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Wireless Weekly

and The Wireless Constructor.

Vol. 3.
No. 9.

CONTENTS

The Omni-Circuit Receiver—Full Constructional Details

The new Book of S.T. Circuits

By JOHN SCOTT-TAGGART, F.Inst.P.

EVERYONE needs this handsome volume of new S.T. Circuits. The fame of S.T. 100, the dual amplification Circuit using but two Valves yet giving the signal strength of at least four, has spread throughout the country. Many thousands of Wireless enthusiasts are using this Circuit with every success.

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3/6

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RADIO PRESS, Ltd., Devereux Court, STRAND, W.C. 2.

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Wireless Weekly

Vol. 3, No. 9
Feb. 6, 1924.

CONTENTS

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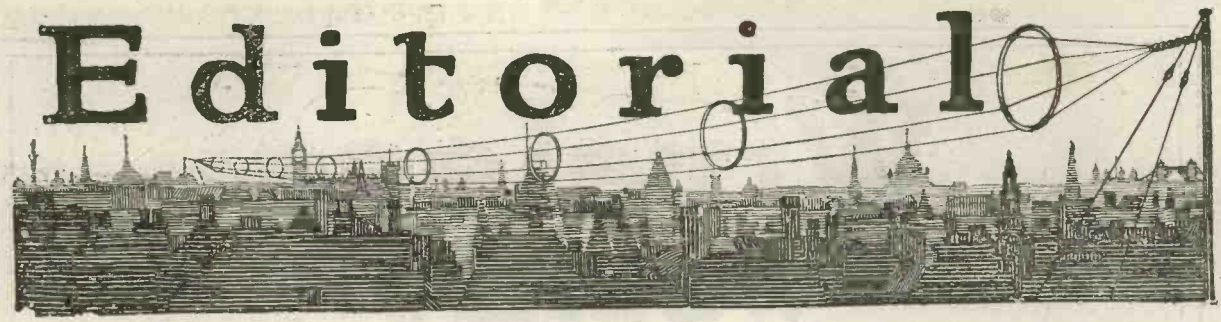
Editorial



The Experimenter

ELSEWHERE in this issue we publish a report of the Presidential address delivered by Dr. W. H. Eccles, F.R.S., to the members of the Radio Society of Great Britain. Dr. Eccles's remarks are of considerable interest and encouragement to the large body of experimenters who, with the constant development of broadcasting, no doubt feel their activities considerably restricted.

A carefully constituted and representative Radio Society of Great Britain, under the continued able guidance of Dr. Eccles, should make for unity, and consequently strength, in the ranks of experimenters, and be in a position to do a great deal towards ensuring that the rights and privileges of earnest amateur workers are safeguarded.

At the time of going to press the meeting of the Radio Transmitters' Society, announced in last week's issue, has not taken place, but we sincerely hope that the members will unanimously agree to the proposed amalgamation with the R.S.G.B.

Advertising

We have received the following letter from an Advertising Consultant, whose work is very frequently seen in the pages of the technical Press. It is not too much to say that Mr. Gilbert's efforts have contributed very largely to the success of several companies, and his remarks are well worth noting :

" From the point of view of one who takes very deep interest in efficient advertising and who is entrusted with the advertising campaigns of several important radio manufacturers, I was very glad to see the timely warning conveyed in your recent Editorial.

" Successful merchandising is dependent upon a careful and analytical survey of the market available, and it is extraordinary to view the mistakes that are being made in advertising wireless goods to-day. It is going to be to the ultimate advantage of everyone connected with Radio—manufacturer, retailer and experimenter alike—that costly experiments connected with advertising are eliminated as far as possible.

" For instance, it will be obvious to anyone that to advertise wireless equipment, such as valves, headphones, batteries, etc., to readers of the daily Press who do not possess wireless receivers, is the height of absurdity. And yet I have seen this done repeatedly. But, you may say, a very large number of readers of the big London dailies are wireless enthusiasts. True, but why pay for waste circulation when you can advertise in papers *where* 100 *per cent. of the readers are wireless enthusiasts*, and who, more important still, are in the mood and even anxious to study advertisements?

" In this connection it is worth remembering that the life of a newspaper is necessarily very short, and its advertisements—to be successful—must be quite different from those prepared for weekly magazines which are read more leisurely.

" Receiving sets *can* be successfully advertised in the daily Press, but here again careful planning and very large capital resources are necessary. It should be remembered that for a space approximately the size of this page an advertisement in a great London daily paper costs £160, and if used correctly it is well worth it. But single insertions of advertisements at odd moments will not sell receiving sets. Unless, therefore, the manufacturer has the resources of a Crœsus he must not hope for much assistance from the general Press.

" No, the sound way is to advertise wireless goods to people who are already sufficiently interested to buy a wireless magazine. Advertising in the general Press may prove successful in a year or two's time, but at present only a comparatively small portion of the population of the country are yet in the market for radio receivers and components.

" If my own personal experiences and advice are sufficient to deter any manufacturer from wasting money on advertising which can only be less than 25 per cent. efficient, then I shall be glad to have rendered some service to the Wireless Industry.

" Yours faithfully,
" ERNEST R. GILBERT."

History Repeats Itself

From the paragraphs appearing in the Irish Press, it appears that the establishment of broadcasting in Free State Ireland is beset by difficulties remarkably similar to those which were experienced here. Firstly, there is the Committee recently appointed by Dail Eireann to inquire into and report upon the proposed system of broadcasting in the Free State; and, secondly, there appears to be considerable trouble in connection with what we used to term " the licensing problem."

It appears that up to the present the only type of licence available is the Experimental licence, and there is considerable talk of strong action being taken in the case of individuals possessing unlicensed wireless apparatus. As in our own experience, applicants perfectly willing to pay a reasonable fee for the necessary permit are informed that there is an " Experimental licence," to obtain which, of course, the applicant has to satisfy the P.M.G. that he is a genuine experimenter with certain qualifications.

It seems to be another case of science and the popular demand moving much more quickly than the official mind, and we sincerely hope that the Committee will come to a decision without the long delay of the British Broadcasting Committee, and that the Free State P.M.G. will take immediate steps to legalise the position by the issue of broadcast and constructors' licences.

How to Make the "Wireless Weekly" Omni Receiver

No. 1.

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

The first article of a series dealing with the construction of a new type of receiver which has created so much interest amongst experimenters.

AN introduction to the Omni receiver has already been given in these pages, and some constructional details have also been given in *Modern Wireless*. It is therefore considered unnecessary to explain, except in brief terms, the general uses of the Omni receiver.

Normally, the Omni receiver consists of a cabinet in which a panel is fitted, and which is also provided with a terminal board on which some 60 terminals are arranged. These terminals may be connected in a variety of ways by means of flexible rubber-covered leads fitted with a spade terminal at each end. Each terminal goes to a component part which is mounted, either in the box at the back of the front panel, or underneath the terminal board.

Fig. 1 is a photograph of the completed receiver, which is only slightly different from that which has already been described in these pages. So many readers have suggested that a second transformer be included in the set so that the ST100 circuit may be tried, that I have modified the design slightly by adding two more terminals to the top panel. Those who have already made the set may easily fit these terminals, and also change the choke coil for an intervalve transformer, which may be included inside the wooden box, and not on the back of either of the panels.

The change from choke coil to transformer does not prevent the experimenter from carrying out work with choke circuits, such as those recently described in *Modern Wireless*, for the simple reason that the secondary of the second transformer may be used as the choke, the primary being left open.

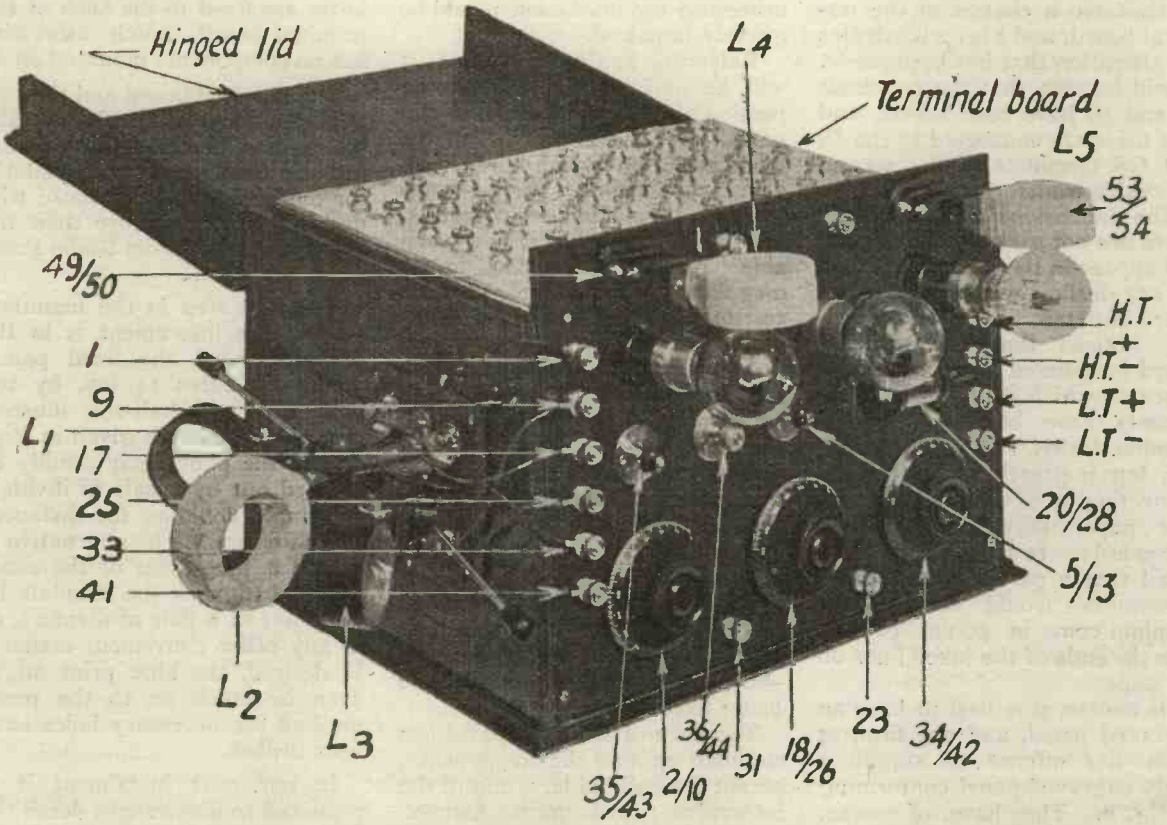


Fig. 1.—Photograph showing the relation of parts to the terminal board connections.

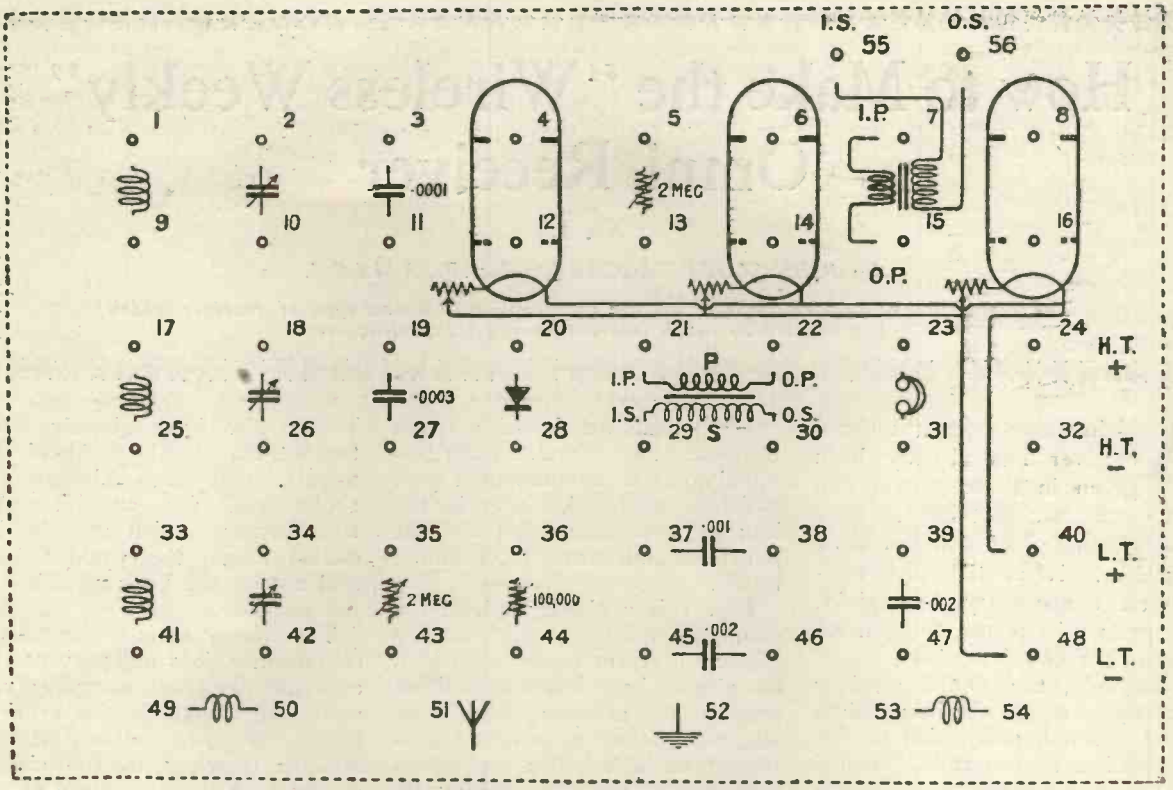


Fig. 2.—The terminal board connections.

The addition of the low-frequency transformer naturally necessitated a change of the terminal board, and Fig. 2 illustrates the alteration that has been made. It will be seen that the terminals 55 and 56 have been added, and that these are connected to the IS and OS terminals of the second intervalve transformer.

The dimensions of the terminal board are not given in Fig. 2, but will appear in the next issue when we are dealing with the terminal board in detail. It is to be specially noticed that the terminal board is covered with a sheet of paper on which the different components have been drawn diagrammatically. This is not essential, but it greatly facilitates the connecting up of different circuits. The paper may be varnished afterwards. It is to be specially noted that a partial short-circuit of terminals would occur if the terminal came in actual contact with the ends of the inked lines on the paper.

Of course, it is best to have an engraved panel, and one firm, at least, has offered to supply a ready engraved panel conforming to Fig. 2. They have, of course, taken precautions to see that the engraved lines do not approach too closely to the terminals, as otherwise the insulation would be gravely impaired.

Referring again to Fig. 1, it will be noticed that the ebonite portion of the instrument is in two parts. We have first of all the front panel on which three variable condensers, three valve holders, three filament rheostats, two fixed coil-holders, two variable resistances of 0 to 5 megohms value, one variable resistance of 100,000 ohms maximum, also variable, a crystal detector of good pattern, and a number of terminals which go to aerial and earth, the telephone receivers, the high-tension positive and negative, and low-tension positive and negative, and also six terminals, seen on the left of Fig. 1, to which are attached the ends of flexible leads going to the coil-holders mounted on the wooden cabinet; this coil-holder is provided with three coils —L1, L2, and L3, the middle one being fixed.

The back of the front panel has mounted on it all the components, except the coil holders, one of the intervalve transformers, namely, that which is connected to the terminals 55, 56, 7 and 15, and some fixed condensers, which latter are fixed to the back of the terminal board, which otherwise has no components mounted on it.

The terminal board and the vertical panel are first drilled to take the various components. Exact full-size blue prints are available for the convenience of those who desire something more than the drawings given, from Radio Press at 1s. 6d. each.

The first step in the manufacture of the instrument is in the preparation of the front panel, which measures 14 ins. by 10⅛ ins. An exact half-size illustration of the panel is given in Fig. 3, and the panel may readily be marked out by a pair of dividers by simply doubling the distances on the figure. The alternative is to use a blue print of the exact size and to mark the template by the point of a pair of dividers, or in any other convenient manner. If desired, the blue print might even be stuck on to the panel until all the necessary holes have been drilled.

In our next instalment it is proposed to illustrate in detail the front view of the panel with the

components mounted, and also a rear view. Details will also be given of the back of the terminal board and instructions given as to the joining of the two panels and the method of wiring the backs of the terminals on the ter-

minal board to the components on the back of the panel.

It is to be noted that the sizes of the holes in the front panel depend more or less on the particular components it is proposed to use in the Omni receiver. In a set of this description it is not desirable, or necessary, to specify the particular components used in the set, but we advise the reader to use good quality components, and particularly good quality transformers.

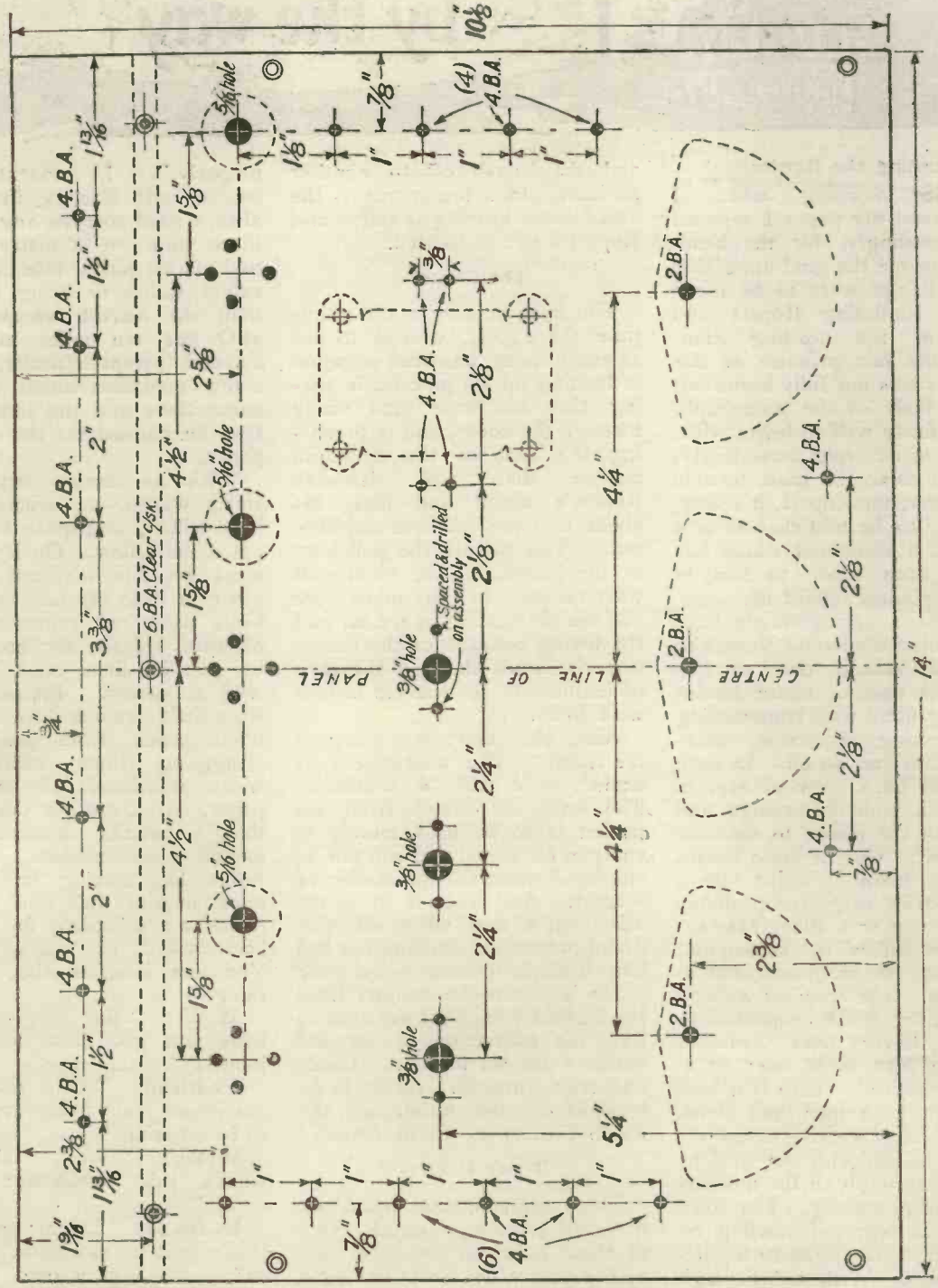


Fig. 3.—Drilling diagram of the front panel. This drawing is made exactly half-size so that the constructor obtains his dimensions and marks off his panel by means of a pair of dividers.

Hunting the Howlers

THIS morning when I opened my paper I rejoiced exceedingly, for the headlines gave me the glad news that at last things were to be made hot for Radiating Rupert and others of the howling clan. Alas! the fair promise of the headlines was not fully borne out by the body of the paragraph. It read fairly well to begin with, and my spirits rose accordingly, but then came the most terrible anti-climax, for Rupert, it seems, is merely to be told that he is a bad lad, a statement which has already been made to him in person by not a few of us.

Wonderful arrangements have been made for running Rupert to earth—or should one say to ether? A fleet of motor lorries are being fitted with transmitting and receiving apparatus, direction finders and so on. In each there will be a crew of experts filled with wide knowledge and fired with the desire to discover the culprit. One of these lorries will sally forth by night into a given district, disguised probably as a fish van or a Black Maria.

Let us follow its subsequent movements as prognosticated in the Press. The crew sit waiting filled with tense expectation. Fingers hover over switches ready to turn them over at a second's notice. There is a look of grim purpose upon their faces. One of them is wearing telephone receivers. Suddenly he stiffens and goes through all the motions of listening intently. The fixed station has reported howling on 380 metres. He signs to his fellow helpers. With a little sigh of satisfaction they fling over the switches, twiddle the condensers and whirl the direction finders. The dread work has begun. Rupert's fate is sealed. They have picked him up, they have noted his bearing. Whispered directions are given to the driver and they dash off to another position. In a few moments the dread cross bearing is taken and Rupert's lair is located.

The Sequel

You imagine that in the meantime the expert, who is to act as executioner, has been engaged in heating up his pincers, in seeing that his rope runs nicely through the noose, and in preparing the fuze of the dynamite charge that will demolish Rupert's aerial and blast his abode into the smallest smithereens. You picture the polishing of the handcuffs, the testing of their chains. In your mind's eye you see the heating of the tar and the loving passage of the executioner's hands through the sack of feathers to see that all is well with them.

Alas, alas, there is nothing of the kind. The executioner is armed only with a notebook. The knife he draws from his pocket is to be used merely to sharpen his pencil and will not be employed upon the quartering of Rupert. And what is to be the miscreant's fate when all this dread process of smelling out has been brought to a successful end?

He is not to be hanged from the highest tree, he is not even to have his ears clipped; tar and feathers are not for him. Listen and take warning. *He is to be brought to the notice of the Radio Society of Great Britain!*

Those Puzzles

There are moments when one does not love one's friends. One of these occurred the other day at the club when I was having a peaceful discussion over the coffee with another fellow. To us approached a third, bearing in his hand a scrap of paper. "Ah, Wireless Wayfarer," said he with a smile, "I wonder if you would help me. I have just rigged up a new set that does not work properly." I consented, of course, with alacrity, for one is always glad to give any help to those who are in distress. He told me his pitiful tale how four valves failed to bring in more than the merest whisper from 2LO but ten miles away. I listened sympathetically, asking a few questions anent soldered connections and the like. And then he handed me the scrap of paper.

With its coming my enthusiasm waned, my friendly feelings wilted, and quite frankly I hated the fellow. On it was the most horrible diagram that it has ever been my fate to behold. Coils were not represented by beautiful spirals, nor condensers by parallel lines shot through with an arrow. Instead, there were little squares drawn with a blunt pencil from which wild straggling lines representing wires wandered all over the paper. To trace out the hateful thing's circuits demanded real mental concentration. It was rather like solving one of the maze puzzles that one used to make as a schoolboy for the embarrassment of one's friends. You can imagine the kind of thing.

W.W.: "But why on earth have you got these two leads joined?"

Ex-friend: "Oh, those are not joined really; they are meant to be crossing."

W.W.: "Well, tell me, what's this condenser doing here?"

Ex-friend: "Let me see. Oh, that's not a condenser, it's a coil. No. I'm wrong, it's the next valve. No, it's not, it's a transformer."

You know what happens to your fishing line when you endeavour to show a novice how to make a perfect cast that cannot possibly become tangled? Well, that wiring diagram was very

much like the ensuing mess-up over which you spend heated moments endeavouring with the aid of your best gold tie-pin (dropped subsequently into the longest grass and never recovered) to unravel. After a hectic half hour I discovered that the grid of the first valve was connected to H.T.+ (this is literally true), and that the grid-leak of the rectifier had somehow wandered into the plate circuit. What I still cannot understand is that the fellow had actually received 2LO with this arrangement. He certainly had done so, though signals were faint. Faint, ye gods!

A Cough Lozenge Wanted

During the days of darkness a few weeks ago, when a real London particular lay like a dirty, clammy blanket over the metropolis, Snoopsworth's set was by no means up to the mark. A bad connection somewhere was causing it to oscillate mildly, so that speech and music were rasping and indistinct. Mrs. Gubble, who had dropped in one evening to hear it, as people always will when things are not what they should be, was quite puzzled. "Oh, Mr. Snoopsworth," she gurgled, "it doesn't sound at all right to-night." "No," said he with great presence of mind. "What can you expect? The fog's making the loudspeaker hoarse."

A Story of a Joke

Some time ago I made a joke to the effect that Adam was the first wireless man, since a loud-speaker, was made from his spare parts. Once launched upon the world, that jest appeared in all kinds of forms and in all sorts of places. In an American paper I beheld a drawing of a little man purrhasing bits and pieces at a wireless shop. "Won't you have a loud-speaker as well?" the salesman was asking. "No, thanks, I have one already. I am married," was the reply. Thereafter it was seized upon by humorous artists in the world's papers; chairmen of wireless clubs brought it gracefully into their speeches at the annual dinner, and few lecturers could afford to be without it. And so it went on quite merrily living a charmed life and bobbing up now here, now there. Its last appearance has tickled me exceedingly. A sub-editor, in the hope of brig!.tening up these notes, had an inspiration a short time ago. I happened to mention the inspiring word loud-speaker. Quick as lightning he inserted, with a view to avoiding any ambiguity, "(the tin sort, I mean, not . . . . .)." Thus does one's ohild return, after many wanderings, to the paternal roof in the manner of the Prodigal Son. I am not killing a fatted calf.

Getting Atmosphere

I am fearfully excited over the announcement that Spain is to have broadcasting stations. An international libel maintains that when a Spaniard is asked to do anything he always replies "*mañana*," which means the to-morrow that never comes. You remember how the Red Queen said to Alice "Jam yesterday or jam to-morrow, if you like, but *never* jam to-day." Luckily a British firm is to erect the stations, so that they will be ready at once if not sooner. I find it a little difficult, though, to credit the statement that there is to be one every 25 miles throughout the country, for, since the area of Spain is about 190,000 sq. miles, this would mean something over 1,000 stations, which would be a pretty generous allowance. But what opportunities it would give for S.B.!

What intrigues me most is the possibility that we shall be able to hear something of the clamour of the bull ring. Bearing in mind the B.B.C.'s instructions that one must always endeavour to give broadcasting a chance by obtaining the correct atmosphere whilst listening, I am ordering at once a sombrero and a red sash. I shall also rub my loud speaker (no, I will not make that joke again) thoroughly with garlic before the show begins.

WIRELESS WAYFARER.

Our photograph shows the broadcasting from 2LO of the play "The Annual Dinner," on January 15th.

Issues published during the Railway Strike can be obtained from your usual Bookstall.

C.W. and Telephony Transmission Using Valves

No. IV.

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

The fourth of a series of articles which began in Vol. 3, No. 6.

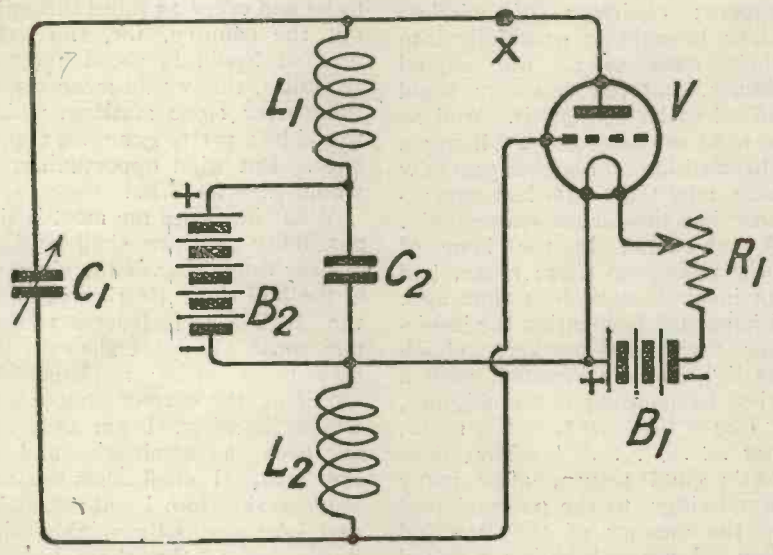


Fig. 6. A single-circuit oscillator using two separate inductances in series.

WE can avoid the use of a grid condenser and leak in a rather different way by using a circuit of the kind shown in Fig. 6. Instead of having one single coil L1, as in the case of Fig. 4, we use a split coil composed of two inductances, L1 and L2; the anode battery B2 is connected so as to come in the anode circuit of the valve and yet to be clear of the grid circuit. Across the grid and anode is a variable condenser C1 and the whole oscillatory circuit consists of the inductances L1 and L2 in series and the variable condenser C1 shunted across the two coils. As far as oscillatory currents are concerned, the battery B2 and the by-path condenser C2 might just as well be connected at the point X; we would then have the circuit of Fig. 4. By connecting the battery B2 in the position shown, however, we get it next to the filament, an arrangement which has several advantages. In the Fig. 6 arrangement, a condenser C2 is used to shunt the anode battery, because the latter always has some resistance which would be a disadvantage if connected in the oscillatory circuit. As a general principle, all anode batteries should be preferably shunted by a fixed condenser having a capacity of not less than 0.002 μF.

It must be pointed out, in connection with Fig. 6, that the operation of the circuit is entirely independent of any magnetic coupling between L1 and L2; this also applies to the circuits of Figs. 4 and 5. The two halves of the inductance above and below the point M may be entirely separate, so as to have no inductive effect on each other. It must be remembered that the grid potentials required to maintain oscillations are obtained through the flow of oscillatory current through the lower portion of the inductance between M and Y (Figs. 4 and 5). In all these circuits, of course, the inductance, or inductances, may be variable.

There is still another general method of obtaining a reaction effect using a single circuit. One form of this is shown in Fig. 7. The single oscillatory circuit consists of an inductance L1 shunted by two condensers C2 and C3 in series with each other. The middle point between these two condensers is connected to the filament negative, while the top end of L1 is connected to the anode through the anode battery B2, while the bottom end Y of L1 is connected to the grid.

It will be seen that when oscillations are flowing in the circuit L1 C2 C3, the anode will be positive when the grid is negative, and *vice versa*; these potentials, of course, are with respect to the filament. Putting it another way, any oscillatory current in L1 C2 C3 (and therefore through C3) will produce grid potentials which will produce changes of anode current which will energise the oscillatory circuit so as to maintain the original oscillations or to strengthen them. Since the mid-way point between the condensers C2 and C3 is connected to the filament, we would ordinarily be unable to obtain the necessary steady direct anode current. To obtain this we connect a choke coil Z across the condenser C3, and the steady anode current now flows from the anode, through B2, through L1 and through Z, and so down to the filament. When the grid

potential varies, the varying currents pass through the inductance L1 and energise the oscillatory circuit L1 C2 C3. This energising and building up of oscillations in this circuit produce high-frequency electromotive forces across the condenser C3. In other words, high-frequency potentials are set up across the grid and the filament. These potentials are such as to produce a reaction effect on the oscillations in L1 C2 C3. Although the choke coil Z serves as a direct current path, it may be considered as non-existent when we are dealing with the high-frequency current circuits, since the choke prevents the passage of any high-frequency currents.

The circuit of Fig. 7 may be modified by connecting the anode battery next to the filament. A grid condenser and leak would then be necessary, as in the case of Fig. 5.

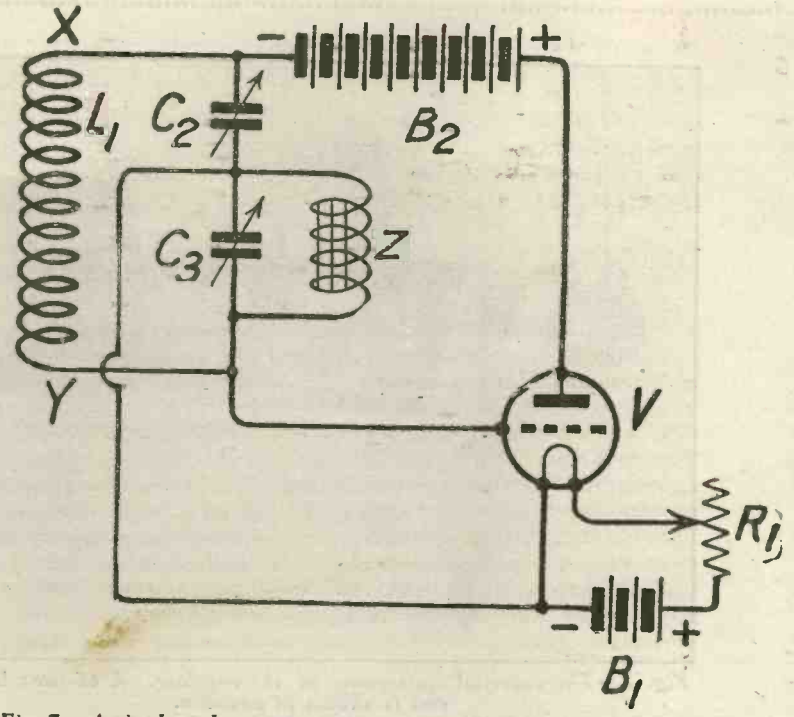


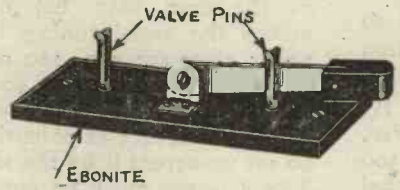
Fig. 7. A single-valve regenerative circuit using two condensers in series.

A Simple S.P.D.T. Switch

A SIMPLE switch of this type can be quickly made up from the usual oddments generally to be found in the scrap box.

The requirements are—a small piece of ebonite for the base and knob, 2 valve pins, a phosphor bronze blade from a rheostat, or a piece of thin brass strip, and a small brass angle bracket or the necessary brass strip from which to make one.

The valve pins are fixed in line in the ebonite base, and slightly opened out at the top for easy entry of the blade, and the bracket with its blade (which has previously been rivetted on, or secured with a screw and nut) fixed in position midway between them.



Finally a knob is fitted to the blade by making a saw-cut in a small piece of ebonite and rivetting it on.

A switch of this description will be found to serve many useful purposes. It may be incorporated in a set, in which case the valve pins and bracket may be mounted direct upon the ebonite panel.

By the provision of 4 valve pins, two blades and a small ebonite crosspiece, a double-pole switch may readily be constructed.

N. K. J.

Matting Ebonite

TO evenly matt the surface of an ebonite panel is to most constructors a somewhat tedious job.

This can be done in an efficient and expeditious manner by using the compound used by motorists and known as valve grinding paste.

An odd piece of hardwood is used, with a circular motion, to rub on the abrasive, and after a short while will produce an evenly matted surface; a final clean off with petrol and a rag will leave the surface of the panel a fine matt black.

Care should be taken to thoroughly clean the surface of the panel with the petrol.

N. K. J.

The Radio Society of Great Britain

An Informal Meeting will be held at 6 p.m. on WEDNESDAY, February 13th, at the Institution of Electrical Engineers, when a discussion will be opened by Mr. J. H. Reeves, M.A., on "*Fine Wire Coils as an Aid to Distortionless Reception.*" Mr. Maurice Child will take the chair.

