistance-capacity unit for intervalve coupling.

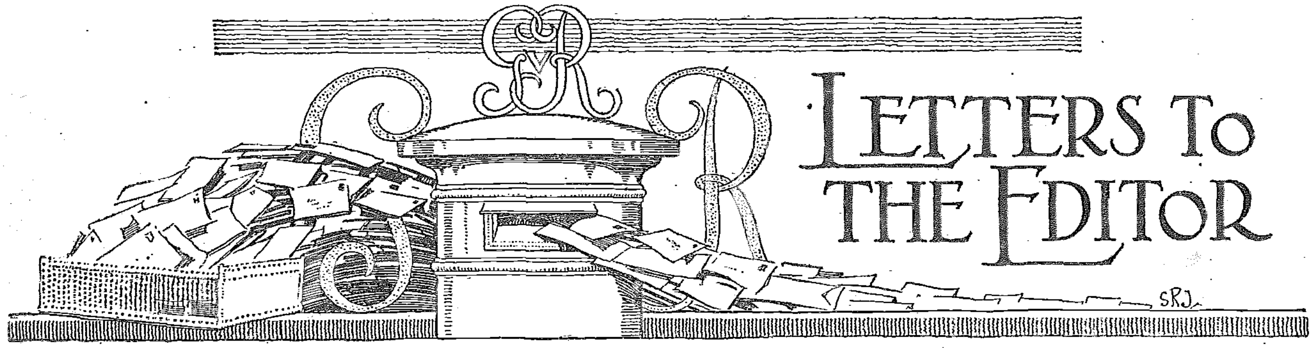


The components of the "Polar" resistance coupling units. Condensers and leaks of various values can be readily interchanged.

EBONITE CASED TERMINALS.

Among the components handled by Messrs. Gaston E. Marbaix will be found a good range of terminals, including the ebonite shrouded type, which have a very good appearance when assembled on an ebonite panel and can, moreover, be connected to high potential circuits.





The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, the "Wireless World," 139-140, Fleet Street, E.C.4, and must be accompanied by the writer's name and address.

WHAT OUR READERS THINK.

Sir,—Just a note to wish *The Wireless World* great success in its revised form, and under its new organisation.

As I am a reader from nearly No. 1, *The Wireless World* is a very old friend, having many valued associations.

The new style certainly promises well, although I venture a hope that it will not become too popular or stuntified.

Your Editorial in the current issue is really invigorating. Good luck to you. A. W. REEVES.

Birmingham.

Sir,—In the first place I should like to congratulate you on the high standard of excellence *The Wireless World* has always maintained; on the soundness of its articles both in theoretical and constructional aspects; and on the general style of its reproduction; and to wish your journal greater popularity than ever.

I think the general arrangement of the journal in its new form is good, although I should like to comment on the only two points which do not, to me, seem quite to reach the old level. The quality of the paper, you must admit, is inferior in comparison to that of previous numbers. Of course it is reasonable to expect economy in one direction to compensate for the increased production costs of a larger sized journal; so this is perhaps a small matter. The only other matter which gave an unfavourable impression, and which is perhaps of greater importance, is the inclusion of the humorous article and drawings. While raising no objection to these features as such, yet at least one reader feels sorry that *The Wireless World* has re-started this sort of thing. It would appear out of keeping with the technical nature of a wireless journal to cater for this class of matter, and it is my humble opinion that it tends to lower the dignity of the publication. We seek humour where we expect to find it.

With best wishes for the continued success of *The Wireless World*. E. E. WALTER.

Ilford.

Sir,—I consider *The Wireless World* is now an easy first in the array that the public have offered to them.

I am glad to see that constructional articles are to be a feature of the paper, and I would like to suggest that *The Wireless World* be the first wireless periodical to publish a constructional article for a real "Super Het."

The wireless "fans" are very much interested in this circuit, especially in view of the reduction in prices of valves.

Sheffield. D. F. HOGAN.