A SIMPLE SHORT WAVE RECEIVER

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

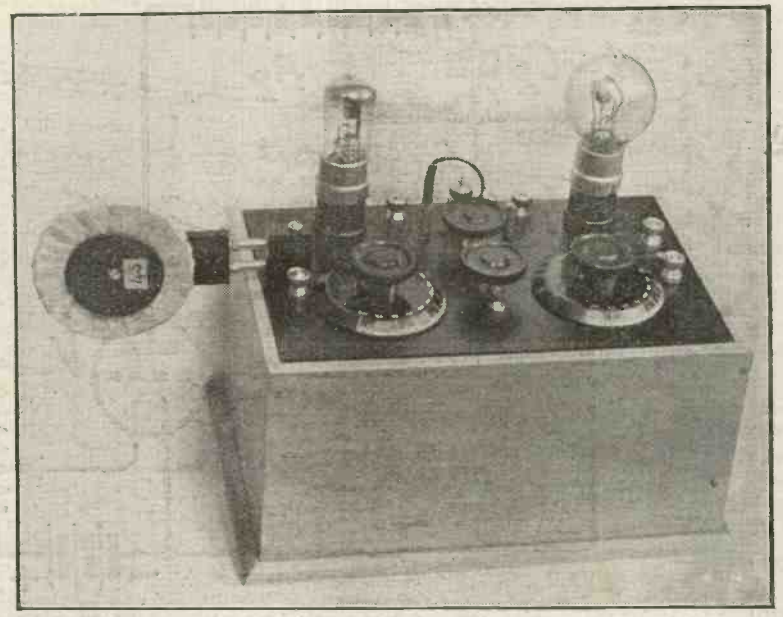


Fig. 1.—The external appearance of the receiver. A 45-turn loading coil is shown in position.

THE whole subject of short wave reception is one which the average experimenter seems to regard as one of prohibitive difficulty, and yet by so doing he misses the fascination of one of the most interesting branches of the science. By short wave reception, of course, I mean those waves below 300 metres which are mainly devoted to experimental work. Upon these waves one may hear, almost any night, the most interesting experimental transmissions, attempts (sometimes successful) to open communication with the American amateurs, English and French experimenters working together with remarkable ease, and may achieve amazing feats of long distance reception with quite simple apparatus.

Upon these waves it seems that what are regarded as freak conditions upon other waves are of *common* occurrence, and hence quite frequently one finds that reception is being achieved over almost incredible distances.

Methods of Tuning

The tuning arrangements must be somewhat modified for success upon the short waves, and hence it is probably not worth while to try to make a receiver capable of working efficiently upon both the shorter waves and those of the broadcasting band and above. It is practically useless to connect the detector valve (or first H.F., as the case may be) directly across the aerial tuning inductance; since for say, 100 metres, the latter will contain so small a number of turns that only a trifling difference of potential will be set up across it by the signals. The detector must be connected across some part of the circuit

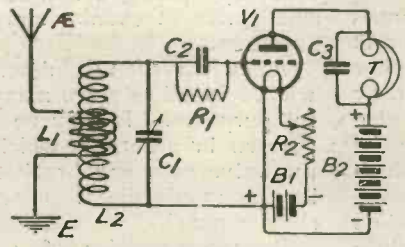


Fig. 3.—A simple form of the aperiodic aerial circuit.

where the available difference of potential is large, and various methods of achieving this end have been suggested.

The ordinary loose-coupled arrangement with a separately tuned primary and secondary circuit is not a very good solution of the problem, since the additional complication is liable to prevent the unpractised operator from obtaining satisfactory results. A method yielding practically equal signal strength (probably greater in inexperienced hands) is the aperiodic aerial system of tuning. For the benefit of readers who may not have seen a previous article on this subject it should perhaps be explained that in this type of tuner the aerial circuit consists of only ten or twelve turns, coupled as tightly as possible to the secondary winding, which is tuned with a variable condenser. No provision is made for tuning the aerial circuit, which appears to function more or less aperiodically, i.e., with a uniform response over the whole band of waves covered by the secondary coil and condenser. A simple circuit for broadcast reception on these lines is shown in Fig. 3.

It is usual to wind the coils simultaneously in the form of a basket, honeycomb or other compact type of coil to ensure the closest possible coupling between primary and secondary, and it is desirable in the case of coils for broadcast and the longer wavelength signals to use extremely thick wire for both primary and secondary, but I have found that this does not hold good without qualification on the really short waves, possibly because one may be working in the neighbourhood of the fundamental wave-length of the aerial. Whatever the cause, the result is a most disconcertingly erratic quality in the reaction adjustment of the set; over a certain wave-band it will entirely refuse to oscillate, while above and below the band it will oscillate so freely as to be constantly on the verge of howling.

A remedy for the trouble was found in a coil containing a

The use of the shorter wavelengths is becoming of great importance, and the general notes contained in this article will be of interest to many readers besides those who will make use of the constructional details which it gives.

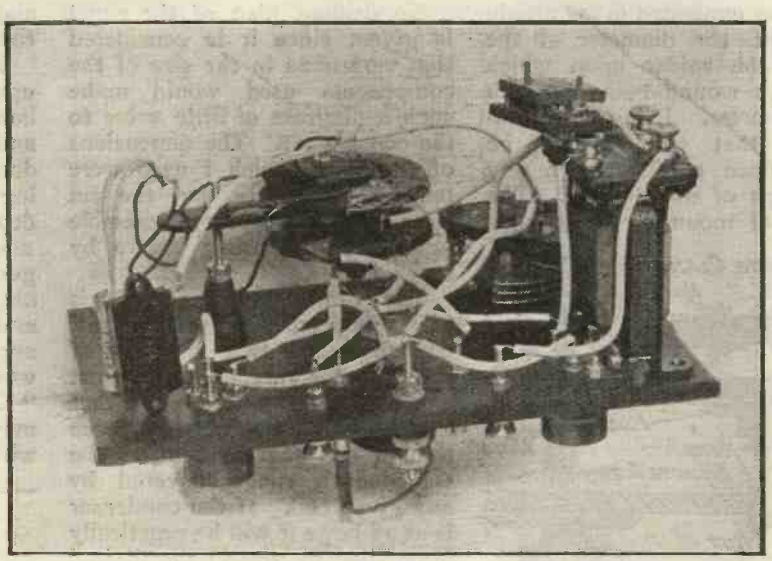


Fig. 2.—Note the method of mounting the reaction and tuning coils.

primary winding of high resistance and a secondary of very low resistance, this combination giving perfectly stable working and unexpectedly good signal strength. As an experiment (which was fully expected to be a failure!) the aerial coil was wound with No. 40 silk-covered resistance wire, and the results were so good that the coil was incorporated in the receiver illustrated in Figs. 1 and 2.

The Circuit.

The circuit of the set is shown in Fig. 4, and it will be seen that it is extremely simple, consisting of a rectifying valve and a one L.F. amplifier. The aerial circuit comprises the coil L_1, which consists of fifteen turns of No. 40 single silk-covered resistance wire, while the tuned secondary

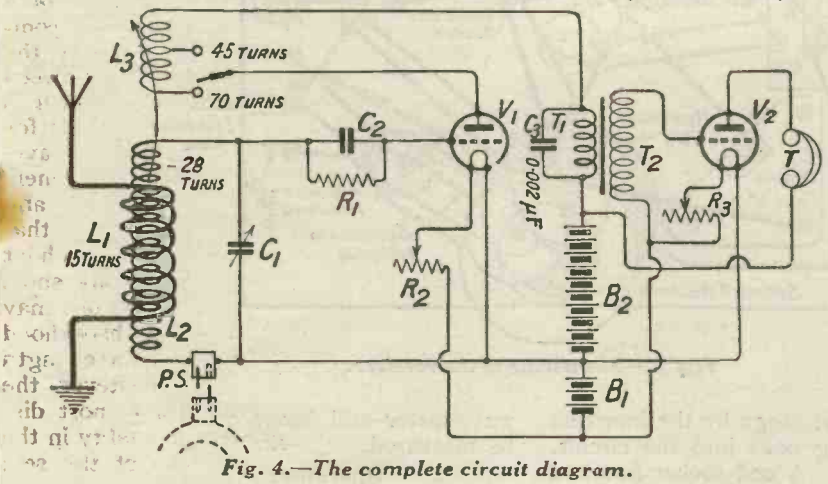


Fig. 4.—The complete circuit diagram.

circuit is composed of the winding L_2 and the variable condenser C_1. The two windings L_1 and L_2 are interwoven in the same basket coil, the first fifteen turns being wound double, the two wires coming from separate bobbins. The secondary is wound with No. 20 double cotton-covered wire, and after the fifteen double turns had been completed the resistance wire was cut and the secondary winding continued for a further thirteen turns (28 in all).

Reaction is provided by the coil L_3, and here again much difficulty is liable to be met with in short-wave work, for it is extremely difficult to make a coil to cover anything but a very narrow band of waves. A tapped coil is necessary, and is only too likely to introduce dead-end troubles if the tappings chance to fall in the wrong places. It may be mentioned in this connection that the reaction coil finally used in the set was the fourth actually made, numbers one, two and three giving trouble of some sort. The windings found satisfactory should be exactly copied by all who make this set, and indeed I would strongly urge that no departure whatever be made from the design, since the difficulty experienced in getting everything just right would seem to promise disappointment to anyone making modifications.

The Tuning and Reaction Coils

The reaction coil is a basket having seventy turns of No. 30 double cotton-covered wire, and one tapping is to be taken at the forty-fifth turn, counting from the inside of the coil. A simple plug and socket arrangement is provided, so that either forty-five or seventy turns can be brought into circuit at will. The plugs consist of valve legs mounted on the panel, and the plug is a valve pin attached to the end of a short piece of flex. The other end of the flex is carried through a hole in the panel and soldered to the plate socket of the rectifying valve, this connection being shown dotted in the wiring diagram.

The inner end of the coil is connected to O.P. of the L.F. transformer T_1 T_2, and the tapping point and the outer end to the two valve sockets into which the plug may be inserted, thus varying the number of turns in circuit.

Both these coils were wound by the double-basket method which was explained in my article last week, the diameter of the hub of the spider upon which they were wound being an inch and a quarter. It is not recommended that they should be wound upon cardboard or any other type of disc former. The method of mounting these coils

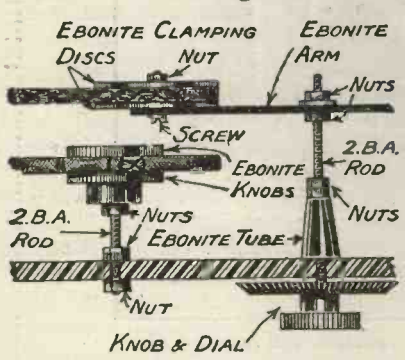


Fig. 5.—How the coils are mounted. The two ebonite knobs are drilled right through and tapped 2B.A.

is fairly clear in the photograph, and Fig. 5 should make the matter plain. The coil L_2 is mounted upon an ebonite arm carried by a spindle consisting of 2B.A. threaded brass rod, so that it can be swung by the rotation of the spindle across the coil L_3 to give the necessary adjustment of reaction coupling. The motion is imparted to the spindle by the knob and dial visible on the right in Fig. 1.

The connections to the windings L_1 and L_2 should be made with light flex, the ends of this flex being bound to the coil with adhesive insulating tape to secure them against breakage when the coil is moved. This combination of coils will be found to give adequate but controllable reaction over the whole band from about 90 metres to 250 metres.

General Details

The two filament resistances are of the "microstat" pattern, obtainable from various advertisers in this journal, this type having been chosen partly on account of its small size and partly because it was desired to use dull emitters from a six-volt accumulator. The grid-leak and condenser are the usual 2 megohm—0.0003 μF combination, and it should be noted that one leg of the condenser is soldered direct on to the grid socket of the rectifying valve.

No drilling plan of the panel is given, since it is considered that variations in the size of the components used would make such a diagram of little value to the constructor. The dimensions of the panel which I used were ten by six inches, but the set would be much easier to assemble upon one measuring twelve by seven inches.

The tuning condenser C_1 is of approximately 0.0001 μF capacity, and this value is of some importance. It is most essential in short-wave work that a *small* condenser be used, even though one thereby reduces the wave-length range covered by any given coil. If the condenser is at all large it will be practically impossible to tune-in the desired signals, and unless the dial is turned exceedingly slowly when searching the signals may be missed altogether.

Wavelength Range

It will have been noticed that the secondary circuit coil L2 contains only 28 turns, and this number is obviously inadequate to give the wavelength range which we have been considering. Provision is made for the extension of the range by the insertion of loading coils into the circuit, however. A coil socket (marked P.S. in Fig. 4) is mounted upon the panel between the aerial and earth terminals, and connected as indicated in Figs. 4 and 6, so that coils can be plugged into it.

To use the 28-turn coil alone a shorting plug (an ordinary coil plug with its two screws joined with a piece of wire) is inserted in this socket, and waves round about 100 metres can then be received.

To extend the wave range upwards I strongly recommend home-made basket coils of 25, 35, and 45 turns, wound with No. 20 double cotton-covered wire. Failing such a set of coils the Burndept concert coils may be used, and were found to give quite good results. The wavelength range of each coil was measured and the results are given in the appended table. These figures were obtained when using a "Ducon" aerial system, and may be expected to vary a little with different aerials.

Coil	Minimum (metres)	Maximum (metres)
25 Basket ...	—	150
35 ,, ...	140	220
45 ,, ...	170	260
S1 Burndept	—	150
S2 ,, ...	140	180
S3 ,, ...	185	240
S4 ,, ...	235	330

No minimum is given in the above table for two of the coils, the reason being that in each case it was below the minimum of my wave-meter and hence could not be measured.

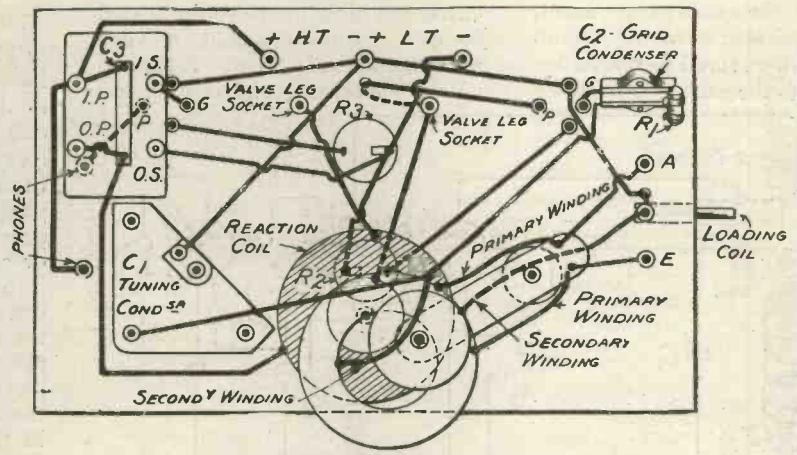


Fig. 6.—The wiring of the receiver.

Operation

Of the actual operation of the set little can be said, since although it is extremely simple it requires a certain amount of skill of a type which can only be acquired by practice. In searching for signals, of course, the

(*Concluded on page 284.*)

The Importance of the Amateur

By Dr. W. H. ECCLES, F.R.S.

The Radio Society of Great Britain's Presidential Address.

AT the meeting held at the Institution of Electrical Engineers on Wednesday, January 23, Dr. W. H. Eccles delivered the Annual Presidential Address. In opening his remarks Dr. Eccles stated that this was the third presidential address he had the honour of delivering before the Society, and whilst in previous years he had dealt rather with the technical side, on the present occasion he intended to deal with other aspects, particularly as he had now gained a better insight into the detailed activities of the Society, through his closer connection with it.

Purposes of the Society

The purposes of the Society, said Dr. Eccles, were, amongst other things, to be the centre of amateur movements. The past year had seen steady progress in the Society, two matters of considerable importance being the formation of the Transmitters and Relay Section, which, as the members knew, had absorbed the British Radio Relay League and the Schools' Wireless Section.

In wireless to-day, continued the speaker, we could trace two main currents—the increase of the commercial, including broadcasting applications and, furthermore, a considerable increase in experimenting. There were more amateurs now than ever before, and also more restrictions as to the wavelength "spectrum" available. We had, of course, a steady increase in the number of stations devoted to commercial work, and with the growth of broadcasting the wavelengths on which the experimenter could work were still further restricted. Those who had come into wireless purely for the enjoyment of broadcasting were apt to consider that the amateur had no rights whatever as compared with the amusement seeker, and indeed there was a tendency to overlook the fact that the experimenter was entitled to his rightful share of the wavelength spectrum.

Two Types of Amateur

We could distinguish between two types of amateur—the constructor and the experimenter. On a previous occasion he had dealt with the constructor and the part he played in wireless to-day, and this evening he intended to deal more fully with the experimenter. The true experimenter was a man who "doted on doing." He (the speaker) knew that there were people who took up such hobbies as keeping rabbits and angling. Personally, he said that it had always been a mystery to him how some people could see anything in rearing rabbits, and equally was it a mystery why others took pleasure in fishing. With those two classes of people he had nothing in common, but he felt great sympathy and interest in the experimenter who spends his time fishing in the ether with a bait of 10 watts. He well understood the joy of establishing communication with some distant friend with the tiny power available to the experimenter.

Dealing with other aspects of the amateur movement, Dr. Eccles said he was greatly impressed by the influence in the late war of the amateur who took up Transatlantic reception. With the entry into the war of the United States a large number of experienced amateurs were mobilised and took duty in the large Transatlantic receiving stations on the other side of the water. The Otter Cliffs (U.S.A.) station, for example, was staffed in this way.

Immediately these experimenters were recruited the standard of reception went up considerably, and soon the Otter Cliff station was handling a record number of words per day. It was significant that the standard of reception fell immediately on demobilisation, and to the best of his knowledge had never since reached so high a figure.

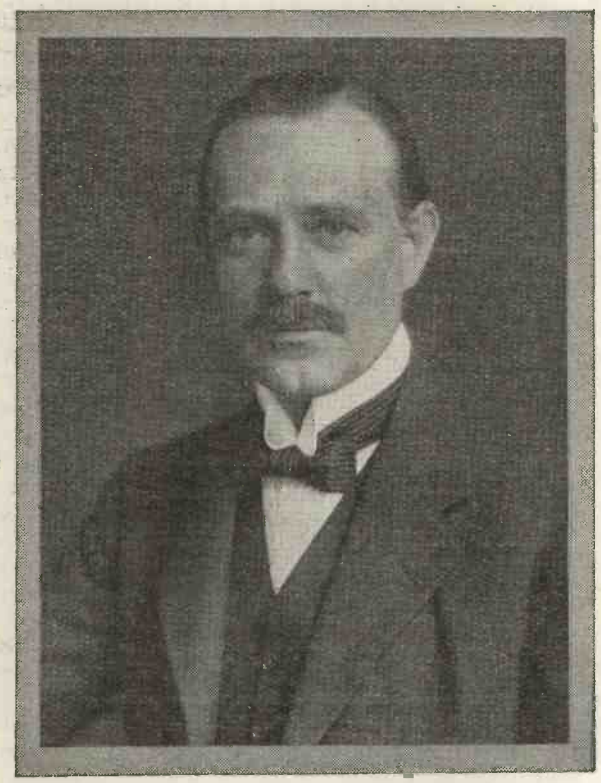
A Noteworthy Achievement

A noteworthy achievement in the amateur movement was the wonderful results recently obtained by a small band of workers on short wavelengths. This communication, or rather the establishment of the facts regarding this communication, had not been easy—witness how these facts had been missed by the large Government staffs who spent all of their time in investigating radio phenomena. Very often, said Dr. Eccles, the best work is done by men who do not earn their living at the particular branch. The experimenters who were doing such work were worthy of the granting of every facility; they were the best of the amateurs. Of course, there were others! There were those people who thought nothing of using 20 or 30 watts (or even more) to establish communication with another experimenter a mile or two away. There was the man who gave long recitatives from corrugated gramophone records. There was the man who did not listen-in either before or after transmitting. There was the man who had no call letters, and the man who used other people's call letters! Of a great many of these people it could be said that they know not what they do, but a certain percentage certainly

did know, and it could only be presumed that what they did was done with malice aforethought. The real martyr, of course, was the true amateur who suffered for the sins of these others.

The Problem of Oscillation

The President then went on to deal with the problem of the oscillating receiver. The British Broadcasting Company, he said, kept in close touch with the Society, and for some time last year the Secretary (then Mr. Leslie McMichael) acted as an intermediary between the B.B.C. and the local societies, but with the growth of broadcasting it became an impossible task to continue work adequately. Three-quarters of the disturbers seem to be "valve learners." Many of these cease to trouble after a few weeks, when they had learned how to handle their apparatus, but there are others who seem to keep on in this way for several months. Then, of course, there were the chronic crystal scratchers. It could not be too widely known that a crystal receiving set could create considerable disturbance in neighbouring aerials every time the user started adjusting his crystal and scratching it. When an aerial is energised by strong signals from the local broadcasting station it can radiate every scratch.



[*Photo by Elliott & Fry, Ltd.*

Dr. W. H. Eccles, F.R.S., President of the Radio Society of Great Britain.

Transmitting Amateurs

Some 10 per cent. of the disturbances seem to arise from transmitting amateurs, and well under 10 per cent. were wilful disturbances. When we come to consider the transmitting amateur, we have to take into account an aspect of the case which is sometimes ignored. If, for example, the listener has a badly-designed receiver it will be affected by transmissions on a wavelength widely different from that used for broadcasting. It seems hard that if a genuine experimenter were transmitting on a wavelength quite different from that of the broadcasting, and incapable of interfering on a well-designed receiver, he should be attacked because other people were using cheap and badly-designed receivers which were affected when they should not be. Of course, the attitude of the crowd would always be that it is the experimenter who is wrong, and unless the amateurs had a strong organisation to educate the public in such matters they would be bound to suffer. Such an organisation was the Radio Society of Great Britain.

A SIMPLE SHORT WAVE RECEIVER

(Concluded from page 282.)

reaction is adjusted to keep the set just oscillating while the capacity of the tuning condenser is varied. When a carrier wave is found the reaction is gradually weakened until oscillation just ceases, the tuning being meanwhile carefully varied on either side of the point at which the carrier wave was heard until the speech is picked up. For continuous wave morse reception, on the other hand, the set is kept oscillating. Should it not be found possible to produce self-oscillation with any setting of the controls the connections of the coil L2 (secondary) should be reversed.

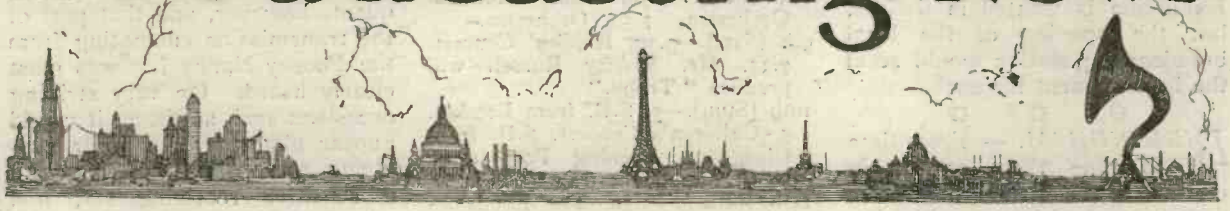
Results

The results obtained with the receiver have been decidedly good; upon an indoor aerial of small size the French station 8AZ was heard at great strength, sending morse, as were a large number of British experimenters in all parts of the country. Later the same evening the set was connected to an out-door aerial of moderate efficiency, and a number of other French amateurs were picked up, the morse of 8BP and 8CT being very strong. A station of call sign 4AL was also heard, and this would appear to be an American experimenter.

To obtain the best results it was found necessary to adjust the H.T. and L.T. supply with some care, in order that the control of reaction might be such that the set passed smoothly into the oscillating condition, and could be set with certainty to a point either just over or just short of self-oscillation.

It may be found also upon some aerial and earth systems that difficulty is experienced in getting the set to oscillate, apparently as a result of high earth resistance or other losses. In these cases the earth should be replaced by a simple counterpoise consisting of ten or fifteen feet of wire lying upon the floor.

Broadcasting News



LONDON.—The "Dogs of Devon," given us by 2LO on Monday night, January 28, was good in every way, and might more aptly have been styled the "Gay Dogs of Devon." The music was bright, the cast good, and the West country atmosphere was brought to us by the inimitable Charles Wreyford. It was, indeed, a good, healthy, little opera, and similar productions are certain to meet with general approval.

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Earlier in the week we listened to one act of "Tristan and Isolde" (Wagner) relayed from Covent Garden. The singing of Isolde and King Mark was well up in high artistic merit, but we thought that Tristan's voice showed more vibrato than tonality, and did not blend at all nicely with the flowing notes of Isolde.

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The B.B.C. is going ahead with its outside broadcasting concerts and has booked the Central Hall, Westminster, for a series, which will take place on February 22, March 7 and 21, April 9 and 23 and May 2, at 8 p.m. The orchestras playing on those dates are The Royal Philharmonic, The London Symphony, and The Royal Albert Hall. The entire proceeds will be devoted to St. Dunstan's.

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Forthcoming Events

FEBRUARY.

6th (WED.).—Roosters' Concert Party. Dance music.

7th (THURS.)—Uncle Leslie, Uncle Humpty Dumpty and Auntie Hilda in "Pip at the Zoo." 7.30, London Vocal Quartette. Mr. Elie Spivak, violinist. Dance music.

8th (FRI.).—Musical Comedy Melodies. Mr. Fred. Gibson and Miss Nance Haines will entertain. Orchestra.

9th (SAT.).—Sacred Music, at 3 p.m. Wireless Trio. Mr. Theodore Cordes and Miss Janet Joye, entertainers. "Samson and Delilah" from Covent Garden Opera House. Mr. Norman Long (items from his repertoire).

10th (SUN.).—Monsieur Vladimoff's Balalaika Orchestra. Miss Marjorie Clare, mezzo soprano. Mr. Seth Lancaster, 'cellist. Mr. Gerald Adams, tenor. Talk by Major L. R. Tosswill, O.B.E., on "Devonshire Dialect." Orchestra. Mayfair Male Voice Quartette. Miss Cecil Dixon, pianist.

11th (MON.).—Orchestra. Mr. Sydney Coltham, tenor. Half hour's entertainment by the Novelty Trio. 7.45, "The Lost Chord" by the Orchestra. Mr. Charles Leggatt, cornet. Opera, "Tristan and Isolde," relayed from Covent Garden.

12th (TUES.).—French Talk under the auspices of L'Institute Français. 7.30, Musical programme by French composers and Band of H.M. Grenadier Guards. Two humorous interludes by the Lyric Quartette.

BROADCAST TRANSMISSIONS

	Call-Sign	Wavelength
LONDON	2LO	365 metres
ABERDEEN	2BD	495 "
BIRMINGHAM	5IT	475 "
BOURNEMOUTH	6BM	385 "
CARDIFF	5WA	353 "
GLASGOW	5SC	420 "
MANCHESTER	2ZY	375 "
NEWCASTLE	5NO	400 "

TIMES OF WORKING.

Weekdays.....3.30 to 4.30 p.m. and 5.0 to 10.30 p.m. G.M.T.

Sundays..... 3.0 p.m. to 5.0 p.m. and 8.30 to 10.30 p.m. G.M.T

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ABERDEEN.—That the quality of the Aberdeen programmes continues to improve is evidenced by the shoal of letters from far and near which the staff is called upon to deal with daily. Perhaps more interesting still is the fact that there are many appreciative listeners in Scandinavia. From that part of the Continent anything from 20 to 30 letters weekly are forthcoming, most of them laying particular emphasis on the quality of the transmission.

While all goes well with local efforts, unfortunately the same cannot be said of relays. Many an anticipated treat from other stations has been marred by a bad land-line, and until something can be done to ensure greater immunity from induction, it is to be feared that the "S.B." will not be regarded with any degree of certainty of materialising. More than once the Covent Garden operas have been marred, while the other Sunday a Manchester programme was scarcely audible above the "racket" on the wire.

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Forthcoming Events

FEBRUARY.

6th (WED.).—Modern Scottish Composers' Night.

7th (THURS.).—Dance Music.

8th (FRI.).—Extracts from Shakespearean Plays.

9th (SAT.).—Students' Night.

10th (SUN.).—The Rev George Walker, D.D., address Beech Grove Church Choir.

11th (MON.).—S.B. from London.

12th (TUES.).—Modern French Composers' Night.

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BELFAST.—A modern electric exhibition without wireless in the forefront is as impossible to imagine as to expect England without London. Hence the recent Electrical Exhibition in the Ulster Hall, Belfast, was marked by very minor public attendance. Are Belfast dealers ashamed of pushing wireless, since they missed a very good opportunity? However, those few who did take advantage

state that they are agreeably surprised by the many good orders for high-class sets received. A really attractive Radio Exhibition is wanted in Belfast, but the opening of the local broadcasting station would seem the best moment for such.

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BIRMINGHAM. — From time to time there appear in sections of the Birmingham press little spasms of letters criticising the type of programme given from 5IT. Strangely enough it seems that only a few disgruntled "low brows" go to the trouble of expressing themselves in print and almost invariably their complaint is the same—too much classical stuff.

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Forthcoming Events

FEBRUARY.

6th (WED.).—3.30, Paul Rimmers' Orchestra. 7.30, Light Symphony Concert. 10.15, Morse Practice.

7th (THURS.).—3.30, Station String Quartette. 7.35, Orchestra. 9.10, Major Vernon Brook, Talk on Motoring.

8th (FRI.).—3.30, Paul Rimmers' Orchestra. 7.30, Orchestra.

9th (SAT.).—3.30, Kiddies' Concert. 7.15, Mr. Sydney Russell will produce "Trilby."

10th (SUN.).—3, S.B. from London. 5, Children's Concert, S.B. from Glasgow. Evening Programme by Station Orchestra.

11th (MON.).—3.30, The Kendrick-Waltho Trio. 7.30, S.B. from London.

12th (TUES.).—7.30, Miscellaneous Programme. 8.45, "The Pack of Cards" Concert Party.

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BOURNEMOUTH.—The long looked-for Burns' Nicht was a great disappointment to many in the neighbourhood of this station. Interference on the land-line was most distressing, and those parts of the programme that one wanted most of all to hear clearly, were often drowned in a sea of land-line noises.

It seemed that "boosters" were used every two or three minutes. As the evening wore on, interference became less frequent, however, and that part of the transmission emanating from the Poosey Nancy Inn was most clearly heard. On very striking occasions such as these, it would appear almost worth while supplying each B.B.C. station with a sensitive receiving set, and allowing it to re-broadcast its reception. Whether this would lead to the appearance of another set of noises peculiar to this method is not certain, but seeing that it has been done with American broadcasting, it might be done with our own.

The photograph given above shows the artists performing the "Dogs of Devon," which was broadcast from 2LO on January 28th.

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Forthcoming Events

FEBRUARY.

6th (WED.).—Popular Orchestral Night. S.B. from Glasgow.

7th (THURS.).—S.B. from London.

8th (FRI.). — Italian Composers' Night.

9th (SAT.).—Request Night.
10th (SUN.).—Rev. T. H. Maddford, Eastcliffe Congregational Choir.
11th (MON.).—S.B. from London.
12th (TUES.).—Night of Memories Songs with Orchestral Accompaniment.

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CARDIFF. — Cardiff station had rather a slack time last week, the majority of the transmission being S.B. from London —this being due to the railway strike, many of the artists engaged being unable to reach the Welsh Metropolis. It is thought here that Grand Opera is being rather overdone, and signs are manifest that listeners are getting just a little tired of it.

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Forthcoming Events

FEBRUARY.

6th (WED.).—Welsh Night.
7th (THURS.).—S.B. from London.
8th (FRI.). — Lottie Wakelyn's Quartette.
9th (SAT.).—Popular Night.
10th (SUN.).—Rev. Walter E. Rees. Modern Russian Night.
11th (MON.).—Band of the 12th Royal Lancers.
12th (TUES.).—S.B. from London.

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GLASGOW.—Mr. J. C. W. Reith, Managing Director of the B.B.C., and Mr. A. Burrows, Director of Programmes, paid a visit to Glasgow and engaged in conference with the members of the Education Committee on the subject of proposed developments in connection with the local wireless programme. It is proposed to arrange special lectures for transmission during school hours as a supplement to the ordinary education curriculum. The Glasgow Education Authority have expressed a willingness to assist schools in getting wireless equipment, but it is expected that the greater part of the costs will be borne by the schools.

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Forthcoming Events

FEBRUARY.

6th (WED.).—Special Play Night.
7th (THURS.).—Orchestral Selections.
8th (FRI.).—Dance Night.
9th (SAT.). — Popular Orchestral Night.
10th (SUN.).—Rev. Llyle Rodger. The Fellows String Quartette.
11th (MON.).—S.B. from London.
12th (TUES.).—Popular Night.

MANCHESTER.—The aerial at the Manchester station has been considerably improved. Formerly one end was suspended from the top of a high neighbouring chimney and led to the studio on the fifth floor of the building. Now the lower end has been raised to the same height as the higher one, being suspended from another similar chimney. The aerial is therefore T-shaped, and has a height of about 225 ft. At the time of going to press it is impossible to report results, but indications point to a great improvement.

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Forthcoming Events

FEBRUARY.

6th (WED.).—3.30, Concert, Vocalists. 8, Garner Schofield Dance Band. 8.45, Talk by Prof. F. E. Weiss, D.Sc., F.R.S., on "Trees."
7th (THURS.).—11.30, 2ZY Trio. 6.30, Girl Guides' and Boy Scouts' News. 6.40, French Talk. 8, Mr. W. H. Craddock's Glee and Madrigal Prize Choir. Mr. T. H. Morrison, solo violin. Miss Jean Gordon, entertainer.
8th (FRI.).—3.30, Afternoon Concert. 8, 2ZY Orchestra. Mr. Carlton on the British Film Week. Talk by Mr. T. A. Coward, M.Sc., on "Early Flowers and Bird Songs." 9, Miss Doris Barron and Mr. Klinton Shepherd, vocalists. 10.10, Spanish Talk.
9th (SAT.).—Concert by the Henry Monarch's Concert Party. 6.30, Organ Recital, Piccadilly Picture House. Popular Light Music Night. Miss Sybill Gordon, soprano. The Sirfessor.
10th (SUN.).—The Rev. Canon R. Lavers Kemp. The Albert Hall Choir.
11th (MON.).—S.B. from London.
12th (TUES.).—2ZY Orchestra.

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NEWCASTLE.—Newcastle abounds in back lanes and gardens are scarce. Consequently considerable resentment has been felt at a recent decision of the Corporation prohibiting the erection of aerials across these lanes on account of alleged danger to traffic. As a matter of fact, there is very little traffic through them, and letters in the local Press have suggested that petitions should be sent to the Town Improvements Committee asking them to revoke this decision, and that such petitions should be exposed in the local wireless shops for the convenience of any who wish to sign.

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5NO was not content with the relaying of the Burns' Nicht celebrations from Glasgow, but gave us also part of the dinner items in connection with the Newcastle Burns' Club. We hope to have more relaying of events of this nature with a local interest.

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Forthcoming Events

FEBRUARY.

6th (WED.).—3.45, Miss Isabel Forsyth's Students' Orchestra. 7.30, S.B. from Glasgow.
7th (THURS.).—3.45, Miss Ella Dent, soprano. Mr. Dan Jacobs, saxophone. 7.30, S.B. from London.
8th (FRI.).—3.45, Miss Gladys Edmonson, pianist. Mr. Yates, baritone. Mr. Ralph Jacobsen, 'cello. 7.30, Orchestra. Miss Lily Adams, contralto. Mr. Wm. Laws, violin. Mr. Jeffcock, baritone. 10, Orchestra relayed from Manchester Arts Club Ball.
9th (SAT.).—3.45, Clay-Page Trio. 7.30, Mr. W. A. Crosse's Military Band. Mr. Geo. Harris, tenor. Mr. A. Robins, cornet. Miss Norah Studley, soprano.
10th (SUN.).—8.30, Mr. Herman McCleod's Quintette. Miss Evelyn Wilson, soprano. Rev. C. C. Goodlet, Address.
11th (MON.).—3.45, Miss Peggy Campbell, pianist. Miss Edith English, contralto. Mr. T. Golder, cornet. 7.30, S.B. from London.
12th (TUES.).—3.45, Mr. Edward T. Stewart, baritone. Mr. Michael Kelley, saxophone. 7.30, Orchestra. Miss Margaret Thackeray, contralto. Mr. Reginald Lawson, baritone.

□ □ □

Simultaneous Broadcasting Events

FEBRUARY.

6th (WED.). — B.B.C. Dramatic Critic. Savoy Band.
7th (THURS.). — B.B.C. Musical Critic. Magic Flute, Acts II and III.
8th (FRI.).—B.B.C. Film Critic.
9th (SAT.).—Savoy Band.
10th (SUN.).—Vladimoff's Balalaika Orchestra, at 3 p.m.
11th (MON.). — B.B.C. Literary Critic, and Popular Concert, S.B. all stations except Cardiff. Dr. Saleeby, "Tristan and Isolde," Act III.
12th (TUES.).—French Talk.

100-Metre C.W. TRANSMISSION

In Vol. 2, No. 21, an account of experiments conducted on this wavelength was given. The following is a further communication relating to the same experiments.

REFERRING to the experiments conducted by the Bureau of Standards in connection with C.W. transmission on a wavelength of 100 metres, the results of subsequent daylight-darkness experiments were as follows:—Cloudy weather prevailed at both the transmitting and receiving stations. The signals were not clearly audible during the early afternoon. At 3.30 in the afternoon, however, with the sun undimmed at East Pittsburgh, and with cloudy conditions in Washington, strong continuous-wave signals were heard. Interrupted continuous waves could also be received at this time. The strength of the signals exceeded that of those of the previous tests. Fading was noted at 8.15 in the evening, a period of time during which the phenomena are usually observed when receiving on the commonly-used wavelengths.

The Radio Laboratory of the Bureau of Standards, accepting the results of these experiments as a criterion for judgment, concludes that wireless transmission on a wavelength of 105 metres is quite practical over a distance of 300 miles. The advantages of this system of transmission are marked—a reduction of the interference from atmospheric disturbances and by the use of a small frame aerial at the receiving station, the annoyance from "strays" is lessened.

Another series of experiments by Dunmore and Engle have already determined the feasibility of employing a 10-metre wavelength for directive radio transmission. From 10 to 150 metres is practically an undeveloped range of frequencies which offers possibilities for use.

[We shall be pleased to hear from any of our readers who have experimented in this direction.—Ed.]

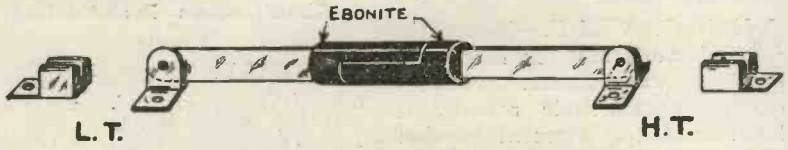
Interlocking Switches

NONE of us is quite immune from those attacks of temporary insanity in which we absent-mindedly do the wrong thing, no matter how good our intentions may be. The idea of an interlocking switch is to make it impossible, for even the most pre-occupied person to close the wrong circuit first.

It is particularly useful when one is using dull-emitter valves, the delicate filaments of which require rather special care. If the high-tension circuit is switched on first a very heavy double strain is thrown upon the filament when the low-tension circuit is closed. Though a valve may stand up to this kind of treatment for some time, its filament is undoubtedly weakened by such a shock, and the time comes when it gives out.

The principle of the switch will be clearly understood from the drawing. The handles of the two switches are cut away with a hacksaw until they are shaped as shown. It will be observed that if when opened the positions of the switch handles are reversed they will fit so badly that the attention of both hand and eye will be called to them. When switching on, the low-tension lever must be moved before that which controls the high-tension supply can be got at. Hence, unless one deliberately sets out to reverse the proper order of things, the plate current cannot be switched on until the filament is illuminated. Many other applications for such a foolproof device will suggest themselves to the reader. It can, of course, be used for double-pole as well as single-pole switches, or it may be so arranged that one circuit cannot be closed until the other has been opened.

R. W. H.



The switch shown in its correct position.

With further reference to the Service Radio Unit Book, which was commented upon in our last issue, the Service Co., Ltd., now state that a copy of the new edition will be forwarded on receipt of two penny stamps to cover postage.

Finding the Resistance of Rheostats

By R. W. HALLOWS, M.A., Staff Editor.

THERE are on the market at the present time vast quantities of very inferior wireless components which because of their cheapness are widely bought by constructors. It is possible to buy cheap things that are good, but in many cases to invest in very low-priced wireless parts is to call for both trouble and disappointment. Rheostats are amongst the worst offenders. To be of any use a rheostat must have a maximum resistance of at least 5 ohms, and it is better that this should be 6 ohms or even a little more. Many of the cheap articles are sold simply as "rheostats," no mention being made of the value of their resistance. Two tested by the writer quite recently proved to have maximum resistances of 2 and 2½ ohms respectively.

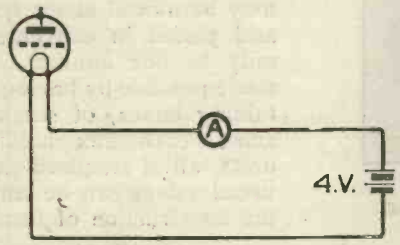


Fig. 1.—How to find the resistance of a valve filament.

Rheostats such as these, if placed in all good faith upon the panel and used with a 6-volt accumulator, would very likely lead to the burning out of filaments, and it is quite certain that valves controlled by them would be worked at far too high a filament potential with a consequent shortening of their valuable lives. No rheostat of unknown make should be used until the amount of resistance that it can throw into circuit has been ascertained. This is not at all a difficult thing to do provided that one has an ammeter, an instrument which should be in the hands of every wireless man. The way *not* to set about the task is to place the rheostat and the ammeter wired in series straight across the accumulator, for should it have a very small resistance value a large current will pass which is not good for the battery, and may burn out the windings of the ammeter. Here is a method which has no such risks and presents few difficulties.

The first step is to ascertain the resistance of the filament of a valve at its normal working temperature. For this purpose a valve of the 4-volt class may be connected to two cells of the accumulator in series as shown in Fig. 1. With the help of the ammeter reading the filament current can now be worked out. By Ohm's Law $R = \frac{E}{C}$. We will suppose that the filament of the valve in use is found to have a resistance of 8 ohms. We now connect up the rheostat under test as shown in Fig. 2, taking care that it is so adjusted that its greatest possible resistance is in circuit. The ammeter reading is again taken. Let us suppose

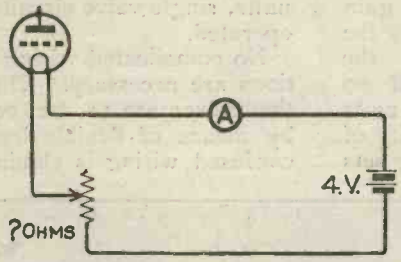


Fig. 2.—Measuring the effect of the filament resistance.

that this is .3 ampere. The sum of the two resistances, that of the filament and that of the rheostat, being in series, *i.e.*, the total resistance in the circuit, neglecting that of the wires which should be as short as possible. Ohm's Law shows us that this amounts to $\frac{4}{0.3}$ or just over 13 ohms. The rheostat has therefore a maximum resistance of rather more than 5 ohms. If one valve is kept for the purpose, the resistance of its filament being checked by the first test from time to time, one can prepare a table of ammeter readings for the second test showing the rheostat resistances that they indicate.

A still better way of making further tests is as follows. A rheostat of good quality is calibrated by the method already indicated, and is used for trying out others. It is provided with a scale marked off in ohms. This is easily made by turning an ordinary celluloid 180 degrees scale upside down and making marks upon it with ink. If the position of the pointer when only the first turn of wire is brought in is taken as indicating zero ohms, and that when the whole of the resistance is in circuit is marked by the figure arrived at by actual test, intermediate readings can be inserted without difficulty. As the voltage drop across the rheostat is quite regular the divisions will be equal. A very exact scale can be made if the turns of wire are counted. Thus supposing that the total resistance of the rheostat is found to be 5½ ohms, and that it contains 220 turns of wire, we know that every 40 turns represents a resistance of 1 ohm. We can thus mark off the scale accurately.

The calibrated rheostat can now be used as shown in Fig. 3, current being taken from a single primary or secondary cell. All that one has to do in making tests is to adjust the pointer of the calibrated rheostat until the ammeter reading is exactly half what it would be if the rheostat were used alone at this setting. The two resistances are then equal, so that the reading on the scale shows the value of the rheostat under test.

Care must, of course, be taken in making any of these tests to see that accumulators or dry cells are up to their full voltage.

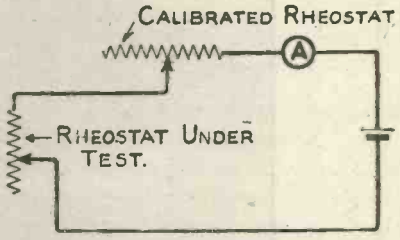


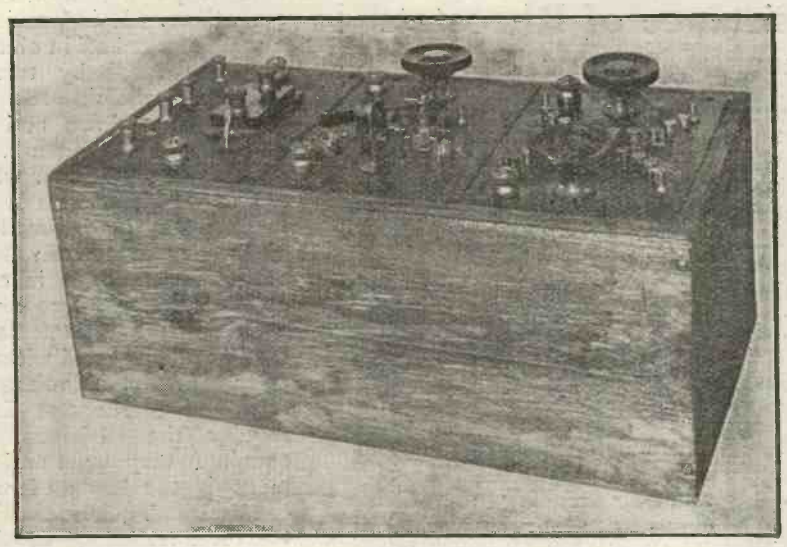
Fig. 3.—A more convenient method.

We are given to understand that Messrs. Harding, Holland & Fry, Ltd., 27, Garlick Hill, London, E.C.4, have been appointed sole selling agents for the British Isles, for telephones and loud speakers manufactured by M. Falco, 7 Rue de Moscou, Paris.

AN EXPE
UNIT R

By H. B

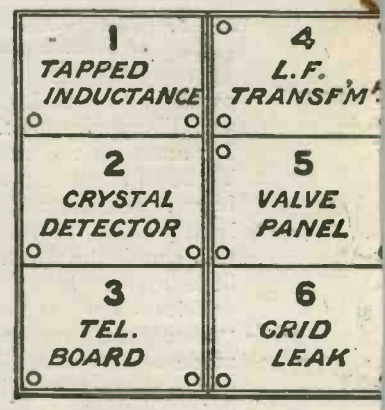
The following article is the firs construction of a progressive un of considerable utility to the h



The first three units complete with their containing box, forming a crystal receiver.

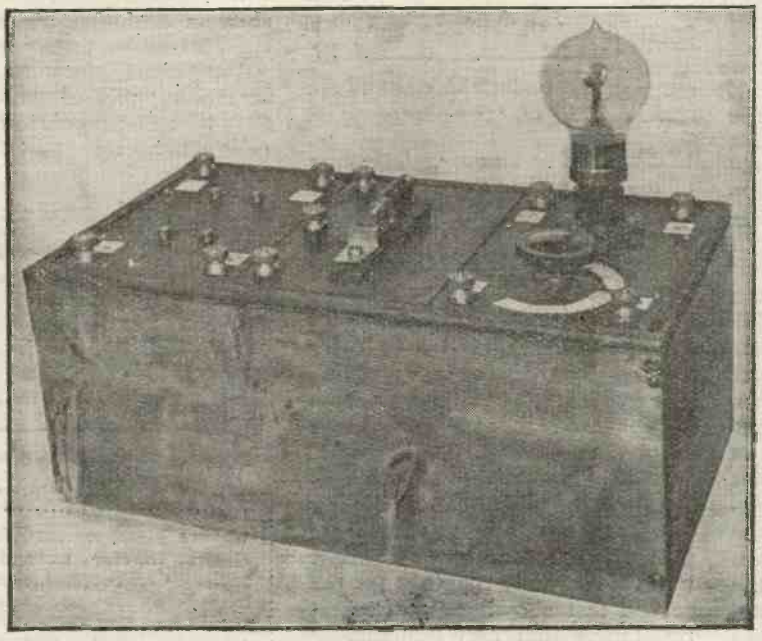
THE receiver to be described in this series of articles has been designed to enable both the beginner and the more advanced experimenter to acquire a number of units by the use of which almost any circuit may be tried. The beginner will gain much practical experience as the work progresses, whilst the advanced experimenter will no doubt appreciate a set of units which eliminates the necessity of making up special receiving sets to try out new circuits. It is not necessary to build up the complete set of units, twelve in all, before results can be obtained. When the first three units are completed, crystal circuits may be tried and, with the first four units, single valve circuits can be operated.

No complicated wiring connections are necessary. The panels themselves are to be connected by means of flexible leads, and confused wiring is eliminated by reason of the fact that the panels may be moved about quite easily and placed in convenient proximity to one another. This is made possible by having four containing boxes, of similar dimensions, each box holding three units, all of standard size. Additional valves can be employed by the construction of further units,



The four containing boxes

which may be fitted into place in any one of the four containing boxes, the complete arrangement in general proving sufficiently comprehensive and flexible to enable most circuits to be operated.



The second series of units which may be used as an L.F. amplifier.

List of Units

The complete set comprises the following twelve units, though, as already mentioned, additional units may be made as found necessary.

Unit No.
1. A Tapped Inductance } Crystal Set.
2. A Crystal Detector } Crystal Set.
3. Telephone Board
4. Low-frequency Transformer } L.F. amplifying unit.
5. Valve Panel } L.F. amplifying unit.
6. Gridleak and Condenser.
7. Variable Condenser.
8. Loading Coil.
9. Double Coil-holder.
10. Potentiometer and Dry Cell.
11. Variometer.
12. Switchboard.

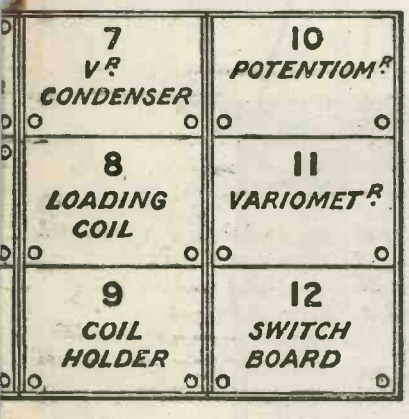
RIMENTER'S ECEIVER

RAMFORD.

t of a short series dealing with the it receiving set which should prove ome constructor and experimenter.

Full constructional details of each of the above units will be given in due course, thus enabling even a beginner to construct the set, with the exception of such components as L.F. transformer, fixed condensers, rheostats and gridleaks, which it is recommended should be purchased.

For short wavelengths, the



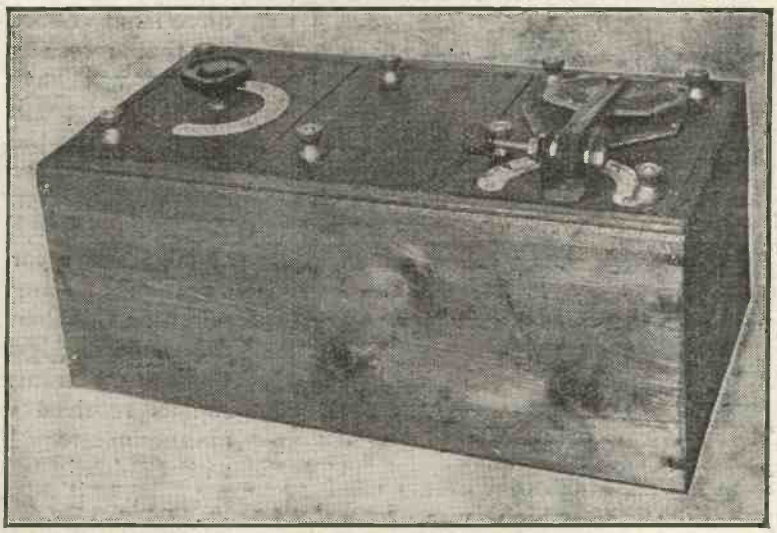
giving a choice of twelve units.

tapped inductance coil or the variometer are to be used. For longer waves a loading coil may be added, whilst the complete range of wavelengths at present in use may be covered by the use of the two-coil holder in conjunction with the variable condenser.

The Utility of the Set

One of the chief points of interest, from an experimental point of view, of a set of this description, is that not only may almost any published circuit be tried, but original arrangements may be tested with a minimum of trouble and expense. thus affording a fair scope to the experimenter's inventive powers. One of the principal drawbacks to individual investigation has probably been the expense of making up innumerable sets, which, if original, may be more or less speculative. The set to be described in these articles is intended to overcome this difficulty as far as possible.

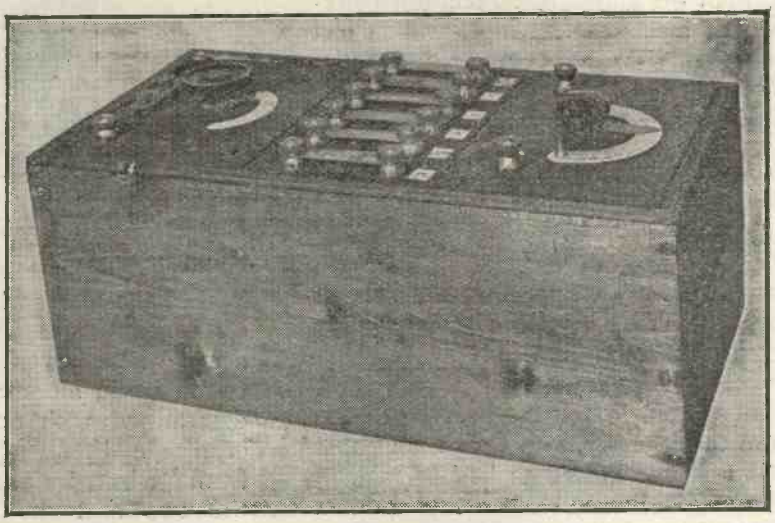
A beginner will find it a good plan to construct one or two complete units each week and experiment as the set grows. A considerable amount of practical experience will be obtained in this manner, and the writer will endeavour to describe exactly what can be done with the set as the different units are added.



The third series of units which provides for reaction and wavelength range extension.

After the first three units have been described, a selection of practical circuits will be given with each additional unit. Subsequent units to be described will enable a valve to be employed as a low-frequency amplifier, whilst further single valve circuits will be described in due course.

The photographs show the four wooden containing boxes complete with their three individual units, and the descriptive details in future issues will be fully illustrated.



The fourth series of units comprising potentiometer, variometer and switchboard.

Wireless for Ships' Lifeboats

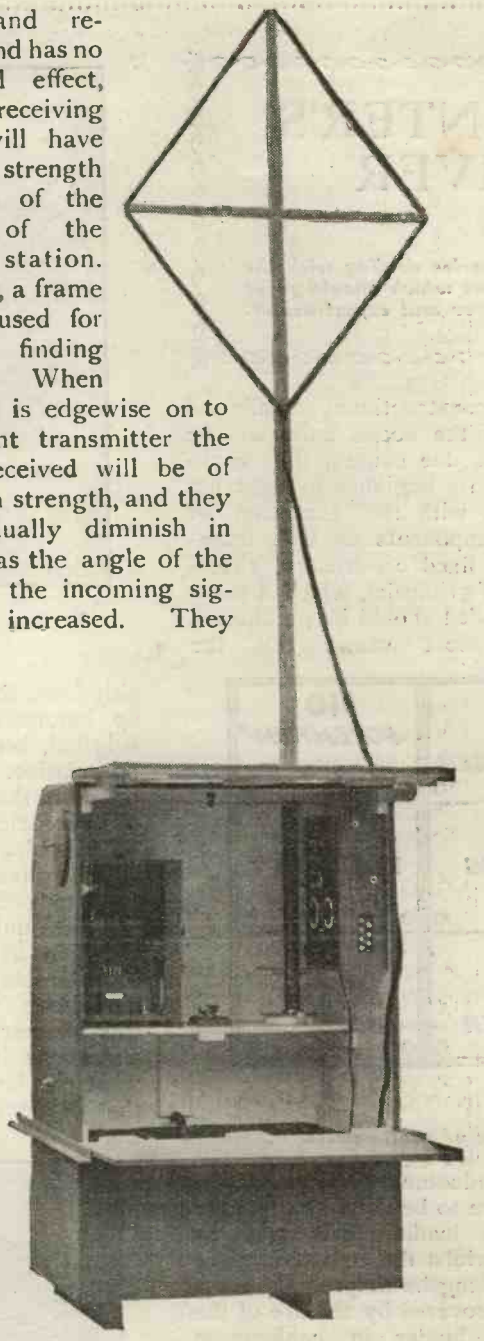
The following article gives a brief idea of an improved lifeboat set by the Marconi's Wireless Telegraph Company, Ltd.

THE improved Marconi wireless set for ships' lifeboats, which was recently demonstrated at Gravesend before the Seafarers' Joint Council, represents great advances in apparatus of this kind in three directions. In the first place, the transmitting power is about four times that which could previously be obtained, with a corresponding improvement in range of about fifty per cent. Secondly, the arrangement of masts and aerials is such that they can easily be handled in an open boat at sea, and the apparatus and operator are afforded adequate shelter from the weather. And, thirdly, the directional receiver enables the actual direction of a rescuing vessel to be determined with sufficient accuracy up to the full distance over which boat signals can be received by ships' apparatus in most common use.

The worst conditions in which a set is likely to be used is in the standard 26 feet open lifeboat, in which masts 22 feet high and 24 feet apart can be fitted without over-rigging the boat. With such an aerial, the Marconi set can be relied upon to draw the attention of any ship at a distance of at least fifty miles over sea. This necessitates the use of a 600 metre wave, and of spark telegraphy, and involves a power of nominally $\frac{1}{4}$ kw.

In the earlier type of direction finder the instrument enabled the operator to ascertain that a given station was on a line running (say) due east or west, but did not indicate in which of these two directions it actually lay. The new instrument gives the bearing of the station from the receiver, and is of the utmost value when a ship's crew has had to take to their boats as it allows the boats to inform the rescuing ship of the direction in which she should steer in order to pick them up.

Two aerials are used in this system. One, termed an open aerial, is used both for transmission and reception, and has no directional effect, so that receiving signals will have the same strength regardless of the bearing of the distant station. The other, a frame aerial, is used for direction finding purposes. When the frame is edgewise on to the distant transmitter the signals received will be of maximum strength, and they will gradually diminish in strength as the angle of the frame to the incoming signals is increased. They will be inaudible when the frame is broadside-on to the transmitting station. The open aerial alone gives no idea of direction; the frame aerial alone allows the direction to be determined with accuracy but does not discriminate between "towards" or "away from"; but, by an ingenious combination of the two and the production of a certain "phase difference" the one receiving set, connected to both aerials, enables the "towards" to be distinguished from the "away from" direction.



Photograph of the apparatus showing the frame aerial.

A Vernier Attachment for Condensers

WHEN dealing with the weak signals that one encounters when engaged in long distance reception such as that of American broadcast telephony, it is almost essential to have some kind of vernier attachment for the aerial tuning condenser in order to be able to make the very fine adjustments necessary. With an ordinary condenser adjustment it may be found impossible to make the tiny changes in capacity that are often needed to convert faint and unintelligible sounds into clear speech or music. A vernier fitting of the type to be described does not interfere in the least with the ordinary use of the condenser for searching or making rough settings, but when small changes are called for, it renders adjustment about ten times as fine, thus very much simplifying the task of the listener.

Fig. 1. shows an attachment that may be very easily fitted to any condenser not provided with a rotating dial. It consists of a large toothed wheel, such as can be obtained from a clockmaker, with which meshes a small pinion, the gear ratio between the two being as large as possible. The size of the toothed wheel will be limited by the amount of space available. Most condensers of the type shown are fixed to the panel of the set by two bolts. If these are placed close together, fresh holes, as far apart as may be, should be drilled, so that the greatest possible amount of space is available. Short distance-pieces made from ebonite tube will keep the top plate of the condenser away from the panel and allow room for the gears.

The hole of the toothed wheel is enlarged to 2B.A. clearance, and it is then mounted upon the spindle, either by means of a set-screw through its hub, or of a pair of nuts placed above and below it and locked tightly. The pinion is mounted upon a spindle made from $\frac{1}{8}$-in. brass rod or 4B.A. studding. The rod can either be screwed into it or soldered. It must be so mounted upon the panel that it does not foul the ebonite of the condenser. The best place for it is that shown in Fig. 2, where it is quite out of the way. A small bush for its spindle should be made from a piece of $\frac{3}{8}$-in. round brass rod, or a standard 2B.A. bush can be adapted by screwing a length of 2B.A. studding into it, cutting off short, rivetting the ends and redrilling. A little knob can be made from a piece of $\frac{1}{2}$-in. round ebonite rod.

If the pinion is mounted as shown in the drawing it is always in mesh, simply spinning when the main knob is used to rotate the condenser vanes. It is quite easy to make it mesh with the toothed wheel only when required in the way shown in Fig. 3. Here a spiral spring is placed between two washers below the knob. The action of this spring draws the pinion up against the panel and throws it out of play when it is not actually in use. By pressing the knob down one causes it to mesh with the toothed wheel when it is required.

Condensers fitted with rotating dials can also be provided with a vernier attachment in the way shown in Fig. 4. Here it is necessary to obtain a toothed wheel almost as large as the dial itself. This is screwed to the underside of the dial as shown in the drawing, and is made to mesh with either a toothed wheel or a pinion of suitable size mounted upon the upper side of the panel. In this case again the small wheel may either be allowed to remain permanently in mesh or may be provided with a spring attachment to throw it out of play. The spring will be mounted below the panel so as to draw the pinion down. One's action when bringing the vernier into use is to pull the knob upwards so as to mesh the teeth before turning it. R. W. H.

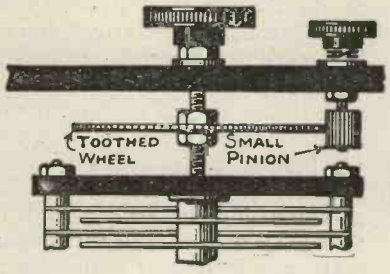


Fig. 1.

Illustrating constructional details of the vernier attachment.

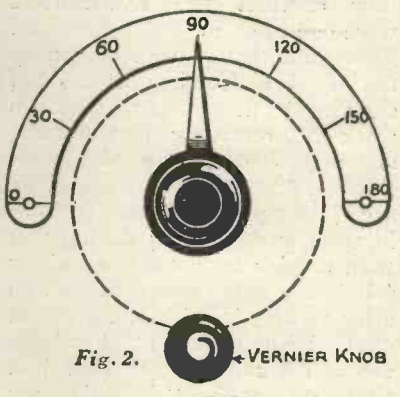


Fig. 2.

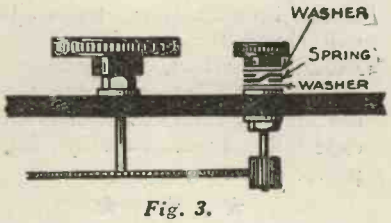


Fig. 3.

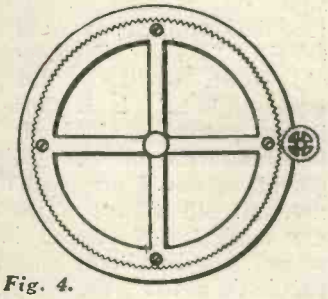


Fig. 4.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

Some general remarks relative to the wants and needs of the experimenter and home-constructor.

NOW that wireless transmitters are organised, I hope someone will take up strongly the question of proper signing off during the transmissions. This question has been raised periodically and at times there is an improvement. About two years ago, it was pointed out how careless the transmitters were getting in this direction. Many of us have little opportunity during broadcasting hours of carrying out proper research work on receiving instruments, and in such cases the weak signals from distant amateur transmitters are of the greatest value. Nothing is more exasperating during test than to pick up some transmitter (obviously many miles away) and after tuning in with the greatest care, with pencil at hand to record his call sign, to hear him sign off with "What's my modulation like now, old man, OVER!" or "Well, cheerio old sport, closing down now, good night!" It is those who have recently obtained their licences who are the biggest offenders, and I am glad to say that our old friends of the ether are meticulously careful in this regard. Furthermore, many people do not like the "superior" attitude adopted by some of the newer transmitters. The permission given to them to operate on certain wavelengths carries with it a number of obligations, not the least of which is to allow fair play to others by not "hogging" the ether for long periods at a time with a futile talk.

★ ★ ★

Have you noticed the practical absence of a carrier wave during certain of the American broadcast transmissions? In common with many other experimenters I have noticed that speech and music will rise and fade away without one being able to detect more than the barest trace of a carrier wave. The effect is not easily explained, although it has been noticed by numerous receivers.

★ ★ ★

Those readers who have very sensitive receiving sets, and are troubled by interference, will often find it a great advantage to do their receiving on an indoor aerial, particularly if the set has more than one stage of high-frequency. A well-designed set with two-stages of high-frequency should be good enough to receive all British broadcasting in fair comfort in the telephones, using a small indoor aerial, and although the strength from distant stations will be less than with an outdoor aerial, the ratio of wanted to unwanted signals will be far higher. On the local station you will probably be able to detect very little difference in strength if you are using a loud-speaker, while on distant stations the local broadcasting transmitter will cause far less interference. Aerials in which the proportion of height to length is great are particularly liable to interference, especially from near-by high-power stations.

★ ★ ★

It is very unfortunate that accumulators for wireless are still sold with the ignition capacity marked on them. The beginner is told to purchase, say, a 30-ampere-hour accumulator, and on going to a shop he may purchase one which has really a capacity of only 15 actual ampere hours. When accumulators are made for motor-car work, and are used for wireless as well, there is, of course, a reason why the ignition rating should be marked on the cells, but when these batteries are made specially for wireless work there is no excuse whatever. I was surprised to find in the shop of a well-known wireless firm the other day an accumulator with the ignition rating marked on it, although the battery was plainly labelled "Blank's *Wireless* Accumulator."

★ ★ ★

Why is it that the manufacturers of 0.0003 μF fixed condensers will not realise that a very large percentage of these condensers are used in conjunction with grid leaks which must not on any account be placed *across* the condenser? There must be thousands of tuned anode sets built, or being built, at the present time, and to sell the constructor of such a set a grid condenser with clips to place the leak across it is to give him something he doesn't want. It would be such a simple matter to arrange the clips on a fixed condenser so that the casing carries the leak in a suitable manner for connection in such circuits, that I wonder it has not been done long ago. As it is, the builder of a tuned anode set buys a condenser with clips that he does not require, and purchases a second set of clips which he must mount on ebonite.

★ ★ ★

Another instrument badly required at the present time is a cheap and reliable wavemeter for wavelengths between 1,000 and 4,000 metres, so as to enable the listener to tune his receiver to the Continental broadcasting. There are several excellent wavemeters covering the British broadcasting range, but, unfortunately, those which have a longer wavelength are too expensive. Experimenters who have been in the game for some time generally use one of the Townsend wavemeters (ex-Government instruments), but these are very broad in their tuning and only occasionally reliable. Furthermore, their buzzers are diabolically troublesome instruments, requiring much banging on the box to get them under way.

News of the Week

ACCORDING to *Reuter's* a complaint by the Federal Trade Commission charges the principal corporations engaged in the manufacture and distribution in the U.S.A. of radio equipment and the rendering of radio service, with creating and maintaining a monopoly in radio apparatus and communications. The various companies are cited to answer within thirty days a charge of violating the law regarding unfair competition.

□ □ □

We learn from the *Morning Post* that loud-speakers have been installed in the Winter Garden Theatre, and the gallery is now entertained by the B.B.C. programmes prior to the rise of the curtain on "The Beauty Prize."

□ □ □

The number of new wireless receiving licences issued recently has very considerably increased. During November and December more than 80,000 new licences were issued, and at the end of the year 596,000 in all had been issued. Since we understand that the increase is continuing at the same rate, it is safe to assume that there will now be over 600,000 licenced sets in Great Britain.

□ □ □

We learn from an Irish correspondent that wireless enthusiasts in the Free State have been perturbed by a report that the Government is about to confiscate all broadcasting receiving sets within its jurisdiction. The position in regard to broadcasting in the Free State is very obscure. Licences have been withheld by the Government, and the whole question is under review by a Committee of the Free State Parliament. It is, however, an open secret that large numbers of wireless sets are in constant use throughout the country, and it is estimated that there are 500 in Dublin and district alone. The owners of these receiving sets are both willing and anxious to buy licences, but the attitude of the Government has been so unsatisfactory that they have taken the law into their own hands and continue in the illicit reception. Quite a considerable industry has sprung up in Dublin during the past few months, and many firms have been making large profits on imported sets.

□ □ □

To meet the emergency conditions when telegraph and telephone lines were down in various directions following a severe storm, a section of the Southern Pacific Railway, U.S.A., was recently operated by utilising wireless facilities. Orders were sent from one Government wireless station to another, and by telegraph between them and the railway stations on routes where inter-station telegraph communication was not available.

□ □ □

A number of inquiries have been received with regard to where hard-drawn square-section tinned copper rod for connecting purposes may be obtained. For some weeks past this material has been advertised in our small advertisements column by Sparks Radio, of 43, Great Portland Street, London, W.

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The new wireless station which has been built at Monte Grande for the purpose of placing the Argentine in direct wireless communication with North America, Europe, and the Far East, will maintain direct services with New York, Paris and Berlin. We understand that it is intended to extend this direct service to England as soon as possible, but since there is not a station in this country sufficiently powerful to communicate with South America, this service cannot be brought into operation until a suitable station is available. The aerial of the new station is supported by ten steel towers, 500 metres apart, each tower being 690 ft. high. The power of the station is 800 kilowatts.

□ □ □

Lieut.-Col. Norman Harrison, C.M.G., D.S.O., M.I.E.E., who retired last November from the Under-Secretaryship, Department of Posts and Telegraphs of the Union of South Africa, and who, for many years previous, was Engineer-in-Chief, has joined the directorate of the Western Electric Co., Ltd., and will shortly return to South Africa to take up residence there in the interests of that company.

THE RAILWAY STRIKE.

Owing to difficulties in connection with the distribution of the last two issues, many readers were unable to obtain their copies. Will all who experienced this kindly apply at their usual bookstall, where adequate supplies of the issues in question are now available?

High-Frequency Coupling in Valve Receivers

THE article appearing in our last issue dealing with the Grebe circuit, and the article by Mr. Harris in this month's *Modern Wireless*, may quite possibly cause the popular interest in tuned anode coupling to receive a check.

The greatest disadvantage of the tuned anode circuit for coupling a high-frequency amplifying valve to a second high-frequency amplifier or a detector, is that as both the grid and anode circuits of the valve are tuned to the same wavelength, self-oscillation is more than probable. The idea that I gave the other day for preventing undesirable self-oscillation when using tuned anode circuits which consists in connecting a variable 100,000 resistance across the tuned anode coil, is being taken up widely, and should do a good deal to eliminate the criminal oscillation which is becoming, in many quarters, a positive nuisance.