Sir,—May I congratulate you upon the new *Wireless World*? This has always been one of the best, and in its new form it has become, without loss of dignity, a more cheerful and live periodical, at the same time retaining the existing high standard of technical and constructional excellence.

I am particularly glad that the desire for a big circulation has not resulted in a neglect of the more advanced experimenter. I say "more advanced," because so often nowadays anyone who makes a crystal set to listen to the local station calls himself an experimenter. It is such articles as Capt. Round's, with the quantitative measurements and full results of experiments, which enable the true experimenter to break fresh soil without wasting time on ground already covered by others.

Another feature which pleases me is the division of the letterpress and the advertisements. Yours, I think, is the only paper a bound volume of which would not be disfigured by stray advertisements, and such a bound volume forms a most valuable work of reference, which it is desirable to keep neat. And in saying this I do not wish to disparage advertisements, which are not the least important part of a technical periodical.

My thanks, sir, for a very good fourpennyworth.

Cambridge. W. M. WHITEMAN.

Sir,—I had a shock this morning when I opened my *Wireless World*. This used to be a good technical paper. What I have got is a cross between John Henry and W. James—mostly John Henry. It is of no use to me and will be promptly cancelled. W. T. TUCKER.

Loughborough.

Sir,—I should like to say that I think the new *Wireless World* a great improvement and that it should draw many more readers, although I must say, as an old reader, that I regret the passing of the old familiar cover and paper, for sentimental reasons if nothing else. Further, I am very glad to note that the paper is still under your editorship, and would like to thank you for past courtesies.

I realise that nowadays you have a new class of reader to cater for, and I think that the new form of *The Wireless World* will appeal, perhaps, to many new readers.

Best wishes for the future. E. G. NURSE.

Hammersmith.

Sir,—I am an old reader of your excellent paper, and when I read in last week's Editorial of the change that was coming over the paper, I thought to myself, "That's done it!" You can perhaps imagine my delight on receiving last evening my first copy! All I can do is to congratulate you on your new production, which is, to my mind, pots better than the old one. I have looked forward enough to the arrival of *The Wireless World*, but in future shall be *ready* for the postman each Wednesday night!

Wishing you all the very best with your new *Wireless World*. L. J. DAVIS.

Ghent, Belgium.

Sir,—On first looking at the new *Wireless World* I was greatly disappointed, chiefly owing to the drop in the quality of the paper.

On reading the articles, however, I was very pleased to find that the old features had been retained, and also to find that the constructional articles, threatened in the Editorial, were very different from the modern type of constructional article and gave the author's reasons for every point in design.

I quite realise that the increase in size of the journal has necessitated a drop in the quality of the paper; but why not raise the price to 6d? I think few appreciate the difference between 4d. and 6d., and *The Wireless World* would be better able to maintain its superior position among contemporary wireless periodicals. I have taken in your paper for the last four or five years, and have therefore a great interest in its future. I hope my views will prove to be constructive and not destructive criticism. J. G. COWAN.

Ealing.

Sir,—May I be permitted to add my congratulations to those I am certain will be offered you on the current issue of your journal?

As a subscriber from No. 1, and as an experimenter whose licence dates some years before the appearance of that issue, I welcome the improved contents and appearance of the present issue. I have had some little experience in radio journalism, and my name is probably not unknown to you.

You have now struck what I feel is the correct note. You are catering for the advanced worker by giving him good design and trustworthy information, while the earnest beginner cannot fail to be inspired by this same design. If you will keep aloof from stunt circuits and the like and steer clear of those journalistic dodges so frequently practised to boost up circulation, you will have the hearty support of the amateurs who really matter.

Candid notes on new apparatus—not disguised advertisements—are welcomed by all; bright and instructive articles on new advances in the science of radio are equally desirous. The reappearance of Col. Beuttler was a happy inspiration.