It is not of much use to advise the culprits merely to loosen their reaction coils. In many cases, a high-frequency amplifying valve using a tuned anode circuit will oscillate, even if the reaction coil is entirely away from the aerial coil, the coupling between the grid and anode circuits being accomplished, chiefly, by the capacity between the grid and the anode inside the valve, and the leads going to these electrodes. Even a reversal of the reaction coil will very often not prevent self-oscillation. The only thing that the experimenter can often do is to dull the filament of his high-frequency valve, or to reduce the high-tension voltage. The latter expedient will usually decrease the amplification obtained with any subsequent valve, such as a low-frequency amplifier.

The expedient of connecting the bottom of the grid circuit to a point on a potentiometer connected across the filament battery, or simply connecting the bottom of the grid circuit to the positive terminal of the filament battery, is not very satisfactory. Rectification is bound to occur, and I much prefer the effective method which consists in using the 100,000 ohm variable resistance across the tuned anode circuit.

It must not, however, be imagined that by holding down the valves in an artificial manner like this, or in any other artificial way, ideal efficiency is going to result. If we assume that a valve will amplify seven times, it must not be assumed that this degree of amplification is obtained in the case of high-frequency currents. In most high-frequency amplifier circuits, any attempt to obtain really efficient high-frequency amplification will result in the valve oscillating, and if we prevent it oscillating by some artificial means, the degree of amplification may be only two.

If a set happens to be so designed that it will oscillate very readily, it does not mean that the valve is acting efficiently as a high-frequency amplifier, the amplification may only be twice, and yet the valve may oscillate readily. If we now introduce damping into the grid or anode circuit we may stop the valve oscillating, but the degree of amplification may be even less than twice.

Mr. Harris's article will, no doubt, cause many experimenters to try out the tuned transformer, using a tuned grid circuit and an aperiodic anode circuit. Whereas in actual practice we have been accustomed to use transformers of the fixed type, the advantages to be gained are apparently only realised when the coupling between the aperiodic anode coil and the tuned grid coil is variable. The coupling is more or less critical; too weak a coupling will result in loss of signal strength, and too tight a coupling will have the same effect, and, moreover, tend to make the circuit more unstable.

The transformer method of coupling using variable coupling is very readily accomplished by means of plug-in coils. The Gambrell coil, by virtue of its low self-capacity, appears to be very successful when used as the aperiodic anode coil.

"A REALLY SELECTIVE TUNER"

(Vol. 3—No. 4.)

We learn that many readers are experiencing difficulty in obtaining the cardboard tube 7 inches in diameter required for the aerial variometer.

Mr. Cowper (the designer of the receiving set in question) informs us that a 6-inch or 5-inch diameter former may be used quite satisfactorily and that, owing to the increased coupling between rotor and stator windings, the wavelength range will be slightly extended, whilst the movement of the rotor will be found somewhat more critical than when using the 7-inch former.

An Adaptor for Myers Valves

MANY readers have no doubt come across the excellent little Myers valves which are made in two types. There is a bright emitter requiring a filament voltage of about 5, and a dull emitter working with 2½ volts or less. Both valves are of the same shape and size, and neither will fit into a holder made to take English or American valves. It is extremely easy, however, to mount them upon their own valve-holder, since special clips are to be found boxed up with each valve, and on one of the sides of the box is a drilling template. Still, most wireless men will no doubt want to be able to use the valve, at first at any rate, without making such radical changes in their sets as would be required if the clips were mounted directly upon the ebonite panel. Here is a little adaptor enabling the valve to be used in the standard English 4-leg socket, which the writer has found most useful. It can be made up in less than half an hour, and its cost is trifling.

Two pieces of ebonite are required, both ¼ in. thick. One of these is 4½ in. in length and 1½ in. wide, the other 1½ in. square. The long piece is laid out and drilled, as shown in Fig. 1. The template printed upon the valve box can be used for laying out purposes so long as it is placed so that the bottom row of holes is 27/32 in. from the lower edge of the ebonite.

In the lower edge of the upright member of the adaptor two 4-B.A. holes 1 in. apart and ½ in. deep are drilled and tapped. These are for the two countersunk screws used to attach the

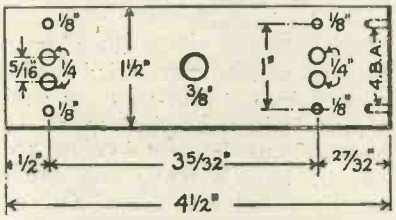


Fig 1.—Dimensions and drill-holes of the valve mount.

horizontal member to it. The writer has met one or two people who cannot quite see how the clips were meant to be fixed to the ebonite. The ends made with small grooves in them to fit the wire connections in the valve caps should be passed through the ¼ in. holes from the back of the upright. The clips are then secured by passing the screws

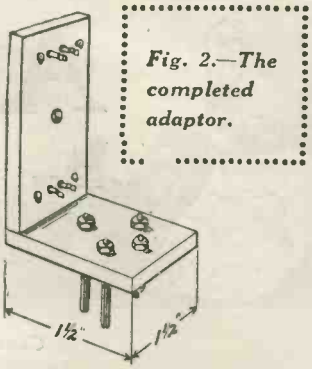


Fig. 2.—The completed adaptor.

through from the front and turning the nuts tightly down. The purpose of the ⅜ in. hole is to give sufficient clearance for the "pip" of the valve. Fig. 2 shows how the horizontal member is made and fitted to the upright. The wiring should be done with fairly stout material covered with systoflex. Care must be taken to keep plate and grid leads well apart, otherwise the valve's special low capacity qualities will be neutralised by the capacity between leads.

If it is desired to make up a horizontal adaptor this is very easily done by using a piece of ebonite 5 in. in length for making the strip upon which the clips are mounted, and laying it out so that the centres of the lower row of holes are on a line 1.11/32 in. from the edge. This will leave plenty of room for mounting four valve pins spaced in the standard way for English holders.

R. W. H.

A LOOSE-COUPLED CRYSTAL RECEIVER

(Concluded from Vol. 3, No. 7, page 209).

Connections

The connections of the complete set are shown in Fig. 5. The beginning of the primary

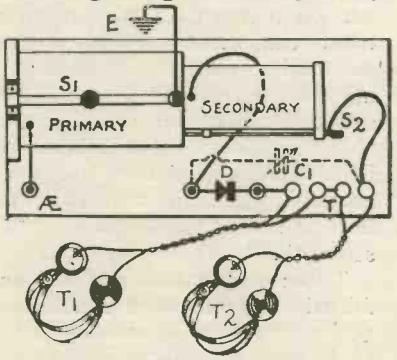


Fig. 5.—Wiring arrangements.

winding is attached to the aerial terminal, whilst the end of the primary is fixed but unconnected. The terminal attached to the plunger rod acts as an earthing terminal. The beginning of the secondary winding is attached to a terminal by means of a flexible lead of a suitable length, which is in turn connected to the cat-whisker end of the detector. From the other end of the detector we pass to one of the telephone terminals, and from the remaining 'phone terminal we pass a flexible lead to the slider. The end of the secondary winding is also fixed and unconnected. A variable condenser may be placed across the secondary coil if desired. The theoretical circuit is shown in Fig. 6.

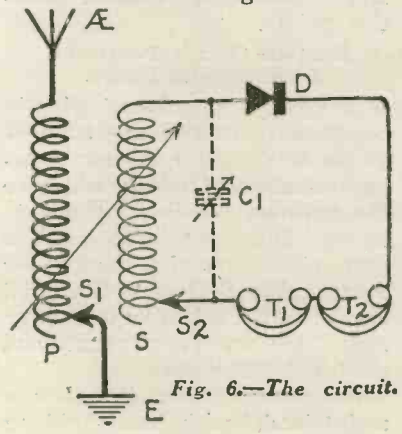


Fig. 6.—The circuit.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

B.B.C. Crystal Set

A small crystal set of neat design and very modest price is the "Midge," submitted for test by the G.H.J. Trading Co.

This has a sliding-contact type of variable inductance wound on the exterior of a cylinder covered with imitation leather, which forms the body of the receiver. A small circular ebonite panel at the top carries the detector and 'phone terminals; contact with the inductance is made by a spiral on a small side spindle.

On a P.M.G. aerial it tuned, on test, from below 300 to just over 600 metres. The signal-strength, measured on the local broadcasting station's carrier-wave, was quite a high percentage of the standard; the inductance being wound with No. 24 enamel wire, and of reasonable length. Aurally the reception was very clear.

"Atomite" Crystal

A sample of "Atomite" crystal, of the galena type, has been submitted by Messrs. Beech & Co.

This on trial showed rectifying properties which compared favourably with the average of sensitised galenas, and gave excellent clear reception, with a large number of available sensitive points.

Plug-In Circuit Parts and Experimental Panels

A type of panel and plug-in components particularly adapted to the needs of the inveterate experimenter, and which will give the greatest possible latitude in trying different "hook-ups," is that placed on the market by Messrs. W. G. Pye & Co., well known to the scientific worker as manufacturers of physical and electrical instruments.

In these the "unit" system is maintained, with small oblong panel units which are connected by brass conducting-bars for H.T. and L.T., and intervalve coupling. The panels, about 9 and 10 ins. by 4 ins. in size, carry a socket-fitting for the valve horizontally in the interior of their bases, while the plug-in fittings, of the most varied kinds, plug into four-way valve-socket fittings on the top of the panel. Thus the actual valves are out of harm's way, and great facility of interchange of fittings is possible, without trailing wires. Even the 'phones on the last unit are connected to a small plug-in panel which takes the place of intervalve coupling-devices. Grid-control terminals are provided on each panel unit;

The "Midge" Crystal Receiver.

on one type reaction-terminals are found, whilst on the other a terminal appears for the tuning-condenser in tuned-anode coupling. The necessary filament resistances are in sight on the top, partly imbedded in the panel.

The panels were tried with various combinations of circuits, and were found to be most convenient in use, and admirably adapted for rapid changes of circuits in experimental work. The finish and workmanship will appeal to the most discriminating. The detector unit in particular is suitable as a nucleus of more pretentious receiving apparatus, for those starting valve work, as it incorporates a grid-leak and condenser of suitable value, and can be quickly adapted for reception with but small additional apparatus.

Of the several plug-in fittings provided, the separate tunable anode coil gave good signals over the range from 350 to over 600 metres with a separate parallel 0.0002 μF variable condenser; the complete mounted unit (with grid-leak and grid-condenser complete) gave the stations satisfactorily over 300 to 600 metres with a 0.0002 μF tuning condenser, and was fairly selective in action. The H.F. plug-in type transformers covered effectively the range from 370 to 500 metres, when tuned with a 0.0002 μF condenser, but the selectivity was not marked. Two resistance-units, for resistance-capacity coupling, showed correct value of resistance, etc., on measurement, and were built up of reliable makes of components. Good amplification resulted with the complete unit, using proper value of H.T. The open terminal-block (for wiring up separate components) and telephone terminal unit were effective on trial.

The very interesting type of L.F. intervalve transformer, to which reference has already been made in these columns, in connection with a four-valve receiver from the same makers, gave most admirable results on separate test in this convenient form, great amplification and remarkable freedom from distortion being obtained. The No. 1 in particular gave in a dual-amplification circuit remarkable signal-strength.

These components can be confidently recommended for the experimenter who is anxious to try each new circuit as it appears with the minimum of troublesome

wiring, and at the same time wishes to be free from the risk of poor performances as the result of using unreliable components.

"Exelite" Crystal

A crystal of the sensitised galena type is "Exelite," marketed by Messrs. T. E. P. Gibbs, which we have recently put to test. This is a brightly granular crystal, and with the usual type of fine cat's whisker it gave, when tested on local broadcast transmissions, excellent reception and a signal-strength quite up to the standard of good artificial galena.

A Crystal and Cat's Whisker

A type of galena crystal and special cat's whisker, for which are made claims of extraordinary long range of successful broadcast reception, is that produced by the National Wireless & Electric Co., Ltd., samples of which we have had recently an opportunity of submitting to thorough test.

The crystal provided showed a high degree of sensitivity almost everywhere over the surface, and also on a freshly-broken surface. With an ordinary cat's whisker the signal-strength, measured quantitatively on the local broadcast carrier-wave, was equal to the best of other types of proprietary sensitised galenas; aural reception was proportionately good and clear. The special cat's whisker gave similar results, and ease of setting.

As the combination gave, on careful measurement, precisely the same as the usual optimum with a good crystal and crystal-setting, no more than the usual range of reception was to be expected, with an efficient low-resistance variometer as tuning device, and ordinarily suburban aerial; this was confirmed on test. No doubt on an exceptionally good and high aerial it is possible to pick up quite distant stations late at night and on favourable occasions, even without the help of the local oscillators; but these conditions are obviously not readily reproduced.

For local transmissions this crystal combination can be heartily recommended, giving excellent signal-strength and ready setting of the crystal.

A Battery Charger for A.C. Circuits

Messrs. Lionel Robinson & Co. have submitted for trial an "Ella" battery charger, which operates directly from an alternating-current supply. This is of the vibrating armature type, and gives full wave rectification, there being two contacts, one on each side of the vibrating tongue, and apparently a split transformer. This is rated at 1-15 amperes and 9 volts maximum D.C. output, and is wound for various standard primary voltages and frequencies.

The apparatus is quite light and compact, measuring about 5 in. by 7 in. by 7 in. high, and can be put out of the way on a shelf or under the table, as it needs little or no attention once the contacts have been adjusted. The power taken from the mains appeared to be quite small, and it could be run successfully from a plug inserted in a lamp-socket on an already heavily-loaded domestic circuit.

The makers suggest that the adjustment of the contacts should not be interfered with at first. However, the writer found it

necessary to make careful adjustments in order to get a full charging rate of some 3 amperes on a 6-volt accumulator, running the machine from the 240-volt mains. Properly set, it ran steadily, with a loud hum (but inaudible outside the room when mounted on soft packing) for hours without requiring attention, and with moderate heating. The sparking at the contacts was but minimum; as these take the form of substantial carbon brushes, they should last a very long time before needing renewal, and are the only parts of the machine subject to wear.

With a 4-volt accumulator, the charge rate rose to nearly 10 amperes, but was readily cut down to a safe rate by a small series resistance.

The machine is substantially constructed, being obviously designed by an engineer. A centre-zero ammeter is incorporated, showing the charging rate and indicating if all is correct. A strong point is that, in case of failure of the primary A.C. supply, the vibrating armature returns to a position of rest where contact is broken for the accumulator circuit, so that there is no fear of discharging the battery through the machine in such a case; it can accordingly be left with safety for long charges.

We note that the price asked is really quite reasonable for a machine that gives the impression of being built for real and lasting service.

Variable Condensers for Board-Mounting

Messrs. Bowyer-Lowe Co., Ltd., have submitted for test samples of their variable condensers for mounting on a board or wooden panel of nominal capacities 0.0003 and 0.0005 μF respectively.

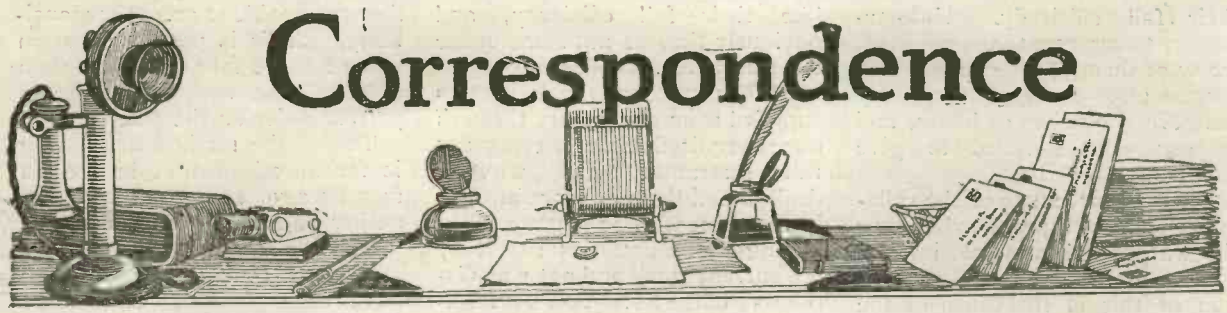
These are built up under a 4-inch circular panel of ebonite, which is designed to fit into and over a hole of corresponding size in the wooden panel or baseboard, fixing by means of four small wood-screws. The depth of each is about 3 in., the different capacity being obtained by different spacing of the plates. An exceptionally clear bevel scale is provided, which is at the same time a metal anti-capacity shielding plate. Contact to the moving plates is made positively by braided copper "pig's tail." Soldering tags are provided for connections.

The instruments are substantially constructed, and highly finished on the exterior.

Careful measurement showed in the case of the larger one an actual maximum capacity considerably above the rating and adequate insulation resistance; the minimum capacity was around 5 per cent. of the maximum. The smaller one showed excellent insulation resistance when tested by the "Meg" with 500 volts; a maximum capacity very close to the nominal, and a minimum capacity of about 8½ per cent.

A Low-Capacity Switch

Messrs. Dubilier Condenser Co. (1921), Ltd., have submitted for test one of their "Minicap" switches for H.F. and general radio-switching. On test the measured capacity across the terminals was found, as desired, to be negligibly small, and the switch proved available for the most various purposes, wherever a double-pole two-way switch is called for.



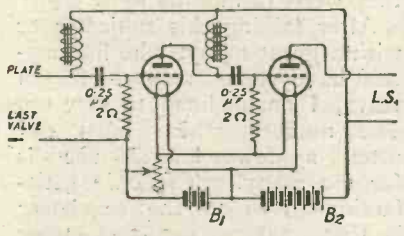
CHOKE COILS.

SIR,—Referring to your notes on choke coils in *Wireless Weekly*, Vol. 3, No. 1, I should like to say I have used this circuit for experimental loud-speaker work, employing 2 choke coils in place of the transformer, as shown. The results were excellent, there being practically no distortion, and amplification was as good as when using 2 stages of transformer coupling. I found that when using either one or two stages the high-tension required was not so great as when using transformers. I used Ediswan A.R. type valves with 40 volts on the plate. The great thing about this circuit is its low initial cost and also the quality of tone obtainable. The chokes used were the secondaries of intervalve transformers, but two "Ford" ignition coils were just as good.

—I am, etc.,

W. M. BLACK BAKEWELL

Stoke-on-Trent. (6UZ).



The Circuit referred to by Mr. Bakewell.

FULLER'S AND DISPOSAL BOARD ACCUMULATORS

SIR,—It is common knowledge that a great many wireless enthusiasts are using Fuller Block batteries purchased at low prices from various dealers who secured them from the War Disposals Department. Many of these batteries were purchased in France, and have been brought over here and offered to the public, and many are giving good service.

As the majority of these batteries are over five years old, some even older, it is obvious to those who know anything about accumulators that they cannot be expected to give anything like

their full efficiency. Unfortunately, to aggravate the position, many of them have been put into service after charging for only the normal number of hours, and in consequence failed to give satisfaction.

Then, again, much of the celluloid which was produced during the war period was of inferior quality, and the natural deterioration of this is the cause of the frothing which may develop in some of these war-time batteries.

It is quite obvious that we cannot take any responsibility for the performance of these batteries; at the same time we would like to point out that a higher efficiency can be obtained even from these old batteries if the initial charging is carefully carried out. The first charge should last at least three times as long as the normal charge of an ordinary battery, and where practicable we would advise charging at a low rate for probably at least 100 hours, or until the volts and gravity have reached their maximum figures. It is only fair to point out, however, that even with the best treatment these old batteries cannot be expected to give anything like their full efficiency, and obviously they do not come under our guarantee.

All our standard batteries, as supplied from our factory through our recognised dealers, carry our full guarantee, and wireless dealers and the public are strongly recommended to ensure when buying Block batteries that they are current stock and not war disposals batteries.—Yours faithfully,

FULLER'S UNITED ELECTRIC WORKS, LTD.,
(Signed) F. J. Gordon.

VALVES.

SIR,—I am afraid I am opening a big question when I ask, are valves as reliable to-day as they were 12 months ago?

After talking this subject over with a great many, who like myself have some respect for a valve, I am inclined to say, no. The number which burn out after a few hours' use is far too many. The only satisfaction given to the purchaser is that makers say they were tested and carefully packed before leaving the factory, and they are unable to accept responsibility. This is poor consolation when a valve fails after less than 4 hours' use with everything in perfect order on the receiver.

To-day the method of packing is far ahead of that in use 12 months ago, and I am not altogether happy in the excuse of "transit damage."

I have to-day valves which have seen plenty of use and a fair amount of misuse over a period of twelve months, during which period they have travelled over 1,000 miles by parcels post, passenger train, in the pocket, handbag; in fact, any way. These are still working.

Another point which seems to knock the bottom out of the transit theory is the fact that if one asks for reports *re* the life of valves made abroad, which are, of course, subject to more transit than are those made in this country, seldom are reports as stated above.

Perhaps a little discussion upon this subject will be interesting. Meantime I sign myself

"DIS-SATISFIED."

Bristol.

Information Department

O. T. (COUNTY DURHAM) asks why it is that with an old high-tension battery his two - valve low - frequency amplifier persistently howls, whereas with a new battery it behaves in a perfectly satisfactory manner.

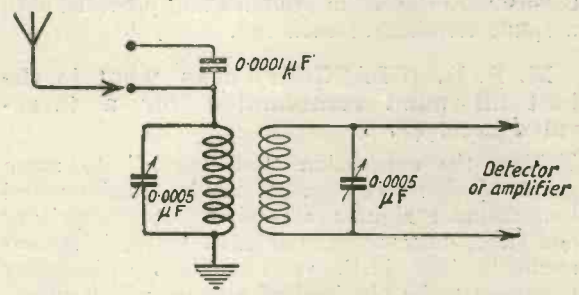
The reason is to be found in the fact that an old high-tension battery may possess a very considerable internal resistance, and as this resistance is common to the plate circuits of both valves, a reaction effect is produced which may be sufficient to maintain the system in a state of continuous low-frequency oscillation. A remedy may sometimes be found in the connection of a large condenser of about 2 μF capacity across the high-tension battery terminals.

C. F. A. (BIRMINGHAM) asks what relation exists between the wavelength range of a coil used as the tuned anode coupling unit in a high-frequency amplifier and a similar coil used as a secondary circuit tuning coil.

If the wiring of the receiver is reasonably short and simple, an identical wavelength range will result in these two cases, provided that the tuning condensers used are identical in value.

T. E. R. (BRADFORD) asks for a diagram of a loose-coupled tuning system to which the principle of constant aerial tuning has been applied.

The accompanying diagram shows how this may



be done, with the provision of an extra terminal to cut out the series condenser when not required.

O. T. R. (TUNBRIDGE WELLS) asks how many stages of low-frequency amplification should be used to operate a loud-speaker.

Not more than two stages should be employed under almost any condition. If these two stages when working efficiently do not give a sufficient volume of sound, the signal strength should be increased by the addition of a high-frequency valve. The use of more than two stages of low-frequency amplification makes it practically impossible to prevent a considerable amount of distortion and trouble from howling.

S. F. J. (BECKENHAM) states that he is constructing a receiver upon the component system, and asks for the best wire to use for the connections.

Probably the best method of carrying out the connections of a receiver consisting of loose components is to make a series of leads of various lengths composed of pieces of No. 20 tinned copper wire sleeved in systoflex and provided with a spade terminal at each end.

M. P. D. (GLASGOW) asks what is the best all-round combination for a three-valve receiver.

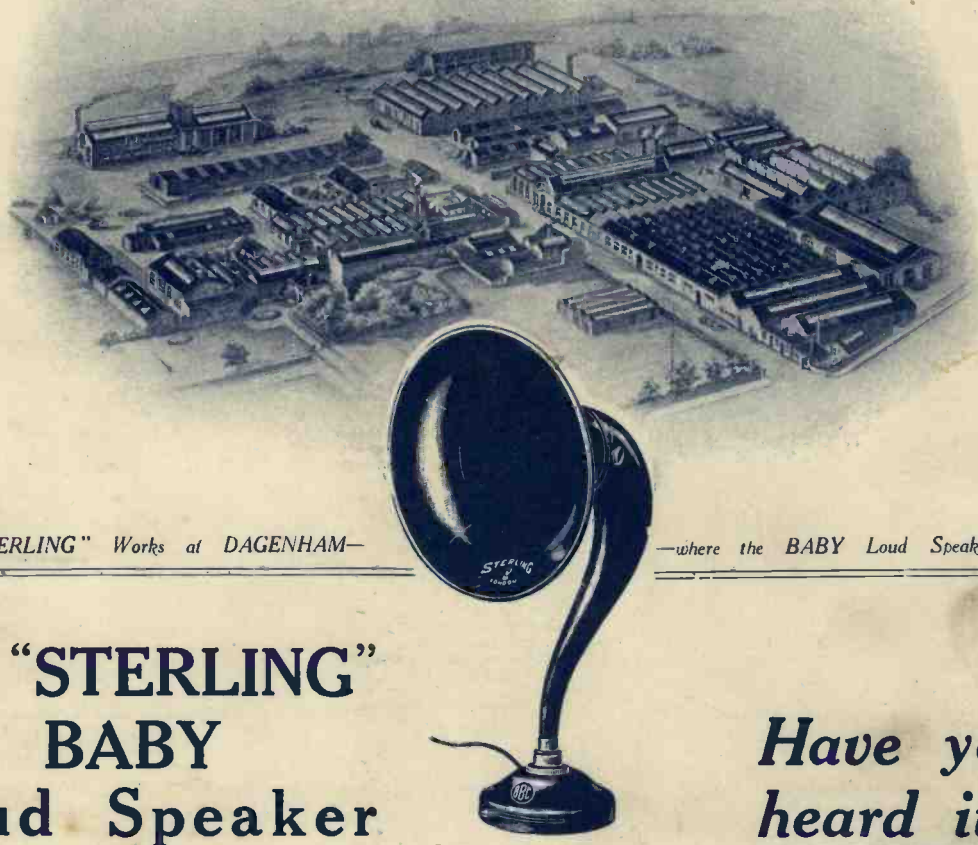
Taking the expression "all-round" to mean good average reception of near-by, medium and long-distance signals, a receiving set comprising one H.F., detector and one L.F. valve, is recommended. The H.F. valve enables satisfactory reception to be obtained of signals which otherwise would be too feeble to actuate the detector valve, whilst the L.F. amplifying valve gives reliable and satisfactory increase in strength of whatever signals come through the detector valve.

H. F. B. (ELLESMERE) states that he recently took his three-valve receiver to a situation very close to a tram route where he found that he could hear nothing but roars and crackles during the frequent passing of the trams. He asks for the cause and cure of the trouble.

As our correspondent surmises, the trouble is due to induction effects from the passing cars, and is most difficult to eliminate. Some relief may be obtained by the use of a counterpoise earth, but the only real solution of the difficulty appears to lie with the frame aerial, and a fairly sensitive set. Even then it may be necessary to employ screening of sheet-iron around the receiver itself.

D. W. F. asks which is the most suitable valve to use in a low-power transmitter using a dry battery of 200 volts for the H.T. supply.

Naturally, we cannot indicate a preference for the product of any particular manufacturer, but some general guidance can be given. Quite good results can be obtained with a really "hard" receiving valve of the high-temperature type, but it is well worth while to try one of the small-power valves now being produced for loud-speaker work. The smaller specimens of this type oscillate fairly freely, and will handle considerably more energy than an ordinary receiving valve.



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Wireless Weekly

and The Wireless Constructor.

Vol. 3.
No. 10.

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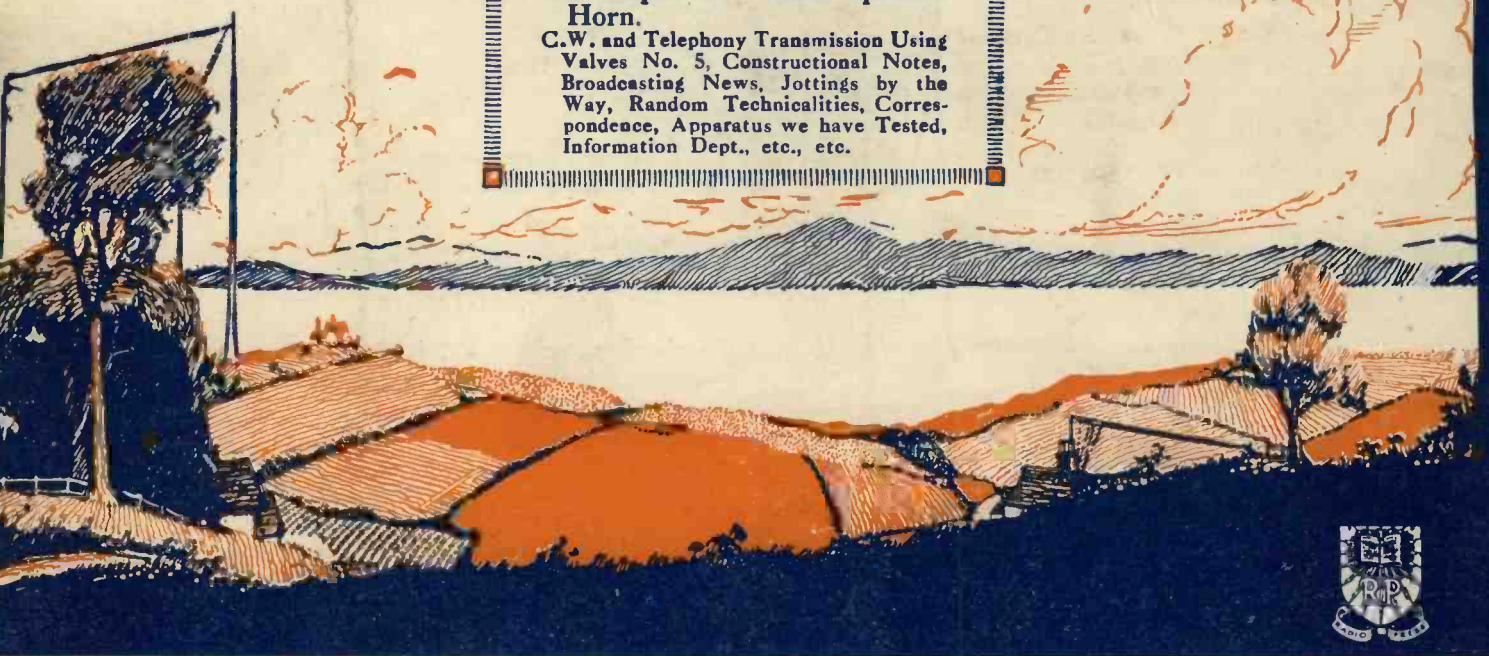
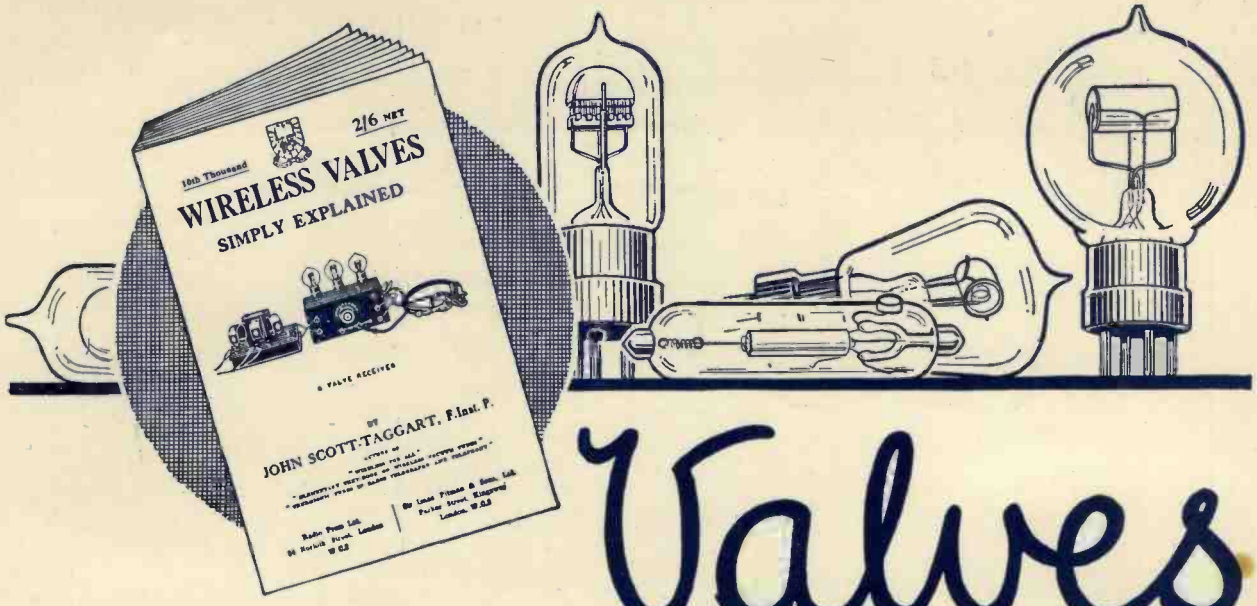


A "Loud-Speaker" Reflex Circuit



Valves

THE valve is undoubtedly the most important part of any Receiver. If your Valve (or Valves) is not functioning correctly, you are not getting the best results from your Set.

Before you can hope to become a skilled driver and obtain the most pleasure from your car you must know how it works. So with Wireless. You cannot hope to get the greatest enjoyment from "listening-in" or experimenting until you have mastered the fundamental principles of Radio.

Dependent on this lies your ability to understand the theory of the Thermionic Valve. Know how it rectifies, how it oscillates, and how it amplifies, and your progress in obtaining further Radio knowledge will be rapid.

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2/6

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Simply explained

By JOHN SCOTT-TAGGART, F.Inst.P.,

is the one Book on the Valve which will really teach you—commencing at the very beginning—everything you need know about the Valve. It has been recognised by all the experts as the standard popular-priced book on the subject.

Purely scientific explanations are omitted because the aim of the author has been to provide a book which, while being absolutely accurate, can be read and understood by novice and experimenter alike.

Get a copy to-day and begin to understand exactly what is happening while your Receiver is working.

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All correspondence relating to contributions is to be addressed to the Editor of "Wireless Weekly."

Editorial

A Principle Again Vindicated

Upon another page we give a full report of the proceedings at a meeting of the Radio Transmitters' Society, at which it was decided by a substantial majority to amalgamate with the Radio Society of Great Britain.

We congratulate the R.T.S. upon having made this decision, which, we firmly believe, is a step in the right direction, and one which will add to the importance and prestige of the amateur movement as a whole.

It will be noted that, during the discussion, reference was made to a certain weekly wireless paper, previous criticism by which rather displeased some of the members. We recognise, of course, that it was this journal which was referred to, and, whilst giving the various remarks verbatim in the report of the meeting, we desire to take this opportunity of making our position in the matter clear. This we could scarcely do during the somewhat delicate negotiations which have been proceeding.

Unity of control in connection with the activities of wireless amateurs has been consistently advocated by us, and it was with regret that we learnt of the secession from the ranks of the R.S.G.B. of numbers of "transmitters" and the formation of a separate Society. Although not greatly impressed by the activities of the R.S.G.B. (as then constituted), we nevertheless recognised its claims and utility in a political sense as the parent society.

At an interview with Capt. Fraser, chairman of the Transmitters' Society, we strongly deprecated the setting up of a separate camp of amateur workers. At the same time we were convinced that the recalcitrant amateurs had very good reasons for dissatisfaction under the old regime, but pointed out that, instead of breaking away from the R.S.G.B., they should set to work and *get the old regime altered.* As the new Society was then actually in existence, however, such a course obviously meant affiliation or amalgamation with the R.S.G.B. Capt. Fraser informed us that these matters had been considered in similar spirit, and that the Committee of the R.S.G.B. had been approached, but after a preliminary talk had declined to discuss the matter further.