May I suggest a small but useful addition—that is, a summary of contents at the beginning or end of each issue? This is valuable for reference purposes while the parts forming a volume are still unbound.

With every good wish for continued and increasing popularity, A. V. BALLHATCHET, M.J.Inst.E.

Merton.

THE OSCILLATION NUISANCE.

Sir,—Your recent editorial on the subject of the oscillation nuisance is of very great importance, and although it is a little difficult to make a really intelligent comment in the time at my disposal, the following remarks may be of interest:—

(*a*) One must reluctantly admit that it is difficult to contemplate the total prohibition of reaction on broadcast wavelengths owing to economical considerations in the design of broadcast receivers. This seems to be fundamental, and therefore has had a great influence on the trend of commercial design. A few manufacturers made gallant attempts in the early days of broadcasting to avoid reaction by various means, but they were forced in a large measure to modify their designs later, in order to enable them to compete with their less moral rivals. Without going into the technique of the subject one may say fundamentally that reaction is a means of increasing the amplification before detection, and, incidentally, this is accomplished without the use of any extra valves. There are, however, equally important considerations, namely, those which have to be regarded by the designer of receiving apparatus when he chooses the position in the cascade arrangement for the detecting valve. The detecting valve, is, of course, the dividing mark between the high-frequency stage or stages and the low-frequency stage or stages, and in making an intelligent choice for the position of the detector, one has to consider not only the relative ease of amplification at high and low frequency, but also the efficiency of the detector at various amplitudes.

With all detector valves available there is a fairly well defined amplitude below which the detecting efficiency falls off very rapidly, and it so happens that the employment of a moderate amount of reaction on a rectifying valve which is not preceded by a high-frequency stage is sufficient not only to reduce the decrement of the aerial, but also to improve the efficiency of rectification.

It seems likely that if reaction *of any kind* were prohibited the listening public would have to spend so much extra on their receiving apparatus that the outcry would be infinitely greater than is the case at present in regard to interference conditions.

Much, therefore, as one would like to see this done, it is clear that we shall not make any progress by giving serious consideration to such a proposal.

(*b*) Pending the introduction of a really effective cure, I suggest that the Press, the British Broadcasting Co., and the National Association of Radio Manufacturers can do much:

1. The Press should not encourage listening-in to distant stations by Tom, Dick and Harry. The Press should not encourage people to listen to their local station with circuits having a factor of safety (as between desired signal strength and signal strength obtainable with critical reaction), of less than two.

2. The British Broadcasting Co. should carry on with their propaganda work with a view to minimising oscillation, which work I believe (contrary to your editorial view) to be very helpful.

3. The National Association of Radio Manufacturers might consider action on the part of manufacturers such as the following:—

(*a*) Improvement in the design of sets with a view to giving the most manageable form of reaction control.

(*b*) Persuading manufacturers to adopt some definite sales policy in regard to the type of set to be recommended for any particular zone. (It is admitted that this proposal contains many difficulties.)

(*c*) The provision of better instructions to the purchaser as to how he should use his set.

(*d*) The evolution of non-interfering circuits of a simple nature.

(*e*) Restriction in regard to the use of sets which employ as an essential feature a valve in continuous oscillation—for example, superheterodyne, supersonic, and super-regenerative receivers.

4. All hope of finding a non-interfering circuit of a simple and universal nature should not yet be abandoned. At the risk of appearing to "grind my own axe" I would refer you to methods outlined in Patent No. 218336.

Broadly speaking, the methods proposed in this patent enable reaction to be used right up to the oscillating point, but if it is pushed just too far the operating conditions of the valve are automatically altered (by a very short train of oscillations at the receiving frequency), and the circuit subsequently oscillates at an entirely different frequency. The oscillating train at the receiving frequency is so short that only a "click" is heard in the telephones or loud-speaker. The second frequency referred to may have any convenient value—in fact, it may be an audible one, and hence it is quite out of tune with the aerial. Radiation from the receiving aerial is therefore not only absolutely negligible, but the minute amount which scientific accuracy forces us to assume as taking place may be at a frequency on which no wireless (much less broadcast) signals exist. The development of these methods of eliminating interference has long ago reached the stage where very conclusive demonstrations can be given, but naturally there are difficulties in getting a purchaser to pay even a very little extra in order that some one else may benefit by lack of interference.