Accordingly, the Radio Transmitters' Society went ahead with their own arrangements and apparently made excellent progress.

Our next interview was with Mr. Hope-Jones, the late chairman of the R.S.G.B. At our invitation, Mr. Hope-Jones visited this office and the situation was discussed. We pointed out the serious loss to the parent society which the formation of the R.T.S. entailed; the weakening of the amateur position by division of control, and emphasised that the next step towards the admittedly desirable re-union must come from the Committee of the R.S.G.B., which had "shut the door" and declined to negotiate.

The happy ending to the story is told in the report of the meeting of the R.T.S. on page 319 of this issue.

Some of the dissentients (who numbered only 10 to 61 who approved) expressed the view that if the vote for amalgamation were carried we would score a point, and the Transmitters' Society would inevitably lose any prestige it had. It is, of course, true that we stated quite plainly that the Transmitters' Society would have to amalgamate or die a natural death, and we have never departed from this view, in spite of our sincere respect both for the executive and the individual members of the R.T.S.

We believe that any attempt to weaken unity of control is to be discouraged, but the decision of the R.T.S. is no victory for us but merely for the principle we support. Whether the R.S.G.B. will exercise their control in a broad-minded manner satisfactory to all is a separate matter needing a separate watch.

How to Make the "Wireless Weekly" Omni Receiver

No. II.

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

The second article of a series dealing with the construction of the Omni Receiver. The first article appeared in our February 6th issue.

HAVING prepared the front panel in accordance with Fig. 3, the next step in the construction of the Omni receiver is to mount the different components on this panel.

The following is a list of the components required for the front panel:—

3 variable condensers of 0.0005 μF capacity.

1 step-up intervalve transformer.

3 Lissenstat variable resistances for controlling filament current.

1 crystal detector of superior manufacture.

2 ½ to 5 megohm variable resistances.

1 50,000 to 100,000 ohm variable resistance.

2 coil holders.

14 Army-type 4BA terminals.

3 valve holders.

Fig. 4 shows a view of the back of the front panel.

The line X Y indicates where the terminal panel is joined on nearly at right angles. This junction is made by means of three screws which pass through the front panel into the edge of the terminal panel. This fixing is not very secure, but a sufficiently good job can be made in the manner described. Both panels, of course, fit into the wooden box which supports both of them. It is, therefore, only necessary that the two panels should hold together by means of the screws while the wiring is being carried out.

In Fig. 4 will be seen the back of the panel illustrated in Fig. 3. The three valve holders will be readily recognised, as also will the Lissenstats, 48; the condensers, 10 2, 26 18, and 42 34, will also be recognised.

It is as well to compare this Fig. 4 with the front view of the panel illustrated in Fig. 6. The photograph (Fig. 6) indicates very clearly how the condensers, etc., are arranged, while Fig. 4 shows what this panel looks like from the back. The coil holders, indicated by 54 53 and 50 49 in Fig. 4, may be of any suitable pattern, and those actually illustrated in the photograph are a trifle more crude than some which are now on the market.

The different figures in Fig. 4 correspond to different component parts, which may be readily recognised from Fig. 6. The figures 28 and 20 refer to the connections to the crystal detector which is mounted on the front of the panel instead of the back, for very obvious reasons. The crystal detector in Fig. 4 is shown in dotted lines.

Looking at Fig. 6, the two terminals at the top are, on the left the aerial terminal, and on the right the earth terminal. Down the left-hand side there are six terminals which are connected by flexible leads to the three-way coil holder mounted on the left-hand side of the cabinet. The two top terminals go to the coil nearest the back, the two middle terminals go to the middle coil, and the two terminals at the bottom of the row of six terminals go to the coil nearest the front. The two terminals at the very bottom of Fig. 6 in the middle of the panel are the telephone or loud-speaker terminals, while the four terminals on the right of the panel are battery terminals; the two top ones are the positive and negative high-tension terminals respectively, while the two bottom ones are the positive and negative L.T. terminals.

The Terminal Board

We now come to the terminal board. The top of the terminal board presents the appearance of Fig. 2, in our preceding issue. Each of the terminals has been numbered, and some experimenters may prefer to have simply the numbers on the panel without any drawing pasted, glued, or otherwise fixed on to the ebonite panel. On my own receiver I have a sheet of cartridge paper on which has been printed the graphical signs given in Fig. 2, and the paper was varnished over with transparent varnish before fixing to the panel. It is, however, appreciated that if the paper absorbs moisture, the insulation between the terminals is likely to affect signal strength. It is therefore preferable to have the panel engraved, but this is an expensive procedure, and it would be cheaper in the end to buy the engraved panels from firms ready to supply them. Any firm may make application to us for permission to supply any of the parts for the Omni receiver, and certain enterprising ones have already set themselves out to supply anything that the reader may require.

Some readers may prefer to paint the numbers only in white paint on their ebonite panel, and to use Fig. 2 as a reference figure. We are at present considering the possibility of obtaining and supplying transfers which may be applied to the panel.

Meanwhile, we have arranged for a large number of sheets, corresponding to Fig. 2, to be

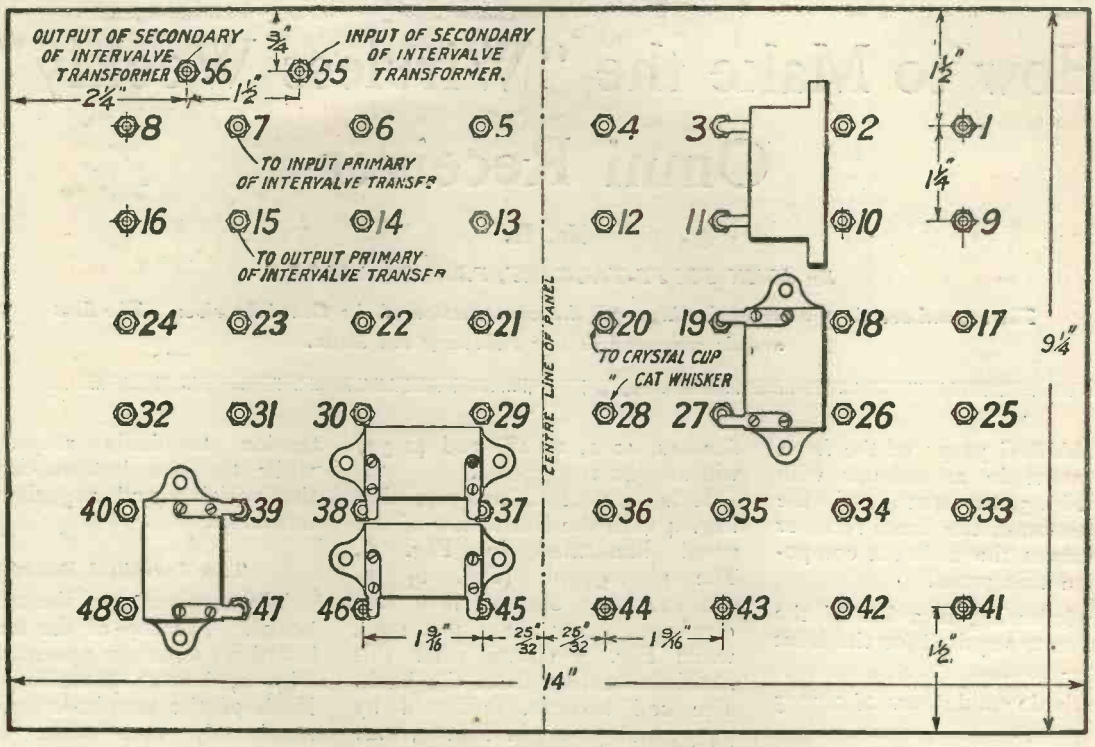


Fig. 5.—The reverse of terminal board, illustrating method of attaching fixed condensers.

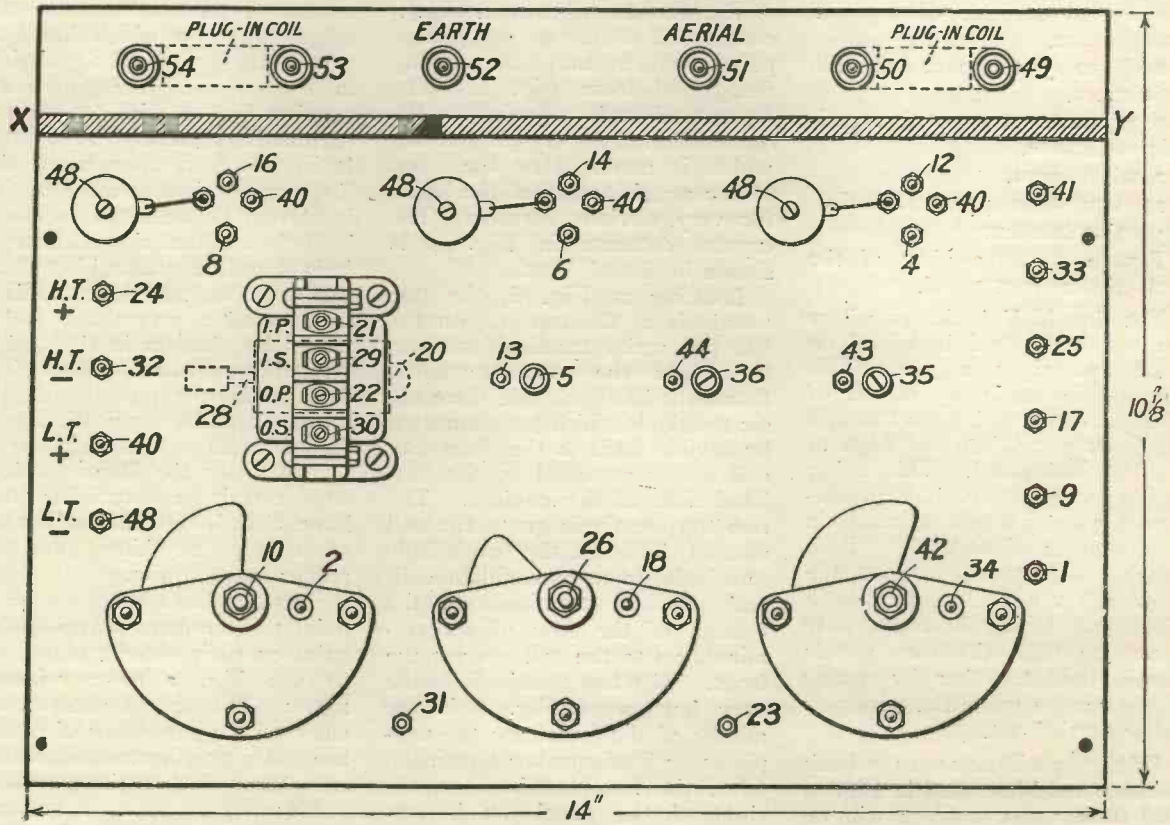


Fig. 4.—A back view of the front panel, showing position of terminal board XY.

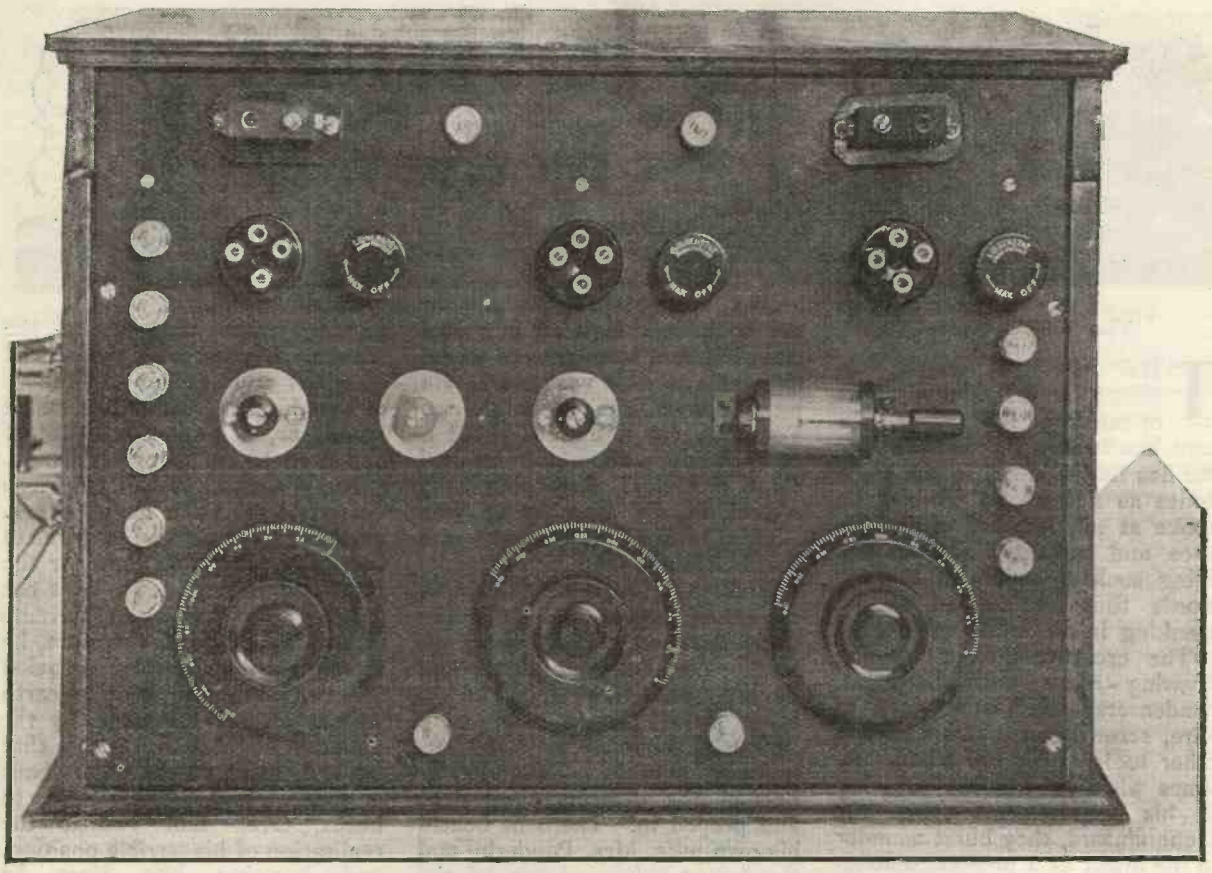


Fig. 6.—A photograph of the front of the panel.

printed, and these may be placed on the panel. There is no real need to stick them on, because the terminals themselves will hold the sheet down. Even if the sheet is not required, it will serve as a drilling template for the terminals. For those who do not desire to purchase the finished Fig. 2, the illustration in Fig. 5 gives all the dimensions necessary for a reader to drill his terminal panel.

The back of the terminal panel is illustrated in Fig. 5, which is placed in this position in order to assist in the wiring of the completed set.

The terminal board is merely a panel of ebonite on which 50 terminals have been fitted.

The components required for the terminal board are as follows:—

50 4BA Army-type terminals.
2 0.002 μF fixed condensers.
1 0.0001 μF fixed condenser.
1 0.001 μF fixed condenser.
1 0.0003 μF fixed condenser.

The fixed condensers are conveniently attached to the back of the terminal board by simply soldering the lugs on to the ends of the correct terminals.

The condenser shown in the left-hand corner of Fig. 5 has a capacity of 0.002 μF and has its lugs soldered to the terminals 39 and 47. The condenser across the terminals 46 and 45 has also a capacity of 0.002 μF. The condenser across the terminals 38 and 37 has a value of 0.001 μF and the condenser across the terminals 19 and 27 has a value of 0.0003 μF. The other condenser is connected across the terminals 3 and 11 and has a value of 0.0001 μF.

It now remains to join the two panels together and wire them up. In our next issue detailed photographs of the wiring will be given, and the method of doing this is fully explained.

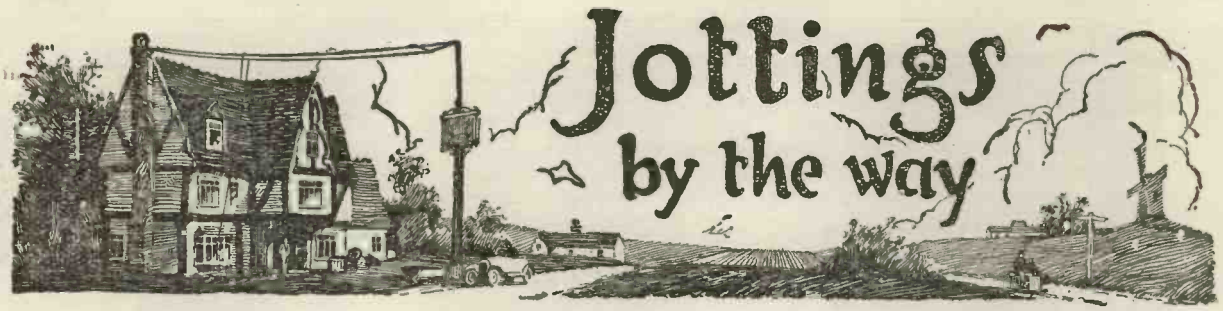
(Continued in our next issue.)

The Radio Society of Great Britain

An informal meeting of the Society will be held on Wednesday, February 13th, at 6 p.m., at the Institution of Electrical Engineers, Savoy Place, W.C.2. A discussion will be opened by Mr. J. H. Reeves, M.A., on "Fine Wire Coils as an Aid to Distortionless Reception."

ANNUAL CONFERENCE OF AFFILIATED SOCIETIES

The postponed Conference of Affiliated Societies is to be held at 2 p.m. on Saturday, March 1st, at the Institution of Electrical Engineers.



The Wife's Turn

THE wireless widow, it seems, at last shows signs of turning. For a long time hers has been a terrible life, for she has had to dwell in the same house as a husband who, if he spoke at all, babbled of inductance and capacity, and so on, using such a variety of strange words that he seemed to be speaking in an unknown tongue.

The creature littered up her drawing-room with batteries, condensers, telephones, coils of wire, screwdrivers, hammers and other tools of his sad trade. At times when he was too exacting in his requirements from the accumulators, they burst asunder in the midst as a protest, scattering acid over the carpet that was the pride of her heart.

The money that should have gone to buy boots for the family was spent upon buying more and more gadgets. He brought weird friends to the house who, after the shortest of greetings to her, plunged immediately into the shoppiest of shop with him. He sat up until unearthly hours listening for American broadcasting, and was, as a consequence, on the next day in a state either of dumpiness due to lack of sleep, or of hilarious triumph if he had been successful.

In either case she had a poor time of it, for if he was in a bad temper he was unduly critical of her household arrangements, whilst if he was elated by some wonderful long-distance feat he poured an endless account of his method and of his results into her ears which neither understood nor wished to understand. But now there are signs that she is about to get her own back in no uncertain way.

The Discovery

It was Waggshurst who first made the discovery that we were not to have things all our own way, but that women were working out a terrible vengeance. He went across one night to see Ponderby for a minute about a new circuit with which he had some difficulty. Returning at 3 o'clock in the morning he was amazed to find that his house was still brilliantly illuminated.

Entering, he heard the sound of voices proceeding from the drawing-room. They were not loud voices, but their tones were intense, and they appeared to come from people who were seriously occupied in some engrossing pursuit. He stealthily opened the drawing-room door and peeped in. There he beheld his own wife, Mrs. Ponderby and the better halves of two of the brightest wireless lights in the neighbourhood sitting round a table with looks of intense concentration. He noticed upon the table a box of his favourite brand of cigarette that he had brought in that evening. The appearance of the box and of the piled ash trays which surrounded it showed him that his taste in cigarettes had apparently met with general appreciation.

But it was not upon his looted cigarettes that he fixed his gaze. The sitters had provided themselves with a collection of small chunks of wood, rather like dominoes, with which they appeared to be engaged in the rather childish amusement of building walls. Laughingly, he said, "Hullo, playing with the kiddie's toys?" No one took the slightest notice. So intent was the quartette upon the matter in hand that they uttered hardly a word even to each other. Such noises as they did make were strange in the extreme.

You know what happens when you tap your rectifying valve: the loud speaker says "ping," or "pung," or "pong," as the case may be. That is the kind of noise that these ladies were making when they broke the silence. Occasionally they raved of winds and seasons and things of that kind. Enormous sums of money or, at any rate, counters appeared to be changing hands.

As Waggshurst has long ago ceased to read the daily papers, since a proper perusal of wireless literature leaves no time for the ingestion of mere news, he is not exactly up-to-date with the events of the day. At first, therefore, he merely looked on in puzzled silence, wondering what on earth was toward. Then suddenly the memory of a conversation that he had heard in the train about a society craze came back to him. Over him rushed the realisation of his terrible position, and bursting into tears he staggered from the room murmuring "Great Scott! A Mah Jongg widower."

The Terrible Results

And so Little Puddleton has become the scene of a dreadful series of domestic tragedies. If wireless kept a man up late, that infernal Chinese game keeps his wife up later. Wireless may have a language of its own, incomprehensible to the uninitiated, but wireless shop is clear, straightforward English, compared with the technical slang of Mah Jongg.

Your wireless man did occasionally, not very often, I admit, but occasionally talk of something else, even if he was with others of the tribe; but the Mah Jongg woman has absolutely no other subject of conversation at any time or at any place. It is worse than golf, whose every hole must be played over again before the fire. Worse even than bridge, with its post-mortems and recriminations. The punging of Mrs. Ponderby is an event calling for discussion far more prolonged and infinitely more bristling with technicalities than the failure of anyone in the old days to lead the knave which

would infallibly have secured three more tricks.

And the worst of it is that the lords and masters have no longer the price of a gridleak about them; also, they are beginning to wear a rather pinched look, as though their diet were not so satisfying as it should be. If Jones or Podsnapp used to spend too much on wireless gadgets, thereby on occasions have to cut down the household allowance, the ladies are now hoisting them heavens high on their own petard, for after a long sitting they will return with a slightly-worried air and without the wherewithal to purchase the Sunday joint. Or they will announce quite casually that they have had a run of bad luck, and that they regret that only tea and bread and butter can be served for breakfast for the ensuing week.

What is going to happen I do not know, but great hopes are entertained by the committee of the Wireless Club which, at an enormous expense, has imported a female radio expert, who has guaranteed to convert all the ladies into wireless enthusiasts. This will, of course, be an improvement, for conversation would again become possible, but I doubt whether any of us will put on weight. Even a transformer represents a good many days' eggs-and-bacon ration.

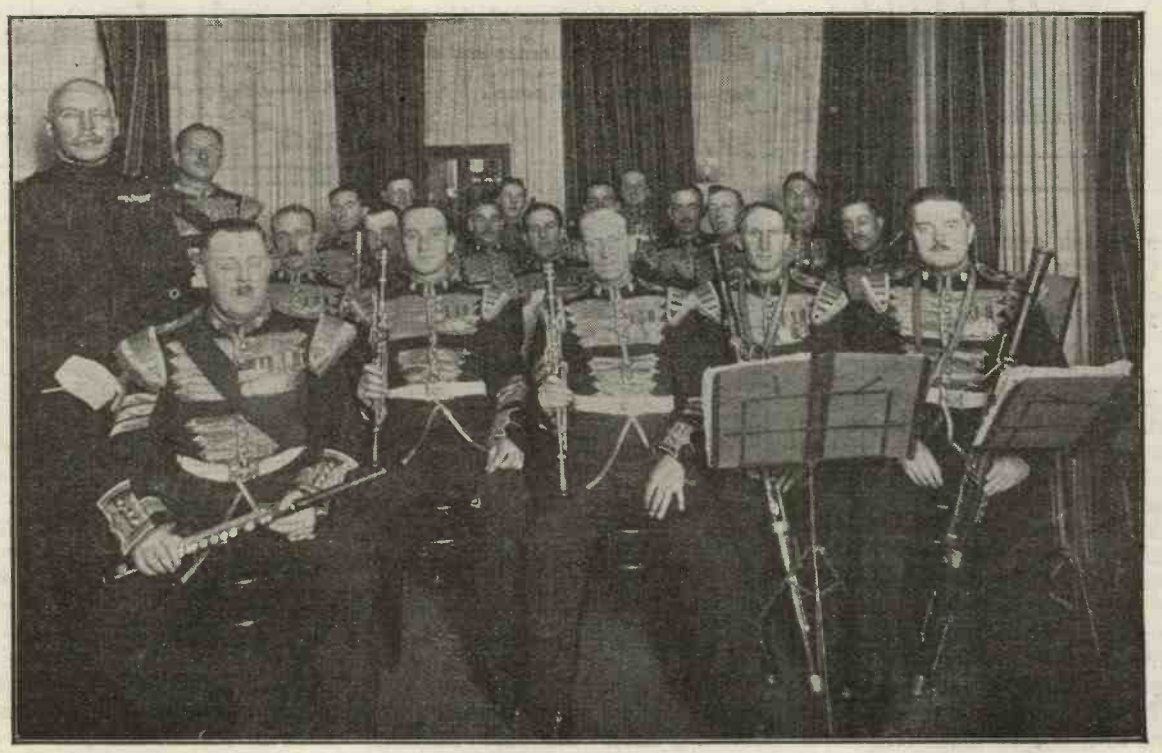
Always for it

Why is it that wireless is now being blamed for all the calamities, great and small, that now befall the community? One would think at first sight that it was a gentle, harmless hobby, incapable of bringing about any dread consequences. But if we are to believe what the papers tell us, especially in their correspondence columns, it is answerable for all kinds of regrettable occurrences. This fearful wireless slays the dear little birds as they fly through the air; in fact, they have been seen to drop dead by hundreds "when they flew across the line of a broadcasting station." It has ruined the weather, it has shattered delicate nerves, it has even produced human receivers who, as they walk about, complain that morse is continuously pinging in their ears. One lady writer has gone so far as to say that listening-in will produce a race of stupid folk.

And now Bournemouth goes and says that it is emptying concert halls, keeping people from the healthy pastime of dancing, and generally playing Cain with the municipality's entertainment arrangements. No one, it appears, will listen to the band. The once gay streets of Bournemouth, if we are to believe all reports, are now deserted at night, for all the world is at home with its head either adjacent to the loud-speaker's spout or embraced by the telephones.

Frankly, I do not believe that matters are quite as bad as this. New things are always blamed for a variety of events, as you know. The gramophone ought to have destroyed the theatres and concert halls long ago, if the forebodings of other days had been correct; the camera should have put all artists out of work; the bicycle should have produced a round-shouldered race with an expression of set melancholy due, as one eminent medical authority said, "to the strain set up by preserving the delicate balance." In fact, every innovation has always been accused of all kinds of dread consequences. The point of humour, I think, is that the Bournemouth municipal orchestra is conducted by Dan Godfrey, senior, whilst Dan Godfrey, junior, is on the side of the forces of evil, being director of the Manchester broadcasting station. Once more you see the terrible consequences of wireless!

WIRELESS WAYFARER.



Our photograph shows the Band of the Irish Guards at the Manchester Studio.

An Experimenter's Unit Receiver

By H. BRAMFORD.

The following is the second of a short series of articles which began in Vol. 3—No. 9, dealing with the construction of a progressive unit receiving set which should prove of considerable utility to the home constructor and experimenter.

Unit No. 1

This unit takes the form of a tapped inductance, and is shown as a completed unit in the photographs Figs. 6 and 7, which are front and back views respectively.

Materials Required

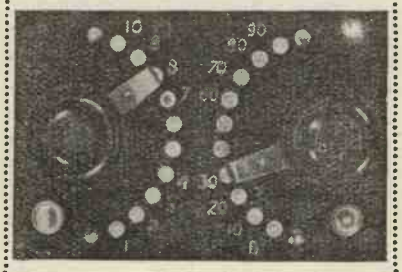
For the construction of this unit the following materials are necessary :—

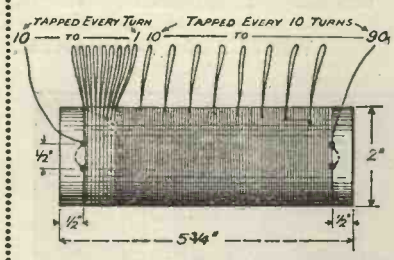
1 piece of ebonite measuring 6 x 4 x ¼.

1 cardboard former, 5¾ long x 2 in. external diameter.

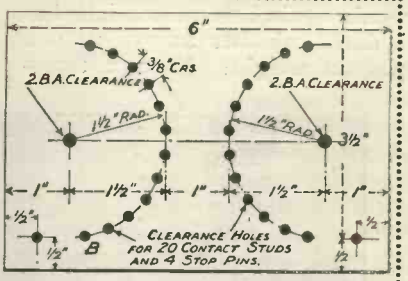
20 contact studs.

4 stop pins.





Figs. 6, 7, 8 and 9.—Illustrating front and back views of the unit, details of the inductance and drilling dimensions of panel.



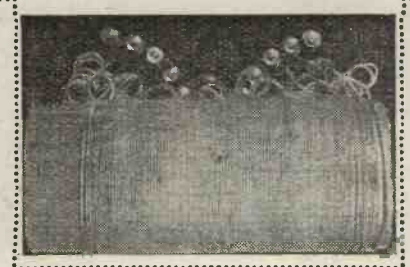
2 switch arms.

Quantity No. 22 S.W.G.-d.c.c.

2 terminals.

Winding the Inductance

The former upon which the No. 22 S.W.G. wire is to be wound should be gently baked and then soaked in paraffin wax, after which it should be laid aside to dry thoroughly. To commence the winding drill two small holes through the tube half an inch from the edge, and half an inch apart, through which the wire is to be passed and made secure, leaving about 6 in. of free wire for connecting purposes. One turn is then made and about 6 in. of wire is looped and twisted together to form a tapping. One more turn is made and then another tapping, still another turn is wound and another tapping made, and so on until the ninth turn. Now wind ten more turns, and take off a



tapping at the tenth turn in the same manner as before, and repeat the operation seven more times, making eight tappings in all, each ten turns apart. The total number of tappings on the former is now seventeen, nine being tapped at each turn, and eight being tapped every ten turns. After the last tapping has been made ten more turns are wound which terminates the winding with a total of one hundred turns. To finish off, two holes are drilled in a corresponding position to those made at the beginning of the winding, and the wire is secured in a similar fashion, again leaving a length of 6 in. for connecting up. Fig. 8 shows the details of the inductance tappings.

The Panel

This is made of ¼ in. ebonite, 6 x 4, 12 holes being drilled ⅜ in. apart on a 1½ in. radius on the left hand side of the panel, and a similar number also drilled on the right hand side of the panel. These holes are to receive 20 contact studs and four stop pins. Two centre holes are drilled to clear 2 B.A. rod for the switch arms. The photograph, Fig. 6, shows the disposition of the studs upon the panel, whilst the drilling dimensions are given in Fig. 9. The stud marked B in both these figures is a blank stud mounted merely for the purpose of symmetry, that is, to give an even number of studs on each side of the panel.

Assembling

First mount upon the panel the 20 contact studs and four stop pins. Assemble the two switch arms in the manner shown, and also the two terminals T_1 and

T_2 in the positions shown in Fig. 10. The coil is next fixed to the underside of the panel by means of two screws and spacer washers.

The connections are to be made in the following order:—The beginning of the winding is to be connected to the first stud of the ten intended for the single turn tappings, the first tapping is connected to the second stud, the second tapping to the third stud, and so on until the ninth tapping is connected to the tenth stud. The terminal T_1 is connected to the switch arm controlling the single-turn tappings, whilst the terminal T_2 is connected to the switch arm controlling the ten-turn adjustments.

The first of the tappings following the first ten complete

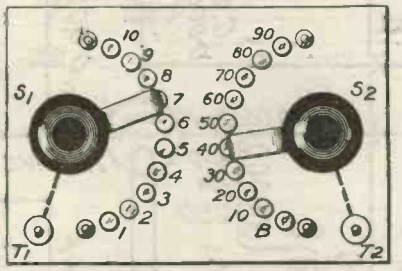


Fig. 10.—A lay-out of the panel.

turns is made to the first of the studs intended for these larger tappings. The second tapping is connected to the second stud, and so on until the finish of the coil is connected to the last stud, so that ten turns are left between each set of studs.

Operation

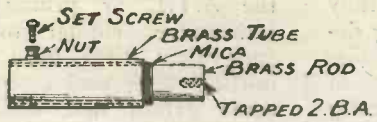
The operation of this unit is such that any number of turns from 10-100 may be obtained by manipulating the switch arms.

When one of the switch arms is on stud No. 10, and the other is on Stud No. 1, the total number of turns in operation will be ten, the sum of the stud numbers, minus one, being the total number of turns in use.

An Excellent Grid Condenser

THE ordinary home-made type of paper grid condenser is usually constructed in such a manner that one has to be very careful in tightening a terminal nut down upon it, for the reason that the contact eyelets are so easily torn loose. The average condenser of this type will stand only a very few changes from one circuit to another. A much more substantial grid condenser may be constructed as follows:—

Bore a 3-32 in. hole into the end of a section of brass rod ¼ in. in diameter and 2½ in. long, and tap the hole to suit the valve leg. Now cut a piece of mica 2 in. wide and just long enough to wrap around the rod with a narrow lap joint. This piece of mica should be very thin for best results, and when wrapped around the rod it should extend very slightly beyond the unthreaded end of the rod, leaving "pincer room" at the threaded end. Now procure a piece of thin brass tube with an inner bore just large enough to fit snugly about the brass rod and mica and on the side of it solder a common battery nut, which has an 8-32 thread. When assembled, screw the condenser directly on to the grid leg of your valve socket; connection to tuning circuit may then be made by means of a set-screw in the battery nut on the outer tube. Any desirable change in the capacity of this condenser may be made by sliding the tube back and forth on the rod.



The brass rod is threaded so that the condenser can be screwed directly on to the grid leg on the valve holder.

It is agreed that it is particularly important to keep the connection between the grid leg of the valve and the grid condenser as short as possible. It will be seen, therefore, that the condenser illustrated in Fig. 1 gives the ideal arrangement of connecting the grid leg of the valve socket direct to the grid condenser.

Connecting the condenser in this manner not only reduces considerably any undesired reaction effects, but also tends to eliminate interference from lighting and power mains.

R. N. A.

Interchangeable Basket Coils

BASKET coils may be made quickly interchangeable by securing them to their mounts in the manner shown in Fig. 1.

The coil is usually carried on a screw fixed into the ebonite mount, and the provision of a loose ebonite washer and a spring clip, formed of a coil of hard brass wire, with projecting ends, makes a quickly detachable fixing.

It will be seen that if the ends of the spring clip are pressed together, the coil of wire forming the clip opens, and may be easily placed on the screw end, and when released closes, holding the washer and basket coil firmly to its mount.

The ends of the winding of the basket coils have similar spring clips soldered to them which make firm contact with the pins which go into the actual coil holder.

N. K. J.

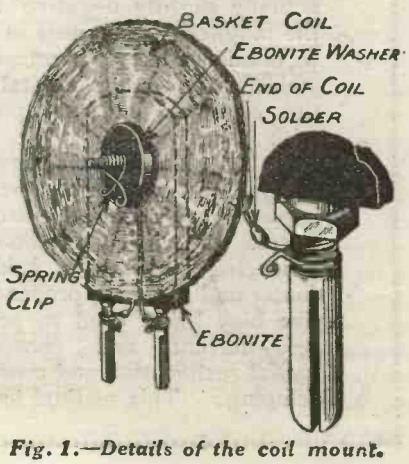


Fig. 1.—Details of the coil mount.