There is therefore no real encouragement at present to place such apparatus on the market, but if it could be arranged that after a given date all manufacturers would agree on a common policy, there might be some chance of improvement.

It is not to be supposed for a minute that the circuits referred to above are the only ones which would give the desired result, but if sufficient alternatives were not forthcoming it is possible that the N.A.R.M. or B.B.C., or both, might consider it of sufficient interest to regulate any difference between manufacturers. NORMAN LEA,

Chief Engineer, Radio Communication Co., Ltd.

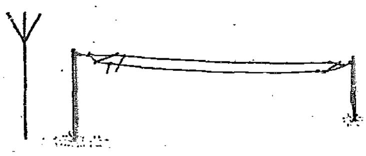
NEW ZEALAND ON SINGLE VALVE.

Sir,—It may interest readers to know that on February 9th at 8.30 a.m. I received the New Zealand amateur Z4AG, who was calling ULCMP, on about 80 metres. My receiver is a single-valve Reinartz. I should be interested to know if anybody has heard New Zealand as late, or later, in the day. The sun was shining quite brightly, and there was absolutely no fading. NORMAN E. N. GUY..

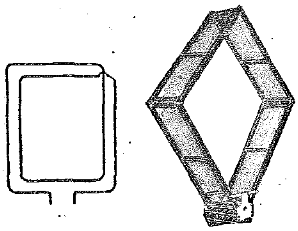
Pinner, Middlesex.

SYMBOLS USED IN WIRELESS CIRCUITS.

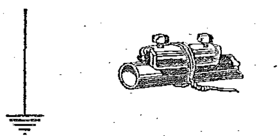
The various pieces of apparatus and accessories employed in reception or transmission are usually represented in diagrams of connections by symbols. Those commonly used are given below, and should be learned by those who wish to derive the greatest benefit from the circuits appearing in wireless articles.



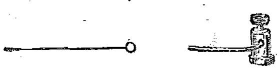
An open aerial. May be an outdoor or indoor aerial.



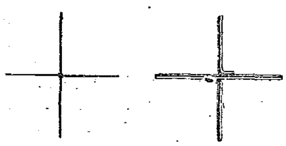
A frame or loop aerial.



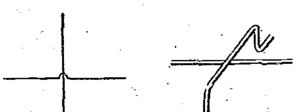
An earth connection.



Connection to a terminal.



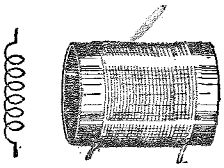
Two wires connected.



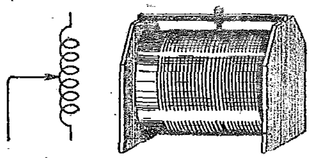
Two wires crossing.

A single-pole switch.

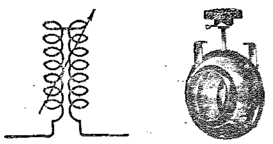
A double-pole throw-over switch.



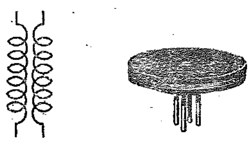
A tuning coil, usually of the cylindrical type.



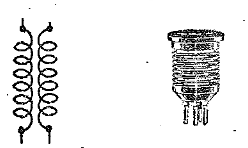
An adjustable tuning coil.



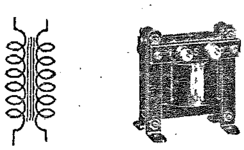
A variometer. The windings may be connected in series or parallel.