A "LOUD SPEAKER" REFLEX CIRCUIT

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

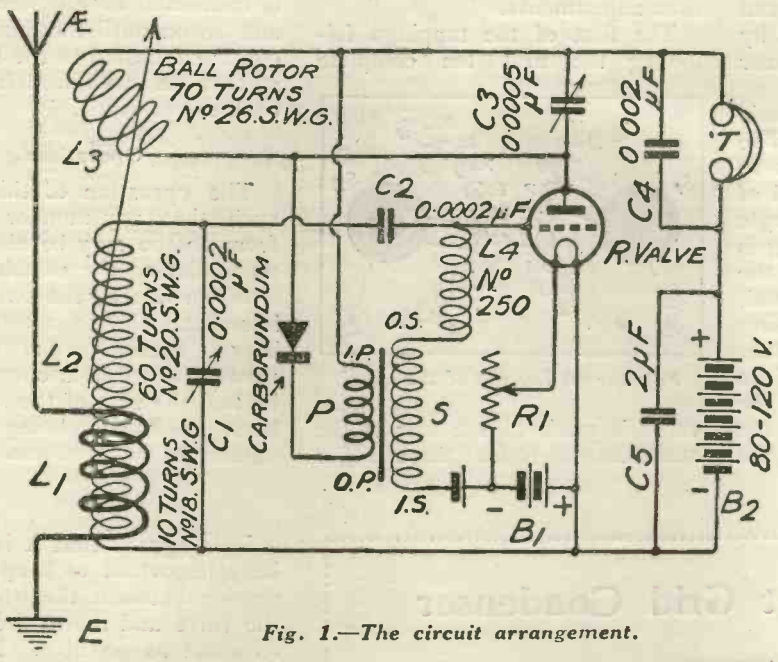


Fig. 1.—The circuit arrangement.

SINGLE - VALVE - AND - CRYSTAL dual circuits, when compared with the results obtainable with a single valve - with - reaction, skilfully used and with efficient tuning devices, are generally rather disappointing in the matter of signal-strength on *very strong* signals—such as those from a near-by broadcasting station. The reason for this is on account of the limiting action of the crystal, and the heavy damping introduced by it.

The circuit shown here represents an attempt to get the very maximum amount of signal strength from a single valve dual, with local broadcasting and a good outside suburban aerial, by using a low-resistance, undamped tuner; controllable reaction that has sometimes to be actually slightly negative as to the magnetic component in order to obtain stability; a robust and stable carborundum crystal; and the effective build-up possible with the Pye No. 1 or other good L.F. transformer, having a fairly high turns-ratio. The L.F. impulses are returned into the circuit through a radio-choke connected between a grid-condenser and the grid, proper negative bias being used to prevent grid-current and consequent partial rectification and unwanted damping. This method has the further advantage of eliminating interference by A.C. lighting mains, etc.

An "aerial-tap" is used on the A.T.I. or primary tuning inductance, similar to the arrangement often used in transmitting sets, and resembling to some extent that described by Mr. P. W. Harris, in *Wireless Weekly*, Vol. 2, No. 10, p. 386, for use with a "capacity" earth. On account of the extremely close coupling produced by the common 10 turns, between the aerial circuit and the main tuned circuit, these being far closer than in the Reinartz circuit which it faintly resembles, the aerial cannot be spoken of, nor behave as, "aperiodic," and the signal-strength certainly does not suffer from the elimination in this way of another tuning adjustment, whilst on practical test remarkably good selectivity results.

The selectivity is, in fact, so high that the circuit is not suggested for use other than for the loud reception of local broadcasting on a permanent type of receiver and with an aerial as good as can be managed. Actually, in a London suburb, at least three other of the B.B.C.'s stations have been heard at comfortable strength in the 'phones whilst London was transmitting, and late at night the transmission from KDKA, relayed from Manchester on 400 metres by the Metropolitan-Vickers Co., Ltd., was received very well. The circuit is, however, too tricky in adjustment for convenient general use in searching for distant stations without the help of a wavemeter. For those who are willing to take a little trouble in tuning-in to their local station, in order to get pretty well all that a single valve will give them, in the way of volume, without distortion, it can be strongly recommended, with the cautionary word, that considerable interference can result from incautious handling of the reaction.

The principal constructional detail is the A.T.I., which is a double or tapped coil, wound with 10 turns of No. 18, S.W.G., d.c.c. wire, and 60 turns of No. 20, S.W.G., d.c.c. wire, single layer, wound on in the same direction, on a 3¼ in. diam. waxed cardboard cylinder, 7 in. long, covering some 4 in. of the length, 2 in. beyond the last turn of the No. 20 wire, and therefore near the end of the cylinder, the rotating anode coil is mounted on an axle of No. 2 B.A. screwed rod. This is the common type of wooden-ball variometer rotor, 2¾ in. diam., wound full, with about 70 turns, of No. 26, S.W.G., d.c.c. wire, and should be arranged to rotate smoothly in bearings within the cylinder, with flexible connections either direct to the ends of the wire or via the stub axles in the usual way; it should also be equipped with knob and scale.

The A.T.C. is quite small, being of 0.0002 μF capacity, and should have a low minimum to tune down to Cardiff and Lon-

Those readers who are anxious to receive local broadcasting at loud-speaker strength, using a single valve, will find this circuit of considerable interest.

don; the anode-tuning condenser may be 0.0003 or 0.0005 μF. The radio-choke may be any coil of about 200-300 turns and of low distributed capacity, of ordinary size; actually a plug-in coil, No. 250, and a frame-aerial coil of ¼ lb. No. 26 S.W.G., d.c.c. wire, have given good results.

The crystal-detector should be of the carborundum type, as the demands made on it in this circuit are very great; ordinary galena will not stand up to the work very long, and requires constant readjustment. A firm contact between a springy piece of

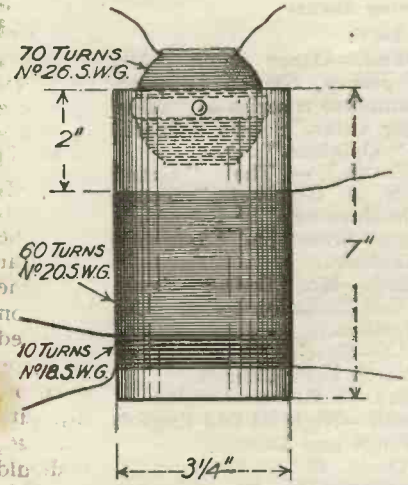


Fig. 2.—Details of the aerial tuning inductance and anode coils

tinned iron (ordinary "tin"), and a fragment of good carborundum mounted in a cup with Wood's metal, gives good signals, and, once set, requires no attention at all. Disappointment will result unless a really first-class transformer be used,

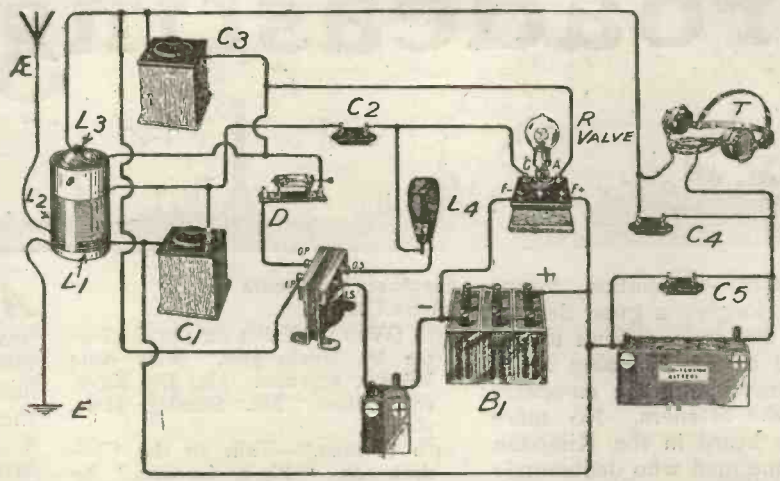


Fig. 3.—A pictorial representation of fig. 1.

and though that indicated gives as good results as one can desire, no doubt other good makes of high impedance and turns-ratio will also give satisfaction. High value of H.T., and a hard valve which gives a generous filament emission, should be used. Negative grid bias of at least one dry-cell, from the most negative point of the L.T. circuit, as indicated in the circuit diagram, must be applied; the exact value is a matter of experiment.

Operation.

At first the dual-amplification feature should be temporarily omitted, by disconnecting the radio-choke from the grid and substituting an ordinary grid-leak to the L.T. positive, and the local station found by simultaneous searching with A.T.C. and anode condenser, the anode coil being given a slight positive coupling to the A.T.I. if necessary. Occasionally the circuit will oscillate violently with the anode coil at right-angles to the A.T.I. When the station has been found, and the circuit brought off oscillation by adjustment of the anode coil (if necessary, so as to have slight negative coupling), by rotating it part way round until oscillation ceases, the change is made back again to dual operation, and slight adjustments made until good signals are heard. Then the coupling is very cautiously increased until the signals fairly roar in on the head-phones, but without the whistling or mumbling which indicates oscillation. A touch on the tuning-controls will snuff the local station right out, and there should be practically silence. Other distant stations can only be found with safety by the aid of the wavemeter, as indicated, tuning in to the wavemeter as before, and then cautiously searching in the neighbourhood of the wavemeter signal.

Once adjusted on local transmissions there is no need to do more than switch on, and make the fine adjustment of negative reaction directly with the loud-speaker, head-phones being unnecessary in a quiet room.

The tuning range, as shown, is about 300 to 550 metres on a P.M.G. aerial. Different aerial characteristics affect this to a much less extent than usually is the case; thus quite a small indoor aerial has been used with success on the lower wavelength range.

For those readers who experience any difficulty in connecting up the necessary components from the circuit diagram (Fig. 1) a pictorial representation is given in Fig. 3, in which the separate components are clearly shown. The components may be mounted upon a baseboard or fitted into a suitable cabinet according to the taste of individual readers.

In the latter case the components should not be crowded together in the cabinet and the wiring should be carried out with care.

Broadcasting News

LONDON.—Oscillation continues to give a good deal of trouble, and it is difficult to say how this matter is going to be overcome without the co-operation of the listeners. No more has been heard in the Kingston area of the man who deliberately oscillated, when certain items of which he disapproved were being broadcast, and the mere fact that people have been out hunting for his blood seems to be sufficient to make him close down.

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Big Ben time signals will be broadcast within the next ten days or a fortnight. We consider that they will be a great improvement upon the inconspicuous (and apparently not infallible) "ticking" method.

□ □ □

We had the pleasure of hearing Beethoven's Symphony in C minor (No. 5) last Monday night perfectly rendered. Was it imagination on our part, or did one of the instruments "speak out of turn" in the beginning of the second movement?

□ □ □

Mozart's little pizzicato selection came through very fine indeed; but the "pièce de résistance" of the evening was certainly that little gem of an intermezzo from "The Jewels of the Madonna." The embodiment of the best in music, the epitome of style, harmony, colouring, contrast, and the grace notes of the flute (or violin harmonics) sounded just like fairy fingers lightly touching stringed instruments, an effect very similar to that occurring in the "Sicilian Vespers" (by Verdi, we believe); in other portions full-bodied orchestration held sway, and now and again was apparent that percussion effect so often associated with Russian music.

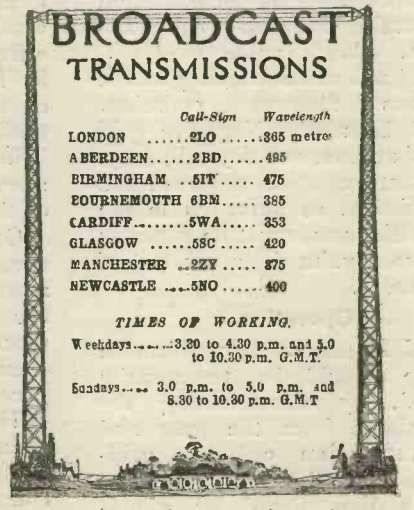
Forthcoming Events

FEBRUARY.

13th (WED.).—Talks on the Orchestra by Uncle Jeff. Miss Kate Winter, soprano. Mr. Jay Kaye, entertainer. Mr. Stanley Holt, pianist.

14th (THURS.).—Talk to the Children on "Pip's Garden," by Uncle Humpty Dumpty. The Georgians' Concert Party. Lecture Recital on "Modern Russian Music." Dance Music.

15th (FRI.). — The Quaintons' "Three Funny Voices and a



Piano" will entertain. Act 3, "Parsifal," relayed from the Royal Opera House, Covent Garden.

16th (SAT.). — Instrumental Trio. Mr. Hector Gordon, entertainer. Operas, "Cavalleria Rusticana" and "Pagliacci," from Covent Garden.

17th (SUN.).—Organ Recital. Mr. Norman Notley, singer. Miss Sybil Maden, contralto. Miss Evelyn Ruegg, violinist. S.B. from Glasgow. Royal Air Force Band. Mr. Leonard Salisbury, basso.

18th (MON.).—Mr. Percy Scholes, music critic. Mr. George Parker, baritone. John Henry on "Highbrows."

19th (TUES.).—Concert Party of "The Pops." "The Tragedy of Mr. Punch," by Mr. Reginald Arkell and Mr. Russell Thorndike. "Columbine," also by Mr. Reginald Arkell. Dance Music.

ABERDEEN.—The first attempt by the 2BD officials to broadcast a complete church service will be made on the 17th inst. The pioneering Church is the North United Free, at which a special service has been arranged for 8.30 in the evening. In addition to the solos and choir rendering, the communal singing of the congregation will be broadcast, and will afford a good guide to Mr. Jeffrey, the Station Director, for a more ambitious project he has in view. This is a monster gathering of local vocalists—three thousand, if possible—whose joint efforts will be broadcast. The scheme is in connection with the formation of a Listeners' Club which Mr. Jeffrey is pushing forward.

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Forthcoming Events

FEBRUARY.

13th (WED.).—Dance Night. Mr. R. E. Jeffrey, Station Director, will commerce a series of "Mind Training Talks." The first will be on "Opinions."

14th (THURS.). — The "Grand Duchess of Gerolstein," comic opera in three acts, by Offendach.

15th (FRI.).—Scenes and Characters from Dickens.

16th (SAT.).—Mr. Dufton Scott, North-East Doric Humorist. S.B. from London.

17th (SUN.).—Special Service relayed from North U.F. Church.

18th (MON.).—S.B. from London.

19th (TUES.).—Night of Old English Folk Songs and Dances.

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BIRMINGHAM.—There was a very happy event at 5IT a few nights ago when Uncle Edgar presented a fine 4-valve receiving set to a party of blind children from the Birmingham Royal Institution for the Blind. The set was a gift from the 5IT Children's Radio Circle, and was paid for out of the profits on the sale of Radio Circle badges. The accessories, the cabinet, accumulator, etc., all represented

the generosity of various firms, and the set was designed and assembled by the engineering staff at 5IT. It has been installed at the Blind Children's Home, where it will be a source of much bright entertainment and a tangible link with the many little friends which the institution has made through the medium of broadcasting.

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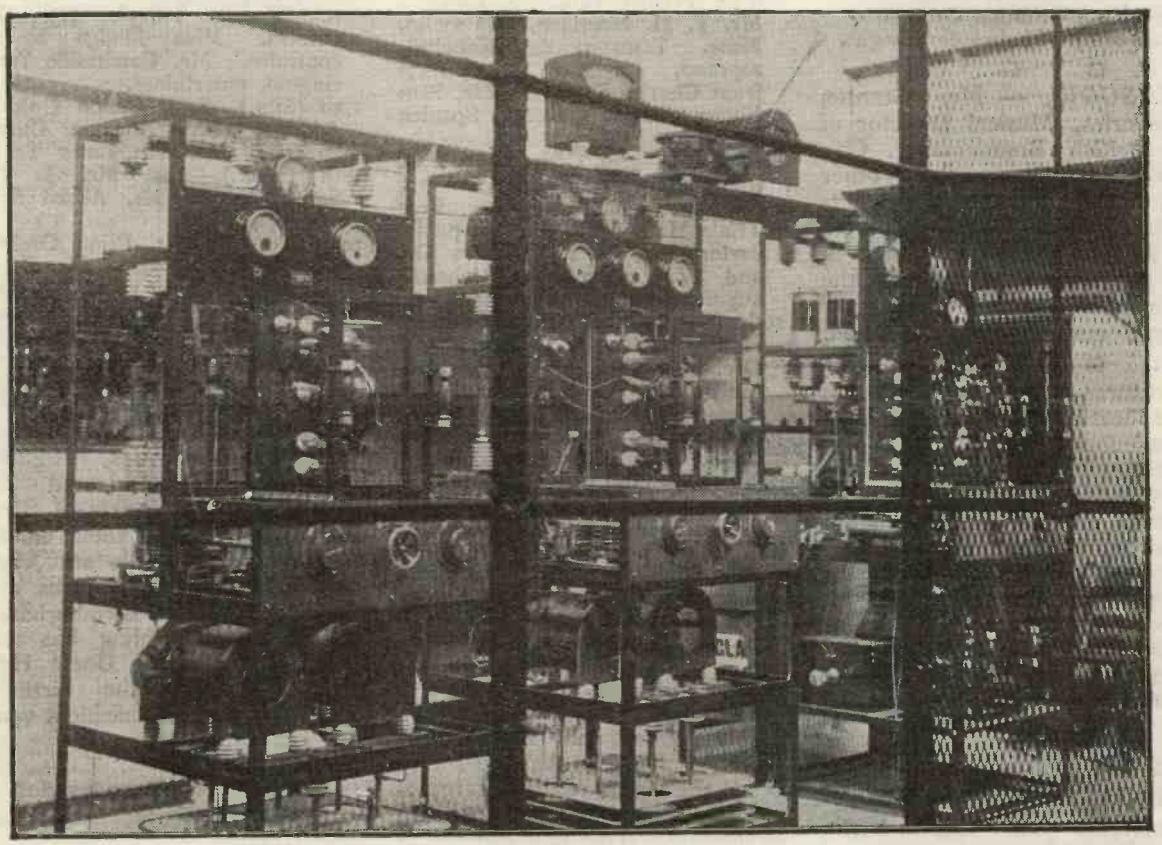
Forthcoming Events

FEBRUARY.

13th (WED.).—3.30, Mr. Stanley Finchett, tenor. 7.30, Band of the Royal Corps of Signals.



14th (THURS.). — Popular Classics Night by the Orchestra.

15th (FRI.).—Evening Programme of Chamber Music by the Edna Willoughby Trio from Leamington Spa.

16th (SAT.).—3.30, Children's Concert. 7.30, Orchestra. S.B. from London.

17th (SUN.).—Orchestra and Repertory Chorus.

18th (MON.).—S.B. from London.

19th (TUES.).—The Greys Concert Party.

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BOURNEMOUTH.—Listeners in the above area seem very pleased with the concert's broadcast during the week ending February 4. On Monday the "Dogs of Devon" was, of course, relayed from London, and was greatly enjoyed. Both principals and chorus came through excellently.

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The "Mock Trial by Jury," the following evening, was also a great success. The Scotch night proved to be most popular, however; all classes of listeners appear to have enjoyed it immensely. Mr. F. M. Coppendale (piper, late London Scottish) added the final touches, making the atmosphere truly reminiscent of the land "Ayont the Tweed."

Our photograph shows the transmitting apparatus at 5SC

The S.B. of "La Boheme" was very well received in this neighbourhood, there being a complete absence of the noises usually associated with relayed transmissions.

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Forthcoming Events

FEBRUARY.

13th (WED.).—Comic Opera Night.

14th (THURS.).—S.B. from London.

15th (FRI.). — Musical Comedy Night.

16th (SAT.).—S.B. from London.

17th (SUN.).—The Richmond Hill Congregational Church Choir. Address by Father Percy Triggs.

18th (MON.). — "A Night of Memories." Orchestra.

19th (TUES.).—Verdi Night with Orchestra.

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CARDIFF.—Disappointment is manifest everywhere in the district, owing to the discontinuance of the afternoon programmes of Falkman and his orchestra from the Capitol Cinema, Cardiff. The Station Director wishes it to be known that, owing to certain complications which have arisen at the Capitol Cinema, over which the B.B.C. have no control, these afternoon transmissions have had to be cut out, but at the earliest opportunity will be continued.

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Work is proceeding apace on the erection of the new permanent studio which the B.B.C. are building in Park Place, Cardiff. It is hoped that transmissions will take place from there in about two months' time. The studio will be a spacious one,

and great things are expected, the smallness of the present studio handicapping greatly the efforts of the staff.

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Forthcoming Events

FEBRUARY.

13th (WED.). — Station Birthday Anniversary. Special Items by the Director and Staff. Short Address by Mr. J. C. W. Reith, Managing Director of the B.B.C.
14th (THURS.).—S.B. from London.
15th (FRI.).—Newport Glee Singers.
16th (SAT.).—S.B. from London.
17th (SUN.).—The Rev. Wm. Evans, B.A., and the Choir of Richmond Road Congregational Church. Chamber Music Evening.
18th (MON.).—Station Orchestra.
19th (TUES.).—Shakespeare Night.

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GLASGOW. — Mr. Stanton Jefferies, Musical Director of the British Broadcasting Co., who visited Glasgow the other day, states that arrangements are being made to broadcast from St. Andrew's Hall a portion of the programme at one of the performances of the Glasgow Choral and Orchestral Union.

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Lectures on various subjects of an educational nature will be a conspicuous feature of programmes in the future, so far as the catering for children is concerned. An interesting syllabus is being arranged, and the education authorities are co-operating in the matter. Mr. A. M. Henderson, organist at Glasgow University, will broadcast lectures on music to the children on Thursday afternoons.

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Forthcoming Events

FEBRUARY.

13th (WED.).—Light English Night.
14th (THURS.).—Instrumental and Vocal Concert.
15th (FRI.).—Story Recital Night by Mr. Percival Steeds.
16th (SAT.).—Welsh Programme. S.B. from London.
17th (SUN.).—The Rev. Bernard T. Smith, of Great Wellington Street Wesleyan Church, Address. Musical Items.
18th (MON.).—Dance Night.
19th (TUES.).—Band of H.M. 1st Batt. Royal Scots Fusiliers.

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MANCHESTER. — The new aerial at 2ZY has improved reception 50 per cent. in all directions, but one, *i.e.*, in a line running approximately North-East, through Oldham, where a poorer reception is reported. This is the line which the old aerial took, and listeners in that direction are thus losing the directional effect they previously enjoyed. However, steps are being taken to improve matters in that district.

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Forthcoming Events

FEBRUARY.

13th (WED.).—3.30, Concert. 8, 2ZY Orchestra. Mr. Robert Parker, bass. 8.45, Talk by Mr. T. A. Coward, M.Sc., on "Early Flowers and Bird Songs."
14th (THURS.).—11.30, 2ZY Trio. 6.40, French Talk. 8, Concert. Mr. T. H. Morrison, solo violin. Mme. Tomson de Konchen, soprano. Lavilette in Extracts from Charles Dickens. Mr. Sam Fitton, tenor. 10.15, Spanish Talk.
15th (FRI.).—3.30, Concert. 7, S.B. from London. 7.30, Concert relayed from Manchester Free Trade Hall, being the first public performance of 2ZY Opera Co. and 2ZY Symphony Orchestra augmented to 60 performers.
16th (SAT.).—3.30, Oxford Picture House Orchestra. 7.45, 2ZY Orchestra. Mme. L. Pickles, contralto. The Sirfessor. Mr. Victor Smythe and Algy.
17th (SUN.).—3, Radio Military Band. 8.30, S.B. from London.
18th (MON.).—3.30, Concert. 8, Humorous and Musical Comedy Programme by 2ZY Orchestra.
19th (TUES.).—3.30, Concert. 8, 2ZY Orchestra. Mr. Tom Sherlock, baritone. Mr. Sidney Coultham, London tenor.

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NEWCASTLE. — Newcastle wireless enthusiasts are highly elated on reading in *Wireless Weekly* that their city heads the list as regards percentage of licence-holders among the population. This is a distinction of which they may well be proud, and the figure 7.8 per cent. is very creditable.

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The relaying of items from local functions furnish some of the most interesting transmissions, and the 5NO authorities are hoping to be able to do considerably more of this in the near future.

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Why is 6BM the easiest distant station to receive at Newcastle? Can it be that Bournemouth's Station Director feels homesick?

Forthcoming Events

FEBRUARY.

13th (WED.).—3.45, Dance Music from Assembly Rooms. 7.30, Orchestra. Mr. David McFadzean, baritone. Mme. Leonora Howe, soprano. Mr. Tom Heenan, tenor.
14th (THURS.). — 3.45, Misses Thornewell, duets. Miss Muriel Robins, 'cello.
15th (FRI.).—3.45, Mr. Harry Corry, baritone. Mr. Jack Boddice, euphonium. 7.30, Messrs. Carl Fuchs and Mr. Edgar Bainton, 'cello and piano. Miss Elsie Downing, soprano. Mr. Geo. Tindle, baritone.
16th (SAT.).—3.45, Walker's Band relayed from Tilley's. 7.30, Orchestra. Miss Madge Raine, contralto. Mr. Catcheside Warrington, entertainer.
17th (SUN.).—8.30, Canon Oakley, Address. Mr. Norman Curry, baritone. Mr. Wm. Laws' Trio.
18th (MON.).—3.45, Mr. J. W. Smith, tenor. Mr. Alfred Seabridge, violin.
19th (TUES.).—3.45, Bijou Orchestra. 7.30, Orchestra. Mr. E. L. Odhams, prose reading. Mr. Vincent Jones, baritone. Mr. Lee Dixon and Party, Excerpts from Shakespeare.

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SHEFFIELD.—"The Dream Lady," whose delightful anonymity has endeared her already in the hearts of Sheffield's kiddies and their elders, has joined the studio staff, and dispenses sweet harmonics and confidences after Birmingham's boisterous little crew has subsided, while genial Uncle Herbert distributes the birthday ethereal favours in excellent vein.

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Simultaneous Broadcasting Events

FEBRUARY.

13th (WED.).—B.B.C. Dramatic Critic.
14th (THURS.).—B.B.C. Musical Critic. Radio Society Talk. The Georgian's Concert Party. Savoy Bands.
15th (FRI.).—B.B.C. Film Critic. "Parsifal," Act III.
16th (SAT.).—"Cavalleria Rusticana." "Pagliacci," Acts I and II.
17th (SUN.).—Organ Recital. Times, Signals and Bulletin.
18th (MON.). — B.B.C. Literary Critic. Highlow Programme arranged by the B.B.C. Music Critic. Mr. George Parker, baritone.
19th (TUES.).—Capt. Eckersley, Technical Topics. Savoy Bands.

The Radio Transmitters' Society and the R.S.G.B.

The decision to amalgamate.

At a meeting of the above-named Society, held at the Institute of Electrical Engineers on February 1, Capt. Ian Fraser, Chairman of the Society, moved the resolution :—

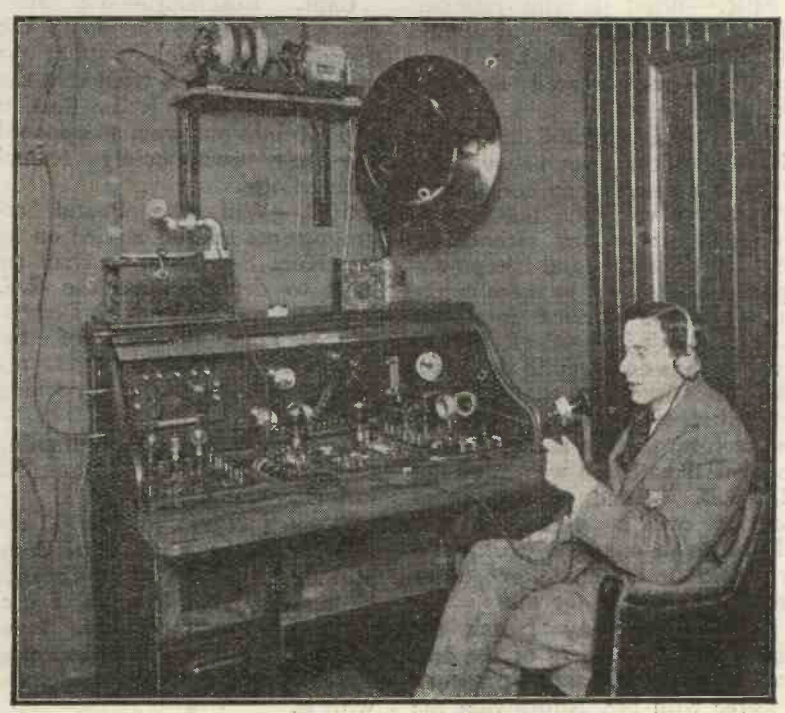
That this Meeting of the Members of the Radio Transmitters' Society approves the negotiations that have been undertaken between the Committee of the Society, and the Radio Society of Great Britain, with a view to securing the fusion of the two Societies, and instructs the Committee to make the necessary arrangements for giving effect thereto.

Capt. Fraser said it was necessary that the matter should receive the greatest consideration, and asked for a hearty discussion. There were several reasonable lines of argument for fusion. The reason why the R.T.S. was formed was on account of dissatisfaction with the R.S.G.B., and thus two factions arose, both having reasonable arguments in support of their existence. The question then arose as to whether or not the new society should be connected in any way with the R.S.G.B., and peace was only secured by a proposition that the new society should be formed, obtain a clear idea of the requirements of the amateur transmitter movement, and then either fuse with the R.S.G.B., or carry on as a separate society. The R.S.G.B. was then approached with a view to fusion, and their reply was that they could not see their way clear to discuss the matter. Later, however, they wrote asking for propositions, upon the basis of which fusion could be effected, and after much discussion, the proposition as above was agreed to. The initial course taken by the Committee of the R.T.S. may have been against the inclinations of the R.S.G.B., but in the end, peace was established between the two societies.

It was clear that the principle of two separate organisations, both professing to stand for the same thing, was against the furtherance of the amateur cause. The conditions above gave the R.T.S. a majority in all deliberations, and enables all business to be conducted as the present members wish. Also, the proposed new formation will express the desires of the majority of radio amateurs, and the R.S.G.B. will be more representative of their opinions. He had much pleasure in moving the resolution, and trusted that all the members would give it their support.

5MD—I have much pleasure in seconding the resolution.

2DX—I consider that the attitude of the officials of the R.S.G.B. was, that if affiliation came about, all was well, and they would assist, but on the other hand, if not, they were out to suppress the R.T.S. Since then, the Constitution of the R.S.G.B. has changed, and also the R.T.S. has established itself, and so, now the future of the R.T.S. is assured, the R.S.G.B. want some say in the matter, and after the rebuff the R.T.S. received from the R.S.G.B. and certain sections of the Press, I consider we are climbing down in discussing fusion. I also feel that after affiliation, the R.T.S. will lose the honour which it at present has in its officers. It seems a wrench that they should fade into the obscurity of affiliation. Another point is that the Postmaster General regards the R.T.S. with as much favour as the R.S.G.B., and both have



Mr. Basil Davis (2BZ), a well-known amateur transmitter.

some influence with the P.M.G., but would a combined Society have the same standing? Whilst not opposing affiliation, I think these points need great consideration.

5BV—A point of view which has, I think, been overlooked, is that as a body in a minority, the Press stated that fusion with the R.S.G.B. would be inevitable, thus proving the futility of the amateur transmitting movement. The only way to keep going, while in the minority, is by maintaining prestige with the people, and it is clear that, on amalgamation, the Press would score a point, and any prestige which the R.T.S may have would inevitably be lost.

A Member.—I wish to ask what power the Section Committee will have in managing the new society, if formed?

5VL. — When the trouble arose with the R.S.G.B. Capt. Fraser left that Society, and I wish to ask how does he stand now, in view of the proposed amalgamation?

Capt. Fraser.—I will answer that now. I am entirely in your hands. If you leave your officers as they are, I go on in my position. I left the R.S.G.B. following my convictions. Others said they would resign also, but I do not know if they did so.

5FR.—What is the relation of the Transmitting and Relay Section to the R.S.G.B.? How are they represented on the Council?

Capt. Eckersley.—I am in a difficult position, but believe me, I am not here in any connection whatsoever with the B.B.C. If we amalgamate, my attendance remains the same, and I hope the spirit which exists in these meetings will be carried into the section. Don't judge the R.S.G.B. by what has occurred in the past, as their attitude has changed, but let us judge by what will be done in the future. We shall be more influential with the weight of the R.S.G.B. behind us. These politics are a nuisance, and hinder us in our real work, and it would be better to get away from it once and for all.

A Member.—May I ask the comparative numbers of the two societies as they stand at present? I agree with Mr. Alford that the P.O. is in rather an awkward position in relation to two separate societies, which will no doubt become rivals if fusion does not take place. Does the Transmitting and Relay Section stand as a mere part of the R.S.G.B., or has it the standing of a separate society, with the use of clubrooms, etc., if any, and so forth?

5BV.—I am sure there is no desire on our part to change any member of our committee for any member of any other committee. Capt. Eckersley said we should be more influential with the weight of the R.S.G.B. behind us. There is not much sign at present of any influence attaching itself to the R.S.G.B., and would it not be better to see some sign of this before amalgamating? Would we get away from politics by joining a society already bound up in them?

A Member.—If we amalgamate, shall we still have these friendly meetings and lectures? The R.S.G.B. do not have such meetings, and their lectures are not nearly so good as ours. On the other hand, if we carry on as a separate society, they will fight. The question is, can we fight them? I think the big names on the R.S.G.B. have considerable weight with the P.O., and thus the R.T.S. would have a bad time.

Capt. Eckersley.—We shall do our best to keep up the friendly spirit which exists at our own meetings, and trust that the Transmitting and Relay Section will fall into our way, as opposed to their own coldly formal proceedings.

5CB.—Will the Postal arrangements still be carried on by our Hon. Secretary, or shall we have to depend upon the R.S. for notices of meetings? Personally, as a member of the R.S.G.B., I usually get my notices of a meeting the morning afterwards.

Capt. Fraser.—In summing up I will deal with the querists in turn.

I much regret that 2DX did not lay his views before the Committee, but owing to the distance he resides from London, I presume this was impossible. I am sorry that, whilst not opposing the fusion, he is not in agreement with it.

Two members have been unjustly severe in their criticisms of the Press, as in this week's issue, the paper retracts somewhat from its former position, and even suggests that the R.T.S. is absorbing the T. and R. Section by amalgamating with it.

If we fuse, we shall have a majority on the Committee, and we can carry on our meetings as we wish, because we shall be able to outvote any opposition. We shall be subordinate to the R.S.G.B., as our representation on their Council will be small, but even then it will be a higher proportion than is the case with any other section.

Our meetings, tests, and so on, can be carried on, and we shall not be trampled on in our affairs. As regards the P.O., I think fusion would strengthen the position of the amateur transmitter, and our negotiations with the P.O. will be carried on in a better spirit, as being more representative.

A member asked for the numbers of the members of the Societies. The R.T.S. has 131 members, while the T.R. Section has between 80 and 90. With regard to the postal arrangements, the Committee can continue to utilise the services of the present Secretary, and we shall be able to please ourselves as to what we do.

I hope all dissentients will reconsider the position, and will unanimously support the resolution.

Nothing that we have gained will be lost by fusion with the older Society. We have beaten the R.S.G.B. at their own game in a few months, so we can certainly continue on the same lines and obtain all we require. I hope you will all vote for amalgamation, as the greatest strength lies in following, not your own desires, but that road which will lead to best results.

The President then put the resolution to the meeting.

The resolution was carried by 30 votes to 10.

Capt. Fraser then said he held 25 proxies from members who were unable to attend, instructing him to vote on their behalf for fusion. The Hon. Secretary held 6. He did not mention this before as he did not wish to influence individual members.

A Practical Neutrodyne Receiver

By ALLAN T. HANSCOM

This article explains the action of the neutrodyne circuit very clearly and gives constructional details of the special H.F. transformers and neutralizing condensers

IT is unfortunate that so many good circuits are labelled with such formidable titles. The name "neutrodyne" is usually enough to scare the average radio amateur. A neutrodyne circuit, as commercially developed, is, however, a great deal more simple to understand than the regenerative or reflex circuit.

The average experimenter is not interested in the higher mathematics of a circuit, but he does like to know the size of the parts so that he can put one together to obtain results.

Fig. 1 represents a simple type of non-regenerative circuit. By

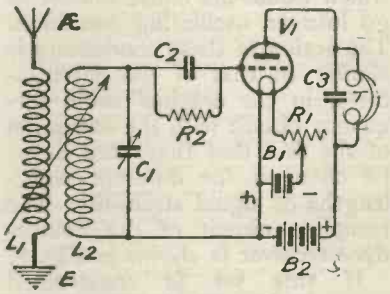


Fig. 1.—A loose-coupled non-regenerative receiver having a tuned secondary.

varying the condenser the natural wavelength of the set can be altered. This is exactly the diagram of the first stage of the neutrodyne.

In Fig. 2, another stage exactly like the first has been added. In this case the first valve acts as a radio-frequency amplifier and the second valve as a detector.

It will be noticed that the plate circuit of the first valve is not tuned, but that the grid circuit of the second valve, as well as the grid circuit of the first valve, are both tuned and in reality make a two stage filter through which the incoming signal must pass.

Fig. 3 represents three stages

exactly as outlined above, and this is the scheme of the neutrodyne after we add the neutralising condensers, which will be considered later.

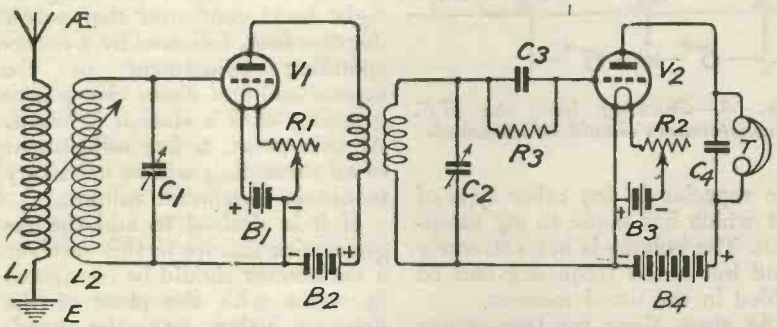


Fig. 2.—One stage of H.F. amplification coupled to a non-regenerative detector circuit, the secondaries of both circuits being tuned.

In Fig. 3, there are two stages of radio-frequency amplification and the detector, each stage being tuned by a variable condenser in the grid circuit. This circuit would give wonderful results if it were not for the internal capacity coupling between the plate and the grid circuit of each radio-frequency valve. This internal capacity is neutralised by the combination of capacity and inductance; the inductance being the windings of the air core radio-frequency transformers. The capacity necessary for the average valve is very small and is usually about equal to two circular plates $\frac{3}{8}$ in. in diameter separated by 3/32 of an inch. This is only approximate and the proper value may easily be found. Other types of condensers for this purpose are shown in Fig. 4.

The radio-frequency transformers can be made by winding 80 turns of wire on 3-in. formers with a tap taken off at the 20th turn. It is preferable to use cardboard because it is an advantage to have a close coupling between this coil and the primary, which is inserted inside. The primary consists of 20 turns of wire on a former which will just clear the former on which the secondary coil is wound. It is not possible to buy one tube to fit inside another in this manner, but it can be overcome by sawing a piece of tube $\frac{1}{4}$-in. wide from the same tubing. Then when it is wound, the wire will

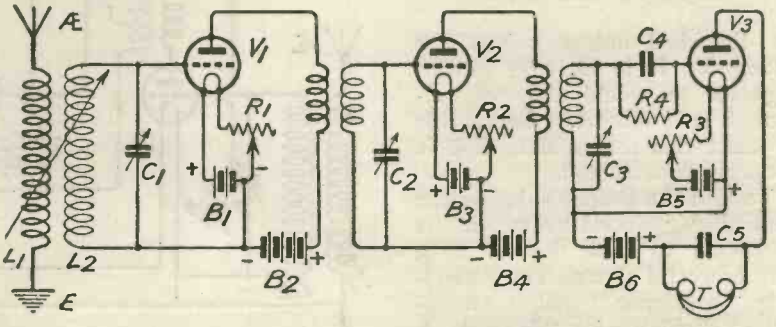


Fig. 3.—Two stages of H.F. amplification and detector. This circuit is free to oscillate due to the internal capacity of the valves.

draw it to a smaller diameter whereupon it may be slid into place inside the full-sized tube. It is very important that these transformers be mounted at least 6 ins. apart and at such an angle that a line drawn at right angles to the axis at the end of the winding does not intersect the winding

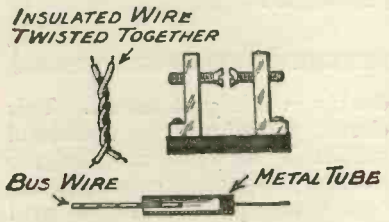


Fig. 4.—Three methods of making the small neutralising condensers.

of the adjoining transformer. See Fig. 6. Note the relative position of primary and secondary windings.

Neutralising Condensers

Since the variable condensers used are connected between the grid and the filament, it is possible to connect the grid to the fixed plates and then mount the other small movable plate on the back insulated portion of the condenser. By this means a very small change of capacity can be made in the neutralising circuit. See Fig. 7.

After the proper value of this capacity is found, it need never

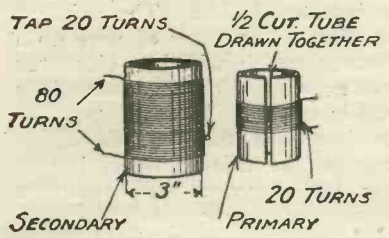


Fig. 5.—Constructional details of the H.F. transformers.

be disturbed unless valves are changed. It is likewise advantageous to shield the set, although it is absolutely impossible to make this set oscillate if it is properly constructed.

To find the proper value of the neutralising condensers it is necessary to tune the set to a very powerful signal. The Flewelling "screamer" makes an excellent oscillator for this case. A paper may be inserted in the socket to cover the filament connections but leaving the plate and the grid free. Then the valve is inserted and the signal is still heard.

This is done for the first stage and second stage separately, adjusting each condenser until the signal is no longer heard. I have found it possible to adjust these condensers without going to this trouble by simply setting them at the greatest capacity which would not cause the set to go into an oscillating condition. The action of these condensers is similar to that of the potentiometer in the original radio frequency circuit with the exception of the fact that they need never be changed for different wavelengths or signal strengths. The complete circuit of the neutrodyne receiver is shown in Fig. 8.

If this set is constructed properly it will give results in clearness and sharpness which

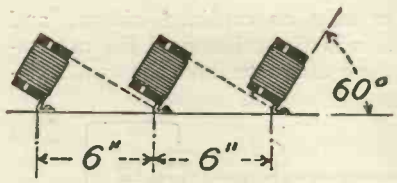


Fig. 6.—Showing how the H.F. transformers should be mounted.

are superior to any other type of set which has come to my attention. The volume is not extremely loud but audio frequency can be added in the usual manner.

As seen, there are two stages of radio frequency amplification and a detector. The radio frequency transformers, unlike the iron-core type, have untuned primary circuits and tuned secondary circuits. The tuning system likewise has an untuned aerial circuit and a tuned secondary circuit. All adjustments are made by the three variable condensers and maximum volume of any one signal will not be obtained until these three circuits are tuned to the same values. This should be kept in

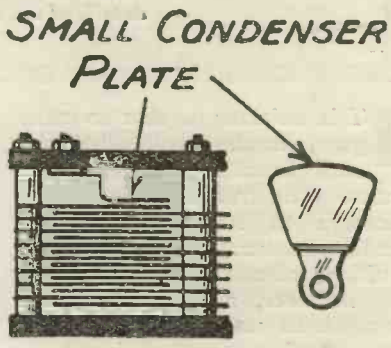


Fig. 7.—An alternative condenser arrangement.

mind when operating a neutrodyne receiver. The simplest way for hunting stations on various wavelengths is to start at zero on all dials and slowly work towards 180 degrees moving the right hand condenser dial a few degrees first, followed by a corresponding adjustment of the second and first dials. Keep progressing until a station is heard. At this point, a fine adjustment of all three dials will be necessary to obtain maximum volume.

If it is desired to add the regenerative feature to this receiver a variometer should be connected in series with the plate of the detector valve and the headphones. This variometer will allow as well the placing of the detector circuit in an oscillating condition for the reception of C.W. signals and without a chance of re-radiation.

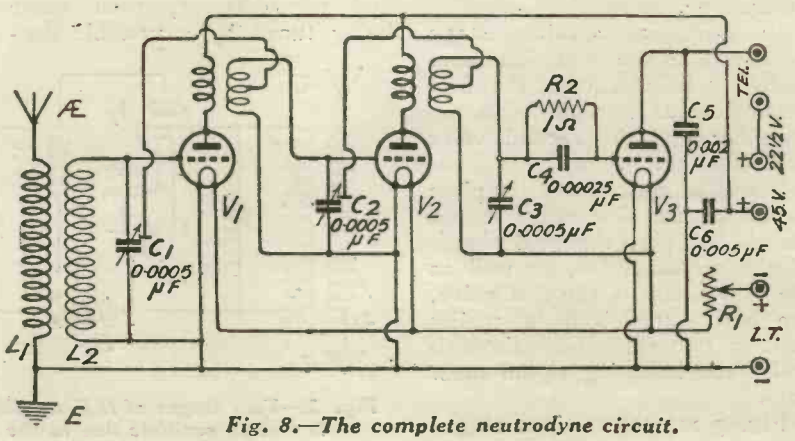


Fig. 8.—The complete neutrodyne circuit.

C.W. and Telephony Transmission Using Valves

No. V.

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

This series of articles began in Vol. 3, No. 6, with a consideration of the theoretical principles underlying valve transmission

Simple Valve Transmitters

SINCE we have stated the conditions under which self-oscillation may be produced, it will not be necessary to enter into a discussion of the theory of the valve as a transmitter of continuous waves. A valve C.W. transmitter is merely a high-power oscillator connected to an aerial circuit, a tapping key being suitably inserted in the circuits to enable Morse signalling to be accomplished.

Fig. 8 shows a very simple valve transmitter. Most transmitters of this kind use direct coupling between the output circuit of the valve and the aerial. By varying the tuning of the aerial circuit we automatically vary the frequency of the oscillations generated by the valve. The anode oscillatory circuit, or aerial circuit in Fig. 8, comprises the inductance L1 shunted by the variable condenser C1; the anode battery B2 is connected so as to give the anode A a positive potential of, say, 200 volts or more with respect to the filament. The negative side of the anode battery is always preferably connected to the positive side of the accumulator B1 in order that the voltage across B1 may be added to that of B2. A grid coil L2 is connected across the grid and the negative side of the accumulator B1; this grid coil is the reaction coil which, being coupled to L1, maintains oscillations in L1 C1; the grid circuit may be tuned by means of a condenser C2, but in nearly all cases it is aperiodic and is intended merely to apply radio-frequency potentials to the grid. The grid circuit is not intended to take any appreciable current, and to render it aperiodic it is frequently wound with resistance wire to enable the circuit to operate over a wide range of wavelengths.

The key K is included in the anode circuit, preferably at a point which is not at a high-frequency potential to earth. We have previously indicated that tapping keys, potentiometers, batteries and other similar apparatus should be connected next to the filament of the valve. In the case of keys, it is desirable, if possible, to connect them in such a position that the operator will not be liable to receive shocks.

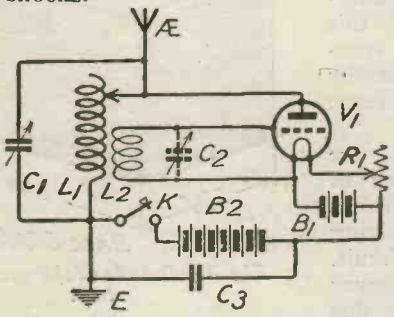


Fig. 8.—A simple valve transmitter circuit.

The operation of such a circuit is very simple. On depressing the key K a sudden flow of current takes place through the inductance L1 which forms part of the anode circuit of the valve. This sudden rush of current sets up a few oscillations in the circuit L1 C1; these oscillations are induced into the grid circuit L2 and the variations of grid potential supply strengthening pulses of current in the anode circuit; the energy thus liberated in the anode circuit helps to maintain the original oscillations in L1 C1. In this way a weak initial oscillation is built up practically instantaneously and the aerial radiates continuous waves of an amplitude which will depend upon the input power which is measured by multiplying the anode voltage by the anode current. On releasing the key, the anode current is cut off and the valve stops oscillating.

Position of Anode Battery

The position of the anode battery in a valve transmitter is of considerable importance, particularly when we are dealing with sets of medium or high power. The most important principle to observe is that the source of anode voltage should be connected in such a position that its capacity to earth, or tendency to leak to earth, has no effect on the oscillations; in other words, no part of the anode circuit supply should be at a high-frequency potential to earth. Another precaution which requires to be taken in the case of higher-powered sets, is to avoid the chance of a leakage of current across the source of anode voltage.

In Fig. 8 we connect the positive terminal of the battery to earth and the negative terminal to the filament accumulator. This arrangement is much better than connecting the anode battery next to the anode; the anode battery is connected to earth and it consequently cannot have any effect on the high-frequency oscillations.

Another rather important precaution which should be taken, if possible, is to see that the aerial is not given a high, steady voltage with respect to earth. If this precaution be not taken, the source of anode voltage is liable to be short-circuited if anything happens to the aerial, and leakages through faulty insulation of the aerial are liable to occur.

A Single Valve "Component" Set

By STANLEY G. RATTEE, Staff Editor

THE receiver about to be described is one which may be assembled from bought components, no construction of coils or other parts being called for. Should the constructor decide, however, to use home-made parts, such as basket or other coils, condensers, etc., he may, of course, do so without loss of efficiency, subject to the values being as given herein.

A straight single-valve regenerative circuit is employed, the reaction obtained being electro-magnetic. Since in the case of all single-valve receivers reaction is only obtainable by coupling the anode circuit to the aerial circuit, every care must be exercised in the operation of this receiver in order to avoid energising the latter circuit, thereby causing considerable interference to neighbours.

Whilst these remarks are meant to warn constructors of the effect caused by careless operation of receivers embodying reaction on to the aerial circuit, they are not intended to convey the impression that a set of this type may not be used by the broadcast listener whose experience of wireless is perhaps but short. So long as the receiver is handled with due care, a condition which applies to all receivers, there is little fear of causing local interference.

Those readers who are unfamiliar with the operation of valve receivers should, when operating an instrument embodying reaction applied to the aerial circuit, adjust the apparatus to give the most satisfactory results and then leave well alone until the evening's performance is concluded. In making the first adjustment the oscillation point should be found by careful movement of the reaction coil and condenser, and the former should then be adjusted so as to be well clear of oscillation point.

It may be found, when making these preliminary adjustments, that an occasional "tweek" may result, but so long as the reaction coil is moved away from the aerial coil immediately oscillation is indicated, and that such adjustments are made only at the commencement of the evening's listening and not during every brief interval, little harm is done.

The photograph, Fig. 1, shows

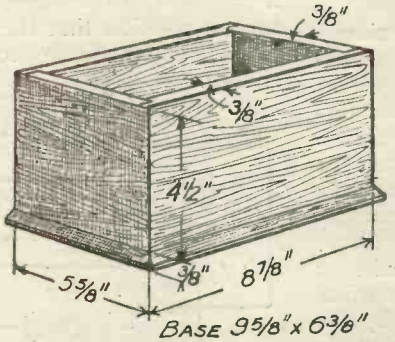


Fig. 3.—Details of the containing box.

the complete receiver, the two terminals on the left being for aerial and earth respectively, whilst those seen to the right are for the telephones, the H.T. battery, and filament lighting battery. The condenser for tuning the aerial circuit is seen to the left of the photograph, whilst the filament resistance is seen to the right.

The photograph, Fig. 2, shows an underneath panel view of the receiver, indicating the disposition of the components and the simplicity of wiring. This figure, used in conjunction with the wiring diagram contained herein, should make the assembling of a receiver of this

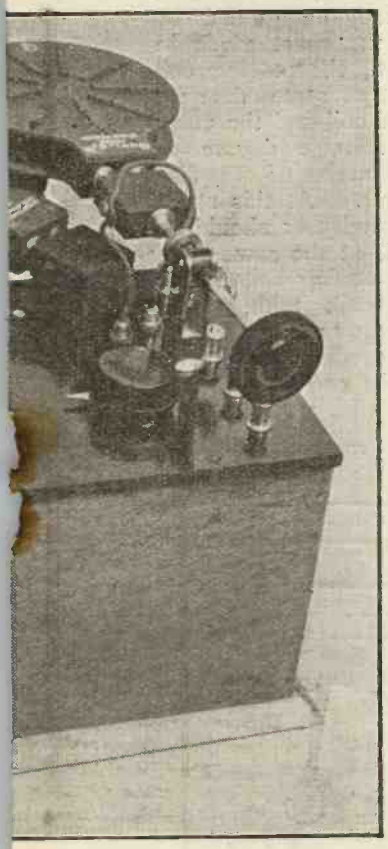
Fig. 1.—The Co

description both easy and straightforward.

Materials and Components Required

The components and materials necessary for the construction of

Fig. 2.—The unders



npleted Receiver.

The following article describes an easily constructed regenerative receiver for broadcast reception.

an instrument to the specification contained herein are as given hereunder. For the guidance of readers the names of manufacturers of the actual components embodied in the receiver are given, but it is in no way intended that constructors should restrict themselves to these makes. Components of any reliable manufacture will serve the same purpose with equal efficiency :—

One ebonite panel 9 in. × 5¾ in. × ¼ in.

One valve holder.

One variable condenser of 0.0005 μF capacity by Radio Instruments, Ltd.

One filament resistance (Igranic).

One 2-coil holder. That seen in Fig. 1 is a new type made by the Radio Communication Co., possessing a very fine movement obtained by a universal joint somewhat similar to that employed in the anti-aircraft guns.

Seven terminals.

ide of the panel.

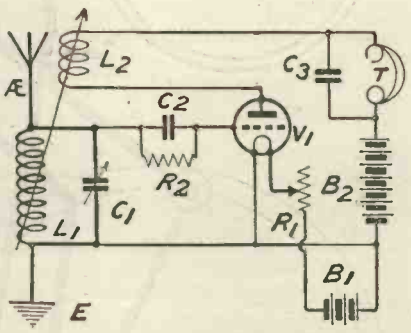


Fig. 4.—The Circuit.

One fixed condenser of 0.0003 μF capacity.

One fixed condenser of 0.002 μF capacity.

One gridleak of 2 megohms resistance.

Quantity of No. 16 or 18 tinned copper wire for connecting purposes.

Quantity of insulating sleeving.

One containing box to the dimensions given in Fig. 3.

Set of honeycomb or other coils for broadcast wavelengths.

The Panel

This is made from ebonite sheet measuring 9 in. × 5¾ in. × ¼ in., drilled to the dimensions given in Fig. 5. It should be noted, however, that with components of manufacturers other than those given above, different dimensions from those quoted may be necessary. With the panel drilled, the glossy finish of both sides of the ebonite should be removed with pumice powder or fine emery paper, as it is often found that this glossy finish is a cause of reduced efficiency due to poor insulation.

The Circuit

As previously stated, the circuit employed is a simple regenerative single - valve arrangement, and is illustrated in Fig. 4. The coil L_1 is the aerial tuning inductance across which is the 0.0005 μF variable condenser C_1 for purpose of bringing the aerial circuit of the receiver into resonance with that of the transmitting station. C_2 and R_2 are the grid condenser and leak, whilst R_1 is the filament resistance. L_2 is the reaction coil connected between the plate of the valve V_1 and one side of the telephones T. C_3 is a fixed condenser of 0.002 μF capacity, shunted across the telephones in order to byepass the radio frequency impulses. Without this condenser the high impedance of the telephones would be sufficient reason for the receiver either not oscillating or not " re-generating " sufficiently to give satisfactory results. B_1 is the filament-lighting battery, whilst B_2 is the H.T. battery.

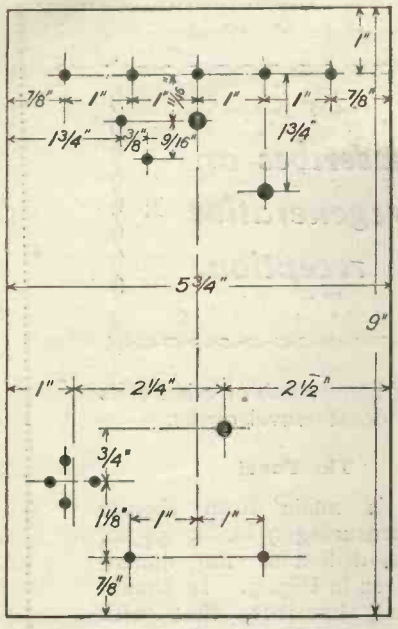


Fig. 5.—Details of the panel.

Wiring Up

With the panel drilled and prepared in the manner previously stated, the components should be mounted as shown in Fig. 2 and as laid out in the wiring diagram, Fig. 6.

The actual connecting up of the receiver should be executed in the following manner :—

From one of the filament legs of the valve holder connection should be made to the earth terminal, from there to one side of the 0.0005 μF variable condenser, and thence to one side of the fixed coil of the 2-coil holder and to the L.T. positive terminal. From the L.T. negative terminal, connection should be made to one side of the filament resistance, from the arm of which connection should be taken to the remaining filament leg of the valve holder. From the aerial terminal, connection is taken to the remaining side of of the 0.0005 μF variable condenser, and thence to the remaining side of the fixed coil of the 2-coil holder, and to one side of the gridleak and condenser, from the other side of which connection is made to the grid leg of the valve holder.

From the anode leg of the valve holder, connection is made to one side of the reaction coil, from the other side of which a lead is taken to the top telephone terminal and to one side of the 0.002 μF condenser. From the L.T. positive terminal (which incidentally is also the H.T. negative terminal) connection is now made to the remaining telephone terminal and to the other side of the fixed condenser.

This completes the internal wiring of the receiver, and at this point a test of its operation should be made.

Operating the Receiver

If the receiver is to be tested during hours of broadcasting, then reception should be attempted on wavelengths other than those devoted to the broadcast band, such as the 600-metre wavelength, for instance.

After inserting suitable coils in the 2-coil holder, the choice of which coils may be guided by referring to the chart given in Vol 3, No. 6, the moving coil should be set at some distance from the fixed coil and the valve lighted to a suitable degree of brilliancy by means of the filament resistance. At this stage the variable condenser should be slowly moved, at the same time bringing the moving coil nearer to the fixed coil, taking care whilst so doing that the set is not made to oscillate too freely. So long as the oscillating point is approached with care, the con-

(Concluded on page 327.)

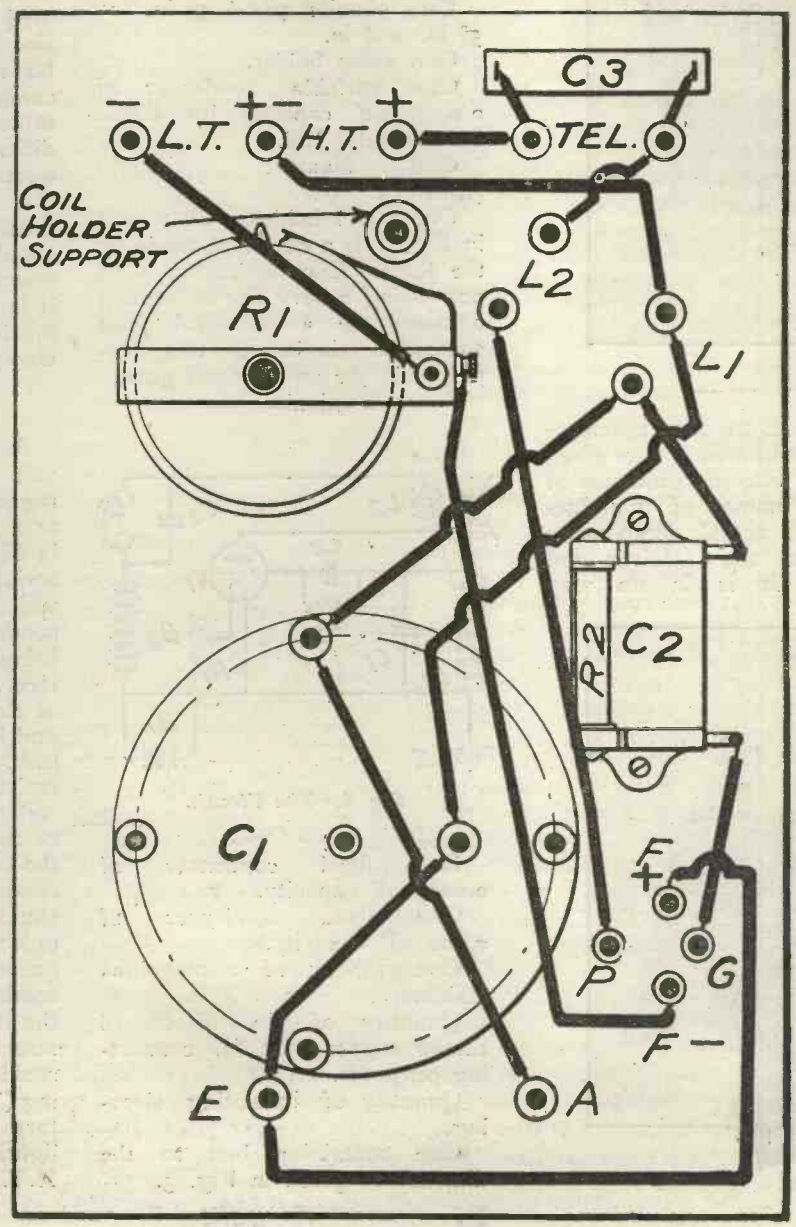


Fig. 6.—The wiring diagram.

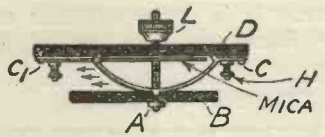
A Neat Variable Condenser

I present in this article, a neat variable condenser. The principal feature of this is the small sum for which it can be made, the small space it takes on a panel and the comparatively steady variation of capacity obtained. The parts required for its construction, are as follows :—

Two pieces of hard rubber measuring 1 in. × 2 in. and 2/2 in. × 1½ in., respectively (when mounted on a panel, only one piece is required).

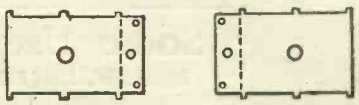
1 piece of mica.
2 brass plates (see Fig. 2).
2 binding posts.
4 screws.
1 insulating knob.

The knob has a sharp ring into which is screwed a large threaded rod (L) about 2 in. long, as shown in Fig. 1. This rod extends through the entire instrument and is permanently fastened to insulating block (B) by the nut (A). Cut two plates, as shown in Fig. 2, making the variable plate slightly wider than the stationary plate. Secure the rod (L) in the centre of the insulating piece (B). The holes in the plates are drilled



Constructional details of the variable condenser. The capacity is varied by turning the knob.

larger than the diameter of the rod (L) hole in the mica which is large enough to pass it. The movable plate (A) is fastened to the insulating block (D) by means of the two screws (C) (Fig. 1). The stationary plate is fastened to (D) by the two screws (C_1). A piece of mica is placed between the two plates and should be slightly larger than the stationary plate, thus avoiding the possibility of short circuit. Two terminals (H) and its opposite complete the construction.



Details of the stationary and movable plates of the variable condenser.

The capacity of the condenser is very close to 0.001 μF at its maximum, and has a comparatively low minimum value.

A. D.

A SINGLE VALVE "COMPONENT" SET

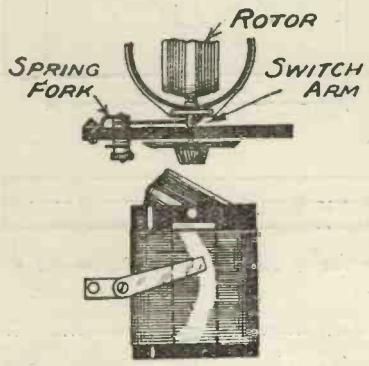
(Concluded from page 326.)

condition of oscillation will make itself known to the operator by means of a "cluck" which will be heard in the telephones, at which point the reaction coil should be moved a little away from the fixed coil.

In the event of there being no easily audible "cluck," its absence indicates that the receiver is not oscillating as it should, and in order that this condition may be remedied it is necessary to reverse the connections to either the aerial coil or to the reaction coil, that is to say, if the connection to the left-hand side of the reaction coil is made to the plate, and the right-hand side to the telephone terminals, then a reversal of these two connections should be made, or if preferred a reversal of the respective back-of-panel connections to the aerial coil may be made instead.

Results

With the receiver as seen in Fig. 1, using an average-sized aerial at Sydenham (London, S.E.), 2LO is easily though, of course, faintly audible without any high-tension battery whatsoever. With 50 volts on the plate 2LO is audible on a small loud-speaker. With the set connected to the power amplifier described by the present writer in Vol. 3, No. 2, and using one amplifying valve, loud-speaking of considerable volume is easily obtained.



A very fine variation of inductance can be obtained by using this system, which is less complicated than the usual method.

A Simple Variocoupler

For those readers who prefer an inductively-coupled tuner, we give herewith a drawing of a variocoupler, which departs from the conventional form of changing the number of turns of primary circuit to tune the wavelength desired. By using a long switch arm attached to the back of a switch spindle, single turn tuning is afforded.

To construct the variocoupler, simply wind the primary coil around the tubing and over a narrow strip of ebonite the length of the tubing. This gives a flat surface for the switch arm to slide on, and is more compact, as well as being neater in the outside appearance, than the ordinary coupler that requires several switch points, and even two sets of switches if signal turn variation is to be had.

H. W. S.

Some Useful Templates

By R. W. HALLOWS, M.A., Staff Editor.

MOST of us do a very great deal of unnecessary work when we are engaged in the construction of wireless apparatus. Suppose, for example, we are making up a 5-valve receiver. We carefully mark out the positions of the holes for each of the 20 valve legs by measurements. We do the same thing with the rheostats, even though we are using five of identical pattern. If we have decided that the numerous terminals to be fitted are to be 1½ in. apart, we find the position of each by careful work with set-square and footrule. There are at least three fixed condensers to be mounted on the underside of the panel, all requiring holes of the same size and spaced in the same way; yet in each case we plot and measure to find the points at which punch marks must be made.

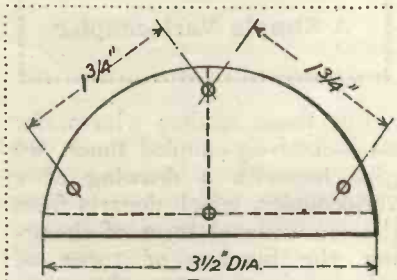


Fig. 2

Some time ago *Modern Wireless* printed a set of paper templates for valve legs. These were excellent in their way, and constructors seized upon them with avidity. Unfortunately, there were only six of them, and when these had been used by most of us, we recoursed once more to ruler and compasses.

It occurred to the writer recently that an enormous amount of work could be saved by putting in one afternoon's work in the construction of a set of simple templates of various kinds. He duly made them up, and the result has been greatly increased speed in turning out any piece of apparatus desired, as well as a feeling of confidence inspired by the knowledge that, so long as the templates are carefully placed when marking out is in progress, no error can be made. The first of these, shown in Fig. 1, is for valve legs. This is simply a piece of sheet brass 1¼ in. in width and 3 in. in length. It can be marked out very simply by making use of one of the *Modern Wireless* paper templates; but, in case these have already been used up, the dimensions are shown in the figure. It is important that the two lines crossing at right-angles should be marked out with a scriber, for this enables the valve to be centred in its correct position without any difficulty. In marking out the panel, all that one has to do is to mark the centre of the valve with cross lines. The template is then laid upon the ebonite and moved until its lines coincide with those upon the panel. One then marks the holes to be drilled with a small centre punch.

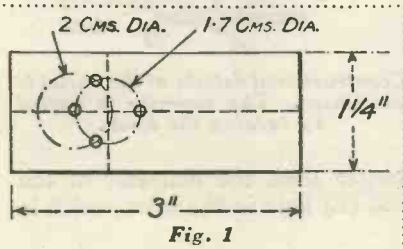


Fig. 1

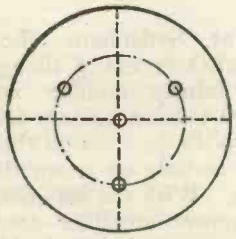


Fig. 3

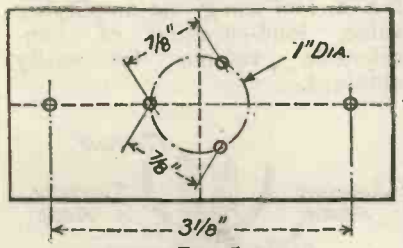


Fig. 5

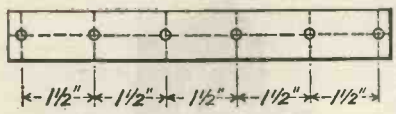


Fig. 6

The second template, shown in Fig. 2, is for moving-plate variable condensers. It is used when it is desired to make these up directly upon the surface of the panel. The cross lines are again important, since they enable a condenser to be placed exactly in the position that it is intended it shall occupy. The dimensions of this template will vary according to the make of condenser used. Template No. 3 is for rheostats with a three-screw fixing. Readers will, of course, make up templates to suit the particular pattern of rheostat which they favour; hence the dimensions are not given in this case. They will find it most convenient, once a satisfactory pattern has been found, to stick to it, since this avoids all further trouble in mounting when fresh panels or complete sets are made up.

The next is for the well-known Dubilier fixed condenser, and beside it is seen a template for the clips of Dubilier gridleaks. Either of these can, of course, be adapted to any type of condenser or gridleak favoured by the reader. Fig. 5 shows a template for the Polar condenser, which is used by so many constructors. Though the marking out in this case is comparatively simple, it is easy to make a slight error in the position of the holes for the screws fixing the dial, which gives an unsightly appearance if two or three condensers are placed in line. The last template shown is for marking out the positions of terminals with equal spacings between them. In that shown they are placed 1½ in. apart, which is the writer's usual arrangement, but these can be varied to suit individual preference.

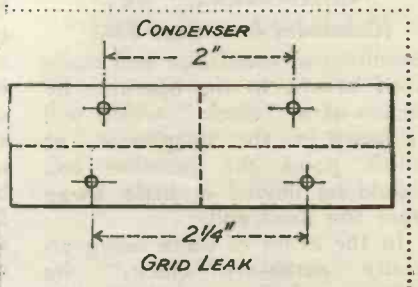


Fig. 4

Random Technicalities

By PERCY W. HARRIS, Assistant Editor

A few notes of interest to the Broadcast listener

THOSE listeners who are using primary cells to light their dull emitters should note particularly that these cells, unlike accumulators, do not give a steady voltage on discharge. When first switched on, the voltage from such cells will be fairly high, but in 5 or 10 minutes will have dropped considerably to a figure at which they will probably remain throughout the period of listening in. On being left 24 hours on open circuit, the voltage will rise again, so that, when switched on the next night, it will be higher than at the end of the previous evening. Of course, these alterations can be compensated by varying the filament resistances, but it is sometimes overlooked, particularly in receivers which have a critical setting for reaction, that the drop in voltage may seriously upset several adustments. A set, for example, which is adjusted almost to the oscillating point (after the set has been in use for a few hours) will probably burst into violent oscillation when switched on next evening. For this reason listeners with sets using primary cells should open up the reaction coil or vary the setting in such a way, when shutting down, that on the following evening they will not cause interference to their neighbours when first switching on.

* * *

We are still waiting for a really satisfactory filament resistance which can be used on either bright or dull emitters of all types. The ordinary 5 or 6-ohm wire resistances, however well made mechanically, are only really useful for the bright emitters as the amount of regulation they give is much too little for the latest types of valves. It is true that in those valves which are supposed to run off one dry cell, the resistance is sufficient to regulate the currents when used with such a cell, but if a 2-volt accumulator is used the average wire filament resistance has too low a value. The difficulty is partially met by the carbon compression resistances, of which there are three or four types on the market, but all of these have the grave disadvantage that you never know quite where you are with them. For example, most of them screw down with a number of turns before the minimum resistance is reached, and for this reason it is impossible to use the ordinary pointer and scale. Even if it were, the resistance seems never to be the same twice for the same position on the knob, and my own experience with them is that after fairly heavy use for two or three weeks they have a tendency to "pack." To take an example, I have recently been experimenting with a receiver in which I was particularly anxious to try all types of valves. For the first two or three days I found it quite easy to regulate the resistance for the dullest of the dull emitters and the brightest of the bright emitters by means of one of the carbon compression devices. However, after three or four evenings' work with bright emitters (which meant of course that the resistance was used at rather a low figure) I found that the resistances were totally unreliable when used with the .06 or even the .2 of an ampere type of valve. When passing a very small current the adjustment is very critical, and the slightest touch of the knob will vary it quite considerably.