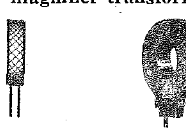
A high-frequency transformer with a fixed coupling. May be of the pin type shown, or consist of two coils fixed together, or a coil with a double winding.



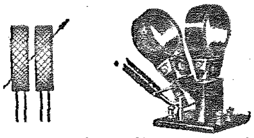
Another type of high-frequency transformer.



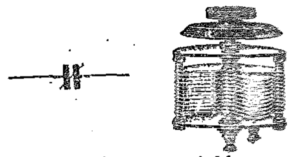
A low frequency or note magnifier transformer.



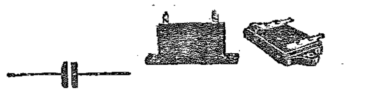
A plug-in coil.



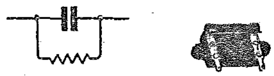
Two plug-in coils mounted in a two-coil holder for the purpose of obtaining variable coupling between them.



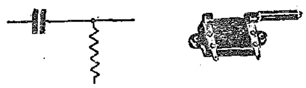
A tuning or variable condenser.



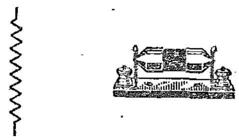
A fixed condenser.



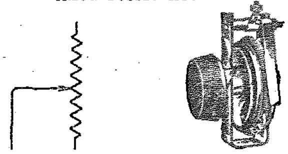
A grid condenser with the grid leak connected across it.



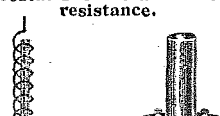
Another grid condenser and leak suitable for coupling a tuned anode and detector, or choke, or resistance stages of H.F. or L.F. amplifiers.



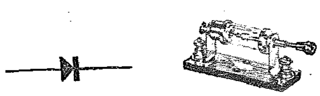
A fixed resistance. An anode resistance is shown, but the symbol applies to any type of fixed resistance.



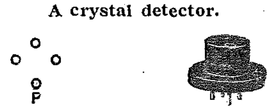
An adjustable resistance or rheostat such as a filament resistance.



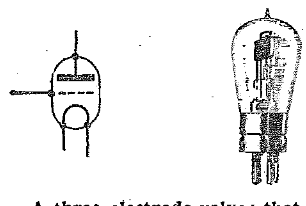
A low frequency or iron-cored choke coil.



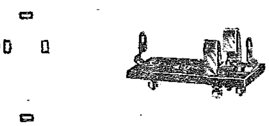
A crystal detector.



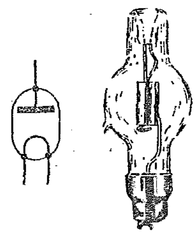
A valve holder for valves of the four-pin type.



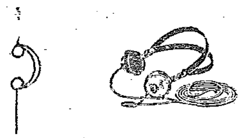
A three-electrode valve; that is, a receiving or transmitting valve having a filament, grid and anode.



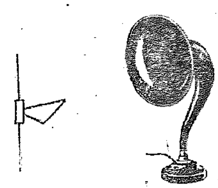
Another valve holder, for V.24 type valves.



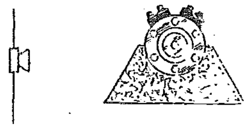
A two-electrode or rectifying valve.



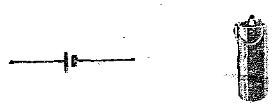
Head-telephones.



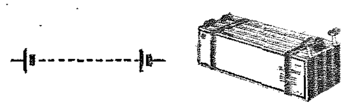
A loud-speaker.



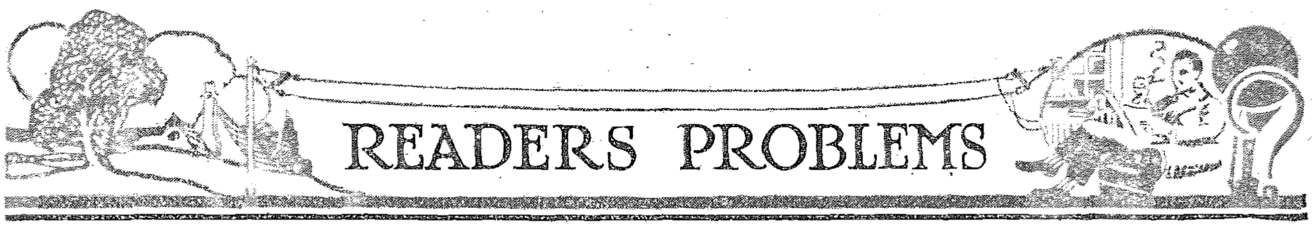
A microphone or other type of transmitter.



A single dry cell or accumulator.



A number of dry cells or accumulators connected in series

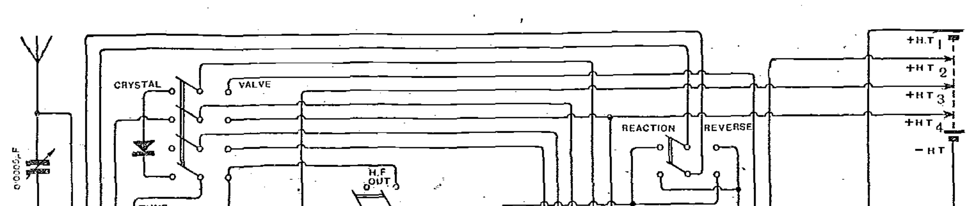


Readers Desiring to Consult the "Wireless World" Information Dept. should make use of the Coupon to be found in the Advertisement Pages.

Switching Arrangements for a Four-valve Set.

A CORRESPONDENT has written requesting us to furnish him with a four-valve circuit embodying a four-pole switch, with which he will be able to cut out the H.F. and detector valves and switch in a crystal. He also desires to include a series-parallel switch, a tune stand-by switch, and the usual switches for cutting out H.F. and L.F. valves according to requirements.

We give below a suitable circuit for accomplishing this. It will be noticed that when changing from H.F. and valve detector to crystal detector only, the filaments of the valves concerned are automatically extinguished, and the O.P. connection of the first transformer is changed from H.T.+to earth. The three-pole switch automatically adjusts the anode potential of the detector valve when the telephones are brought into this circuit, thus obviating the necessity for adjusting wander plugs. It is recommended that a 9-volt tapped dry cell battery be used for grid biassing in order that the correct bias may be applied according to the particular type of valve used. A reaction reversing switch is also included in the diagram.



A four valve receiver with switches to enable valves to be put in or out of circuit, or a crystal to be employed as a detector instead of a valve.

Resistances for L.F. Amplifiers.

SEVERAL readers have asked for the address of the firm manufacturing Zenite rods, which were recommended for resistance coupled L.F. amplifiers on page 397 of the December 17th issue of this journal. These may be obtained from the Zenith Manufacturing Company, Villiers Road, Willesden Green, N.W.2. With regard to the slotted formers mentioned in the same article for winding anode resistances, these may consist of H.F. transformers taken from old R.A.F. amplifiers.

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Measurement of Aerial Capacity.

A CORRESPONDENT is desirous of measuring the capacity of his aerial, and he asks us to suggest a simple method whereby this may be approximately ascertained.

The capacity of the aerial can be approximately ascertained by connecting a coil of 75 to 100 turns in the aerial circuit, and then exciting the aerial system by means of a buzzer. The frequency at which the aerial is oscillating should then be measured as accurately as possible by a wavemeter. The coil should then be removed from the aerial circuit and connected in parallel with a carefully calibrated variable condenser. This oscillatory system should then be excited and adjusted to the same periodicity as that of the coil and aerial previously measured. It will then be found that the capacity indicated by the calibration chart of the condenser is approximately equal to that of the aerial. This will give a moderately good approximation, but it must be remembered that the distributed inductance of the aerial has not been taken into account.

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The Position of the Filament Rheostat.

WE receive many letters from readers asking us whether it is better to place the filament resistance in the positive or negative L.T. lead.

The resistance of the ordinary filament rheostat will be found to have a more or less negligible effect in biasing the grid of the valve. When in the negative lead it will be found that it causes the grid to become slightly more negative than the negative end of the filament. This is all to the good in L.F. amplifiers, but its biasing effect is not nearly enough, and we shall still need grid biasing cells. In H.F. amplifiers the rheostat can be connected in the negative lead unless it is desired to attempt to stabilise the H.F. valves by introducing a certain amount of grid current. In detector valve circuits it is necessary to apply a positive bias to the grid of the valve, and the connecting of the filament rheostat in the positive L.T. lead will still further assist in this. In practice, however, not much difference will be noticeable in ordinary circuits, the important thing to take care of being that the grid return leads of the various valves connects to the correct side of the L.T. battery, irrespective of which lead the rheostat is in.

o o o o

Record Crystal Reception.

IN view of the many reports now daily appearing concerning the reception of New Zealand amateurs on one and two valve sets, a reader asks what is the long-distance record for crystal reception.

Readers' Problems.—

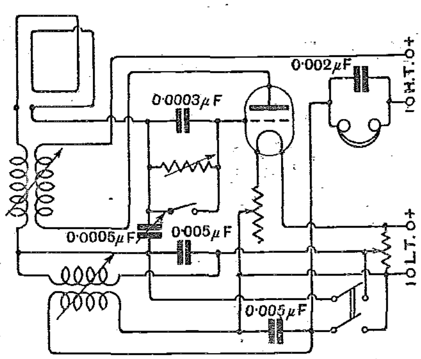
Our correspondent does not state whether he is referring to reception of morse or telephony, but in any case we can give no exact information on this subject. Reports have been received that 5XX has been heard on an unaided crystal set in Algiers, which is a distance of approximately 1,000 miles. In view of the high power which Chelmsford uses, this report cannot be ignored. Crystal reception of morse signals is, of course, in a different category, and distances between one and two thousand miles from an ordinary low-powered commercial station are quite common.

oooo

An Experimental One-valve Receiver.

A CORRESPONDENT wishes to construct an experimental one-valve receiver for use with a frame aerial with which, by simple switching arrangements, it is possible to change over from a plain one-valve reaction circuit to one embodying the super-regenerative principle.

We illustrate a suitable circuit below. It will be seen that by closing the double-pole switch, the "quenching coils" are short-circuited. These coils should be of such a value that, in conjunction with the 0.005μF condensers shunting them, they will have a natural periodicity of about ten to twenty kilocycles. The "plug-in" type of coil is quite suitable for use for both of these, but they should be withdrawn from their sockets when using the receiver as a simple one-valve set, since the proximity of such large coils, forming, as they do, a closed circuit through the short-circuiting switch, will have a detrimental effect on the functioning of the receiver as a normal one-valve reaction set.



An experimental single valve receiver.

The grid leak and condenser unit is provided with a short-circuiting switch in order that experiments may be carried out on the "super" circuit without these components.

oooo

Fault Tracing in a Three-valve Set.

A READER has written to say that he has carefully constructed a receiver modelled on the circuit given in this section of the journal for November 5th, 1924, with the exception that he has replaced the resistance by a choke, in order to avoid the higher anode voltage required with the resistance. He states that results on either one or three valves are all that could be desired, but that very poor signal strength is given when using two valves only, and he is puzzled by this, since, when using all three valves, the second valve functions perfectly normally. All switch connections, etc., have been carefully checked and tested.

The reason for this curious behaviour of the second valve, although puzzling at first sight, is readily revealed if a few moments' study is given to the diagram. The circuit was designed so that when the telephones were brought into the anode circuit of the second valve the anode resistance was kept in series with them in order to offset the high anode voltage applied, otherwise it would have been necessary to move the wander plug every time a change was made from two to three valves, and *vice versa*. Now, if we substitute a choke and lower the anode voltage accordingly, it will readily be seen that when we bring the telephones into this circuit we have a very large impedance choke in series with the telephones, with a similar result that would be experienced if we had connected several pairs of telephones in series in this anode circuit. When changing over to three valves, however, things become normal again. The remedy is fortunately simple. It will be noticed in the diagram that a connection runs from the right centre contact of the first inter-valve switch to one end of the choke or resistance, as the case may be. It is only necessary to move this connection to the other end of the choke.

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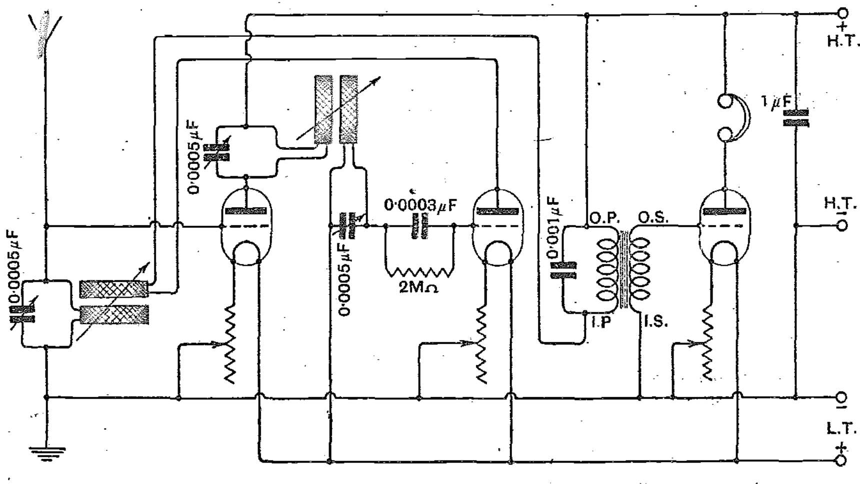
Selectivity in a Three-valve Set.

A READER is desirous of building a three-valve set containing one stage of H.F., in which selectivity is obtained by means of loose coupling between the H.F. and detector valves.

The circuit which we give above will be found suitable for this purpose. The energy in the anode circuit of the detector valve is transferred to the detector grid circuit by means of a loose-coupled tuned transformer. This transformer can, of course, consist of two plug-in coils mounted in the conventional two-way coil holder. Both the primary and secondary are shown tuned by separate condensers, although when working with coils closely coupled it is possible to dispense with one of these condensers. Potentiometer control of both H.F. and detector grids could be used with advantage in this circuit, but is not given in the diagram, as it would, of course, add two more controls to the receiver.



A receiver with one stage of loose coupled tuned transformer H.F. amplification, valve detector and note magnifier.

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Distortion in a Choke-coupled Amplifier.

A CORRESPONDENT who has constructed a choke-coupled amplifier using an intervalve transformer with primary and secondary in series for his choke states that he is greatly disappointed with the results obtained, the quality of reproduction being distinctly "tinny."

This effect of poor quality is due to the non-amplification of the lower musical frequencies, and should not occur in a well-designed choke amplifier. It may be caused either by using too small a value of coupling condenser, or too small a choke in the anode circuit. The coupling condenser should not have a smaller value than 0.05 μF if even amplification of all musical frequencies is to be effected. The inductance value of the choke should be high, a value of 100 henries being suitable, and it will be found that the use of an intervalve transformer with primary and secondary connected in series is excellent for this purpose. It is highly probable, however, that in this particular case the primary and secondary of the transformer have been connected in such a manner that the magnetic fields created by the two windings are acting in opposition to each other instead of mutually assisting each other. This would easily account for the distortion referred to. Great care is necessary when using a transformer in this manner, and the correct method of connection must be found by experiment.