What we really want is a satisfactory variable resistance of the wire type, with the wire sufficiently heavy to carry about .7 of an ampere, the resistance of the whole device being about 40 or 50 ohms. It should be possible by combining two or three resistances in series or parallel, or by some other switching device, to use that part of the resistance which is most suitable for the valve. The mere addition of a fixed series resistance of about 30 ohms to the ordinary rheostats is not good enough, for the variable part is still only a small portion of the total resistance.

* * *

Users of wave traps should note that on the final critical adjustment a slight movement of the filament resistance will often prove of great assistance in eliminating the local stations. Results with wave traps seem to vary a good deal with the aerial on which they are used.

An Improved Loud-Speaker Horn for Indoor Use

By A. W. SHRAEP.

Herein is described a novel form of loud-speaker horn designed to give an equal distribution of sound throughout the room.

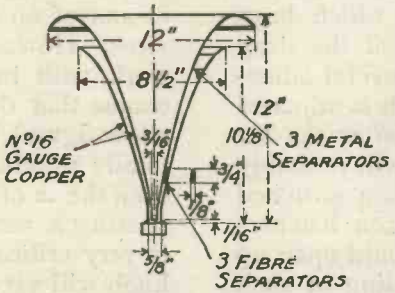
WHENEVER there was occasion to demonstrate a receiving set with a loud speaker, either in a large or small room, to a number of people where a comparatively large volume of sound had to be used, there was always met the annoyance, to those near the speaker, of being disagreeably affected, while listeners at a point half way to the rear of the room would just about be able to judge the good and bad points of the receiving set employed. At the present time, when entertainment is furnished in an auditorium, hotel lobby, etc., it is necessary to use two speakers placed at different points.

From time to time new loud speakers have been placed on the market. However, the manufacturer of every one makes new claims only for quality of tone, etc., due to the construction of the diaphragm, etc. In principle, they are all alike, throwing the entire volume of sound *in one direction.*

Beginning with the premise that *even distribution* of this volume of sound *over the entire room,* in other words diffusion of the sound, would solve the problem, it logically follows that this must be done from some point at the centre.

From the above, the line of research to be followed, and the solution, will be readily understood by the description and illustration of the means employed to get the desired effect of diffusing the total volume of sound practically evenly over an entire room. The first step was to place a horn within a horn, with simple means to hold these two horns in their proper relative positions. Horns with straight sides would naturally constitute no improvement, therefore, the principle of the bell (as for instance the opening of a cornet) of the brass musical wind instrument was adopted—and please note—this bell has been used since time immemorial without change.

On the curve of the bell, however, depend to the largest degree the acoustical qualities, and to fulfil its purpose this curve has to be mathematically, as well as acoustically correct, and by collaboration the true curve was designed. After using various materials, the horns were made of No. 16 gauge copper, and in order to still minimise internal vibrations, the interior, as far as possible, as well as the exterior of both horns were covered with paper. The illustrations show the dimensions as well as the curves.



Constructional details of the horn

It will be noted that the inner horn at the bottom is shorter than the outer one, and the travel of sound waves through this horn is directed and spread against the ceiling, while the flare directs the sound waves from the outer horn sideways and downward.

This combination of bells or duplex horns replaced the horn of a well-known loud speaker. No power amplification was needed as the receiving set employed was provided with sufficient low frequency amplifying valves. The speaker was placed within an electric light fixture of the reflecting bowl type, and suspended in such a manner that the top of the speaker would be within 4½ ft. of a room 12 ft. high, and in rooms with lower ceilings, approximately the same proportions were maintained.

Considering the fact that the bells in this speaker were by no means perfect, each was made in two pieces, cut out of a flat sheet of copper, shaped by hand, brazed and finished on mandrels which happened to be near the dimensions required — the result was truly surprising. In every part of the room, be it directly underneath the speaker or at a distance of 15 ft., the results were entirely different from those obtained with the usual type of horn. Good music or the voice received, acquired or were reproduced in a soft mellow tone, though the full volume was used at the input, and without this input being greater than necessary with the old type horn.

The above results were obtained in a room 28 ft. × 35 ft., using a single speaker. It is a practical certainty that in a large auditorium with fair acoustical qualities, two or three loud speakers using the described type of horn, will give excellent results. Naturally, tests for placing the horns will have to be made in every case, as the length, width and height of the auditorium will govern the situation.

Only the horn of the size illustrated has been made and used. However, there should be no question from the acoustical standpoint why different sizes of double horns, equipped with different types of telephones should not work satisfactorily.

Some Practical Wireless Problems

A page of particular interest to users of Crystal Receiving Sets.

Using a Potentiometer with a Crystal Detector

In order that certain crystals shall operate at the critical point on their characteristic curve, at which point rectification of incoming signals is most effectively carried out, it is desirable to apply an initial steady voltage across the detector.

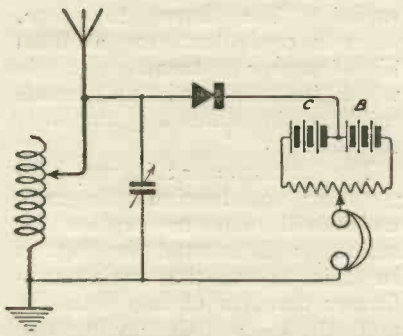


Fig. 1.—A crystal circuit using a Potentiometer.

Detectors fitted with crystals of the " firm contact " type, such as carborundum-steel, zincite-bornite, zincite-copper pyrites, and tellurium-zincite are improved by the application of this initial voltage, whilst with the " light contact " type of detector, such as the popular catwhisker-galena type, little or no improvement is observable. In the case of the carborundum-steel detector, an extremely stable combination, an applied voltage is essential.

The diagram herewith, Fig. 1, shows the method of applying a potential to the detector by means of a local battery and potentiometer. The latter should have a high resistance in order to prevent the battery running down rapidly, and should not be left connected to the battery when the set is not actually in use. It should be noted that the potential is actually applied to the crystal through the aerial tuning inductance, or secondary coil, in the case of an inductively coupled tuner.

Instead of connecting the batteries C and B (each of which may be a 4-volt flashlamp battery) as shown, a single battery may be used, but in this case it may be necessary to reverse either the battery or the crystal detector.

Increasing the Receiving Range of a Crystal Set

It is now fairly well understood that the addition of low-frequency amplification to a crystal receiving set, though giving a marked increase in signal strength, cannot enable signals to be received from greater distances. In other words, unless the crystal set itself is capable of receiving and detecting the signals, and making them just audible in a good pair of telephone receivers, the addition of L.F. amplification will not prove any advantage as far as *range* is concerned.

It is a fairly easy matter, and does not involve much expense, to add one stage of high-frequency amplification *before* an existing crystal receiving set without any necessity for pulling to pieces and re-wiring the receiver. The circuit diagram herewith shows the arrangement recommended.

Referring to the diagram (Fig. 2), the crystal receiving set, which must be of the *direct-coupled* type, is shown enclosed by a dotted line, and is to have its terminals shunted by a small condenser C, value 0.0003 μF.

The additional apparatus includes an aerial tuning variometer V, a valve panel (complete with valve-holder, rheostat and four terminals), filament lighting and high-tension batteries, B_1 and B_2.

In operating the modified apparatus it is necessary that the oscillating circuit LC of the crystal set be tuned to resonance with the aerial circuit, for which reason the compensating condenser C is fitted.

If the inductance L is wound with a large number of turns (say 100 to 120 upon a 3½ in. former), the condenser C may be dispensed with for the shorter broadcast waves (353 to 375 or 400 metres).

E. R.

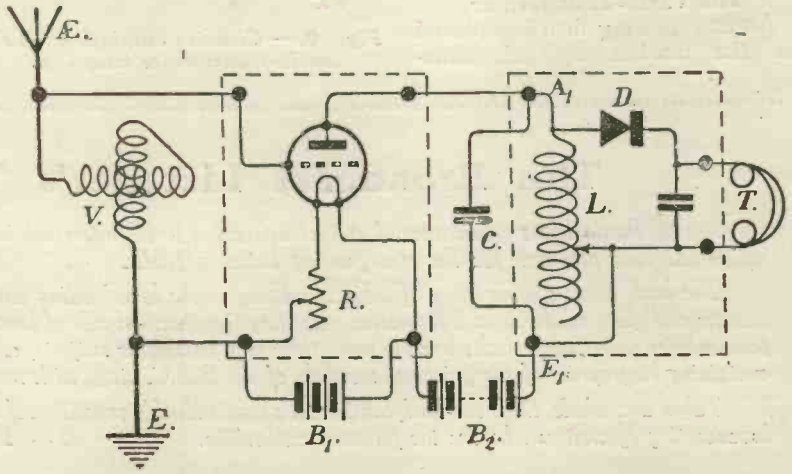


Fig. 2.—Circuit for adding a H.F. valve to a crystal receiver.

IN last week's issue I discussed the merits of the aperiodic primary-tuned secondary high-frequency transformer for coupling the anode circuit of one valve to the grid circuit of the next. This arrangement has distinct advantages, particularly on the shorter wavelengths.

Experiments I have conducted seem to indicate that the tuned grid circuit should employ as large a coil as possible and a small value of variable condenser. This, of course, applies more or less to any tuned circuit, but even more so in the particular arrangement described by Mr. Harris in our issue of January 30. It is to be noted that Mr. Harris's experiences indicate that the anode coil should be one size smaller than the grid coil; for example, if the grid coil is a No. 75, the anode coil should be a No. 50. The coupling between the two coils is of importance and the experimenter should not merely find that the tighter the coupling the better the results.

Those with variometers will wish to try out the arrangement of Fig. 1, which does not involve tuning the grid circuit by means of a variable condenser, but simply by a variometer.

The Vario-Transformer

An enterprising firm has placed on the market a vario-transformer for high-frequency coupling. This transformer consists of a kind of variometer having two windings, a primary and a secondary. The primary winding really consists of two separate and distinct windings, one of

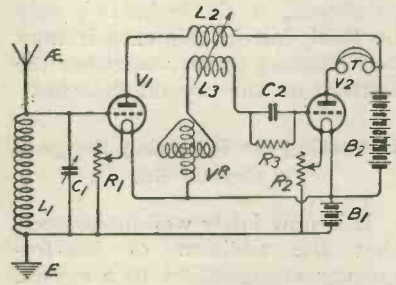


Fig. 1.—H.F. amplification with variometer tuned grid circuit.

which is included in the anode circuit of the first valve, and the other in the grid circuit of the

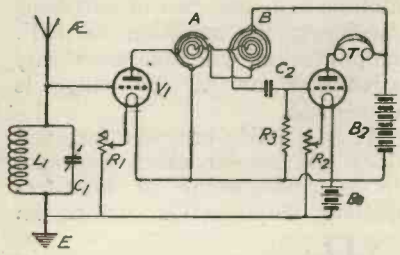


Fig. 2.—Circuit employing H.F. vario-transformer coupling.

second valve. The secondary of the variometer also has two windings, each being connected in series with the corresponding winding on the primary of the variometer.

The final result is that we have two variometers having a fixed coupling. As the adjusting knob is turned round, each variometer becomes tuned to the same wavelength as the other, and this wavelength may be varied. We have, therefore, what is equivalent to a fixed high-frequency transformer in which both the grid and anode coils are simultaneously smoothly variable.

The arrangement is very interesting, and the circuit diagram, which will help to explain its action, is illustrated in Fig. 2. In this form, the vario-transformer consists of two slabs, A and B, each slab having two windings; a part of the grid coil is in B and part in A, and likewise a part of the anode coil is in A and the other part in B. By moving the two slabs A and B relatively to each other, both grid and anode circuits are simultaneously tuned.

We have not yet received one of these instruments for test, but if properly designed and made, as we have no doubt it will be, the results should be very good.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

Porcelain Coil Mounts

A rather unusual material for plug-in coil-mounts is introduced by Messrs. Athol Engineering Co. in their new porcelain fittings, samples of which we have had submitted for test. The obvious criticism of fragility proves, on trial, to be ill-founded, for these samples were deliberately subjected to the most brutal treatment, which would have wrecked any ordinary coil, without any sign of chipping or breaking.

The insulation resistance was, as might be expected, too high to measure. The ease of insertion and removal in different coil-holders was noticeable; the plug is split on two diameters, and is turned down to a smaller diameter on the lower half, giving excellent springy electrical contact. Substantial side-screws and washers are provided for the wire connections.

The mount is neat in appearance, and obviously carefully made.

A Terminal

A quickly-detachable terminal fitting is that supplied by N. K. Mousley, samples of the No. 2 B.A. type of which have been sent for test. These are for use with a special end-ferrule, which is soldered on the wire, or alternatively with a twisted end of thicker wire.

The ferrule or looped end of the wire is pinched between the top of the terminal-post and an inner shoulder of the cap, which is slotted out for the introduction of the former, and has a milled edge; connection can be made by one hand, and is positive and secure, as actual trial showed. The makers lay some stress on the ease of cleaning of the contact surface, and its small size—only the end of the screw pillar.

The terminal is made in various sizes.

A Filament Resistance

Messrs. L. McMichael, Ltd., have sent for test a filament resistance of fairly standard general design, but adapted particularly for use in board-mounting, the lower side of the ebonite former being devoid of projections, and also being provided with two tapped holes for No. 4 B.A. screws by which it may be fastened in position on a wooden base-board. Two terminals are provided in an accessible position at the side.

Positive stops are provided at both ends of travel of the moving contact, an ingenious lifting cam device providing a very definite "off" position.

On test, the resistance was found to be about 6 ohms, and it carried the current for two R valves without any evil effects; whilst the control was smooth and silent.

We would suggest that the terminals might with advantage be rather more firmly secured in position.

A Panel-Mounting Potentiometer

From T. C. Ball comes a neat potentiometer, or large variable resistance with three terminals, uniform in all other respects with the bright- and dull-emitter filament resistances of the same make.

On test, this showed a resistance across the whole coil of approximately 220 ohms; the sliding contact gave smooth and finely-adjustable potentiometer control. The neat design and small space occupied on the panel by this device makes it particularly suitable for use in controlling the conventional type of high-frequency amplifying valve, as well as for many other purposes.

L.F. Transformer

We have received from the Hestavox Co. a L.F. transformer for practical test. This is of the medium large type, standing nearly 4 ins. high, and is suitable for mounting on a baseboard or behind a panel.

The insulation, as tested on 500 volts, proved excellent. On actual trial the transformer was satisfactory, and there was absence of parasitic noises.

A Covered Crystal Detector

Messrs. Winfield Bros., Ltd., have submitted for trial a sample of their "Wincrystal" covered crystal detector. This is of the cat's whisker and galena variety, of fairly large size, and ready mounted on an insulating base with terminals. A strong point in this detector, and one that will appeal to the experienced listener, is the ample provision made for rapid replacement of the crystal, without the necessity of dismantling or disconnecting any other parts. This is effected by means of small cups (in which the crystal is to be fixed with Wood's metal) which screw into one end of the detector body, and which can be replaced in a moment; extra cups are provided for this purpose.

A reasonably fine and springy cat's whisker is provided and a heavy glass tube protects the whole from dust.

On actual trial with a good sensitised galena crystal, excellent reception of local broadcasting, ships, etc., resulted and the adjustment was found to be convenient and stable.

Messrs. Harding, Holland & Fry, Ltd., inform us that the O.T.B. crystal set fitted with internal lightning arrester is the Type B.

Correspondence

THE "ALL CONCERT RECEIVER"

SIR,—With reference to your reply to "R.C." (Hammersmith) in your issue of Jan. 9, it may interest him to know that, with the exception of 2ZY I have no difficulty in getting, at good strength, all the B.B.C. stations, and L'Ecole Superieure des Postes et Telegraphes on an Amplion Junior (type A.R.35).

My panel is 18 in. x 12 in., as my components are somewhat larger than those described in your article. I am using Igranic Rheostats (vernier adjustment on H.F.), L.F. transformer and coils, "W. and M." variable condensers (0.001 and 0.0005 μF). Valves—H.F. Cossor red top, detector—Ediswan, and L.F.—Mullard Ora old type. The wiring is 16 gauge bare tinned copper. My aerial is 38 ft. twin, 25 ft. high, due North and South (lead in at N.), and is well shielded by houses.—I am, etc.,

W. F. HUNTER.

Walthamstow, E.17.

PWX, HAVANA

SIR,—It may interest you to know that on December 8 last I received with 1 H.F., detector and L.F., the station PWX, Havana. The reception between 12.45 a.m. and 3.30 a.m. was constant, and except for interference from Morse, distinct and exceptionally strong.

I have received a letter from Havana authenticating my reception, even to the ticking of a clock between the items, which in my ignorance I suggested may have been caused by WHAS, who was also on 400 metres and who was occasionally audible through Havana.

I attach a copy of the letter I have received, which I trust may be of interest to you.—I am, etc.,

F. DENT.

Cupar, Fife.

"SIR,—Your esteemed favour of the 9th ulto. reached us a few days ago, and it is with great pleasure that we write to let you know that it was station PWX that you heard on the night of December 8 at the hours stated in your letter. We are enclosing you two copies of the programme which was transmitted

that night, together with a few postal views of our station, which we trust will be of interest to you. We are also sending you under separate cover a copy of the Cuban Telephone Magazine, showing pictures of the announcer and ex-announcer.

"Station PWX is owned and operated by the Cuban Telephone Co., one of the associated companies of the International Telephone and Telegraph Corporation, of 41, Broad Street, New York City.

"The station is equipped with a Western Electric 101A radio telephone broadcasting outfit, having an output of 500 watts; the operating wavelength is 400 metres and the average aerial current 5-8 amperes. The station will broadcast every Wednesday and Saturday evenings, from 8.30 to 11 o'clock, until further notice.

"It may interest you to know that the most distant point reporting reception of the station is Southport, England, which is approximately 5,000 miles from Havana, but we believe you now hold the long distance record, Cupar being much further north than Southport.

"We are using the tick of a clock between numbers to aid our listeners in keeping tuned in. Our announcer, ROH, speaks both English and Spanish; therefore all announcements are made in both languages.

"We shall be pleased to hear from you at any time, and if we can be of any assistance to you, please do not hesitate to let us know.—Yours, etc.,

"M. DE CASTILLO,
"Director of Broadcasting Station PWX."

ST100

SIR,—I should like to thank you personally for the pleasure you have given me in your ST100 circuit, which has kept me constantly amused since last June.

From the very outset I obtained good results with the cheapest materials, and since then I have constantly improved until I can obtain all the more distant stations at good loud-speaker strength (fading excepted). I have on more than one occasion heard American stations.

Glasgow comes in very clearly on a small diamond-shaped frame aerial, with spreaders 3 ft. by 2 ft., and 2LO can be obtained clearly on the coils alone (on several occasions clearly audible in a fair-sized room on the loud-speaker).

I am an absolute novice and had never seen the underneath of a panel when I designed my set, which I did entirely from your theoretical circuit published in *Wireless Weekly*.

I know of two other enthusiasts who, after hearing my efforts, have also put up the ST100 and are delighted with the results.—I am, etc.,

WILFRED H. POWELL.
South Norwood, S.E.25.

THE "MYSTERY" STATION

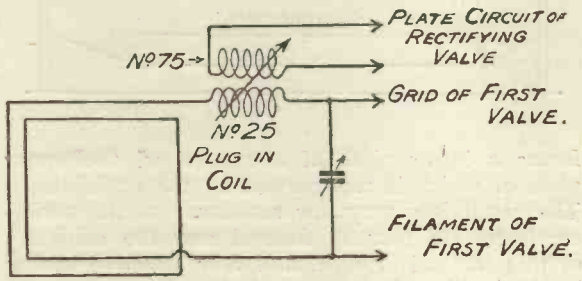
SIR,—I believe I can give the information desired regarding the "New Station" after which your correspondent inquires in *Wireless Weekly* for January 9, page 166.

It is Gothenburg S.A.B., and to my knowledge he has been working for some months at the times given by your correspondent. I am engaged on the Hull-Hamburg run and hear him frequently. He listens simultaneously for calls on 600 m. Wishing you the very best in "24,"—I am, etc.,

JOHN STRONG.
S.s. "Townley."

Information Department

V. S. W. (WOLVERHAMPTON) states that he is using a frame aerial consisting of 12 turns of bell wire upon a wooden frame 3 feet square, and wishes to know how he can improve his reception.



Since it appears that our correspondent cannot make his receiver oscillate, he will probably derive much benefit from adding additional reaction. The diagram shows how this may be done with two standard plug-in coils.

J. B. S. (LONDON, N.W.3) asks for the best method of reducing the volume from a loud-speaker when the latter is overloaded by the signals.

Probably the ideal method is to use a small number of valves, but if no alteration of the set can be made, the reduction should be obtained by detuning the receiving circuit. On no account should the method of dimming the valve filament be employed, since this device almost invariably introduces undesirable distortion.

P. J. (BIRMINGHAM) asks whether galvanised steel cable would be satisfactory for an aerial.

This material is not a very desirable one for aerial wire, since the presence of the steel is likely to result in magnetic losses. The cable which you possess, however, will be extremely useful for staying your aerial mast. Copper, phosphor bronze, silicon bronze, or some other non-ferrous, high conductivity metal should be employed for the aerial wire itself.

F. K. (WILLESDEN) asks whether he can run a pair of wires from his four-valve receiving set in one room to a plug and socket fitting in another room where he desires to use his loud-speaker.

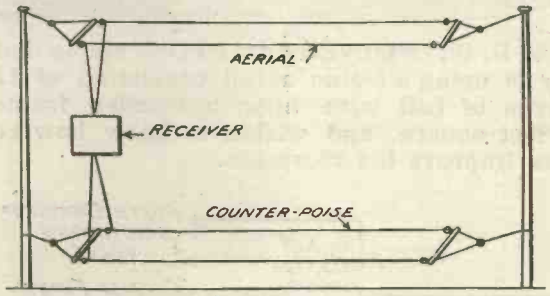
This arrangement is usually quite a satisfactory one, more especially if a low-resistance loud-speaker can be employed. In the case of some receivers, however, the capacity of the long lead may upset the working of the set and cause howling. It is therefore difficult to say in any particular case without trial what the results will be.

B. C. W. (HOUNSLOW) asks for the best combination of low and high-frequency amplifying valves for the operation of a loud-speaker.

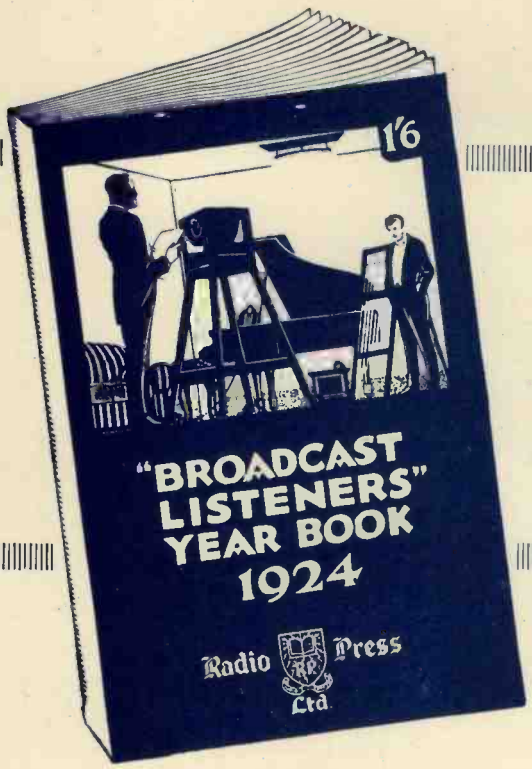
Sufficient high-frequency amplification should be used to enable the crystal or valve rectifier, whichever is used, to function efficiently, but not so much as to overload it. The necessary number of high-frequency valves will therefore vary according to the distance from the broadcasting station which it is desired to hear. The amount of low-frequency amplification to be employed should also be limited to two stages if the greatest freedom from distortion is desired.

T. L. J. (CARDIFF) asks whether a counterpoise earth would be an advantage in his case, since the ground is so exceedingly dry in his situation that he finds it almost impossible to obtain a good conductive earth.

A counterpoise or balanced capacity would probably be of considerable advantage in this case. It usually consists of a number of parallel copper wires suspended upon insulators 2 feet from the ground, immediately beneath the aerial. It thus



forms a lower plate of a condenser, the upper plate of which is represented by the aerial itself. The result is a very low resistance of the aerial-earth system thereby formed and the efficiency of this method is high, and very selective tuning is obtainable. It is particularly advantageous in transmission. The accompanying diagram will show how the counterpoise and the aerial are usually arranged.



"Broadcast Listeners" Year Book 1924

Get a copy of this new Book and have a peep behind the scenes

THIS new Book is entirely different from any Radio Year Book or Annuals that have ever been produced. It is, as its title denotes, devoted exclusively to Broadcasting. As you will see by this list of contents, it brings the B.B.C. right into your home, and introduces you to many of those who are responsible for the pleasure you get from Broadcasting.

We feel confident that it is one of the most interesting and entertaining Books that have ever been published—and a ready sale is assured. To make sure of a copy, an order should be given to your newsagent at once as the supply is limited.

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Wireless Weekly

and the Wireless Constructor.

Vol. 3.
No. 11.

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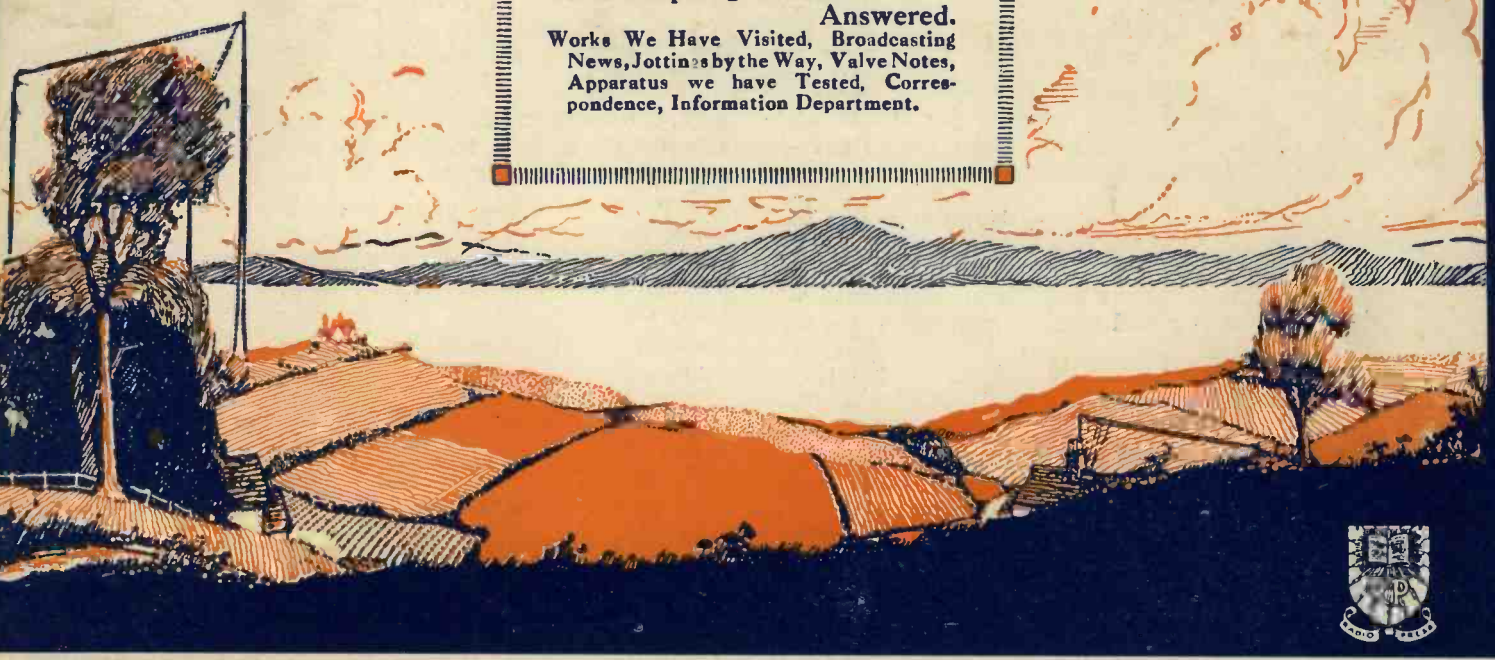
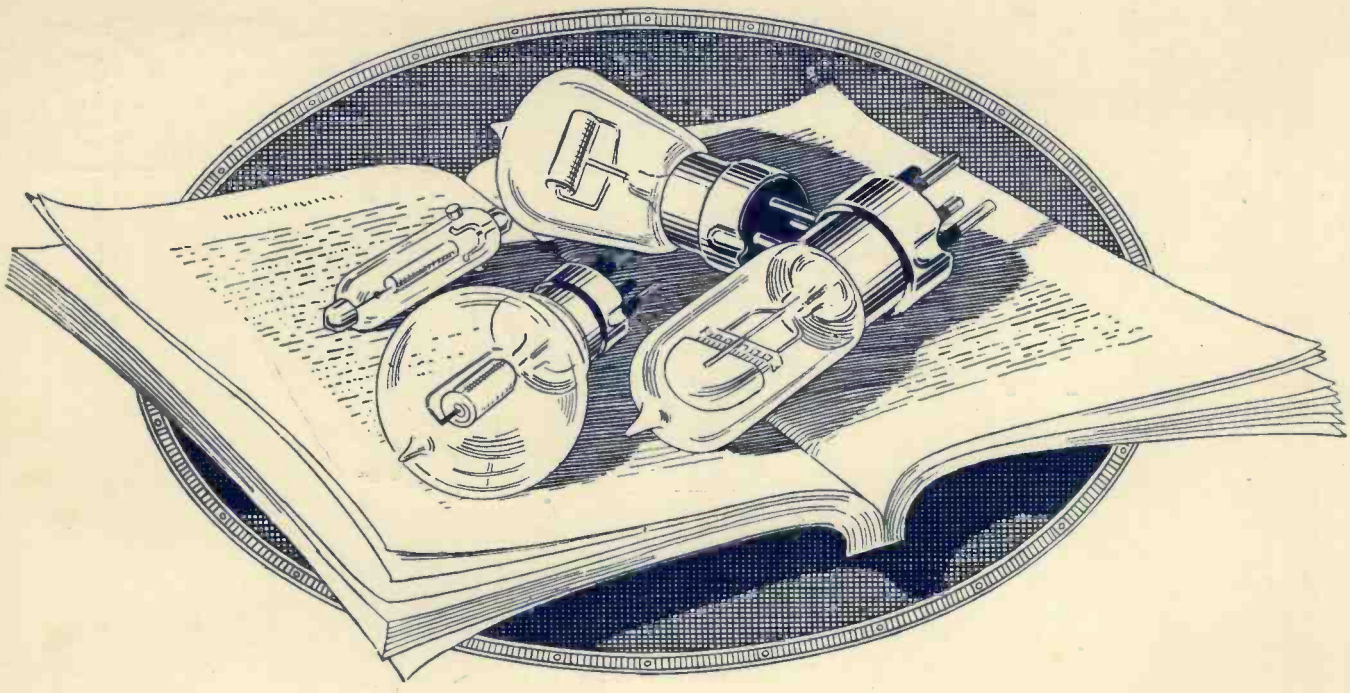


How to Obtain Extreme Selectivity

By A. D. COWPER, M.Sc.



Radio Valves
and how to use them
By John Scott-Taggart F.Inst.P.

TO a very large number of Wireless enthusiasts the Valve is still enveloped in mystery.

This lack of knowledge may be due in part to the fact that many books on the Valve are apt to presume that the reader has a good groundwork in electricity and wireless in the first place.

It is to remedy this that Mr. Scott-Taggart has prepared his new Book "Radio Valves and How to use them." As Editor of ***Modern Wireless,*** he has come into close contact with a very large number of wireless enthusiasts who are particularly good on the construction of Sets, but who are not too well versed on the theoretical side.

Every question that you could ask about the Valve is answered in this Book — and answered in a most helpful and convincing manner with many diagrams.

To understand the working of your Valves is to be in a position to get the best possible results from them, and ultimately greater pleasure from Broadcasting. Surely half-a-crown is little enough to pay for such invaluable assistance?

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Editorial

Helping the Experimenter

IN the early hours of Thursday, the 14th February, the Radio Society of Great Britain's station 6 XX sent out calibration waves for the benefit of experimenters interested in short-wave reception. The power used was sufficient to enable all serious experimenters throughout the country to avail themselves of this service, whilst the particular wavelengths on which the signals were sent (191 metres, 153 metres and 121 metres) were in a useful region. Of course, this is not the first occasion on which the R.S.G.B. have sent out calibration waves, but we are glad they are continuing to do so at intervals, and we foresee excellent results in this sphere of work.

Accuracy of measurement is the essence of all sound experimental work, and we suggest that the Society could with advantage considerably extend its activities in this direction. Comparatively few experimenters can afford to purchase an accurately calibrated heterodyne wavemeter, and it is by no means simple, particularly for the amateur in the country, to get his home-built wavemeter properly calibrated. Whilst the calibration waves of the R.S.G.B. are usually on the short wavelengths, it should not be forgotten that accurate calibration waves for the broadcast band would be of great help. Furthermore the immediate interest in broadcasting must not blind us to the fact that there is still much additional work to be done on all wavelengths at present in use—and these, of course, run up to some 20,000 metres. The Radio Society might consider extending their activities by announcing that on certain evenings the wavelength of particular stations would be accurately measured; later a list of the wavelengths measured could be broadcast. In this way experimenters would be able to pick up the high power stations for long waves or the medium power stations for shorter waves, and note the positions on their heterodynes. Then, when the actual measurements were announced, they could calibrate the instruments without delay.

That there are very few accurate wavemeters in use is proved by the fact that any evening one can hear experimenters asking one another what their wavelengths are, and many of the newer with transmitters are quite ludicrously inaccurate in their estimates. Recently in the United States the Bureau of Standards have been sending out such waves, and have indicated that certain broadcasting stations can be relied upon within very fine limits to maintain constancy of wavelength. So far as this country is concerned the Radio Society would appear to be pre-eminently the body to organise such work, and we commend the idea to them.

Experimenters themselves can do a good deal to help the movement towards accuracy in wireless work. Those transmitting amateurs who know accurately the wavelength on which they are sending (and there are quite a number of whom this can be said) should make a point of announcing this wavelength repeatedly during their test. The grant of a transmitting licence carries with it certain obligations, not the least of which is to make frequent reference to one's call letters, and the addition of the actual wavelength would be widely appreciated by listeners-in.

Once more we would like to draw attention to the slackness amongst transmitters in the use of call signs. A badly announced call sign is worse than none at all, for it is deliberately misleading. Again, some of the newer recruits to this branch of work are adopting the irritating habit of dropping the numeral, so that, as we now have twos, fives and sixes, identification is made much more difficult.

The mere possession of a transmitting licence does not make it obligatory to do all transmission tests with an outdoor aerial. Much of the experimenting we hear after broadcasting hours could just as well be carried out with an artificial aerial, and indeed would produce less congestion if it were so effected.

How to Make the "Wireless Weekly" Omni Receiver

No. III.

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

This article deals with the concluding stages in the construction of the All-Circuit receiver which has aroused so much interest.

To many, the final wiring up of the Omni receiver will be no small task. As a matter of fact, many of the difficulties are more imaginary than actual. The mere thought of having to solder connections to some 60 terminals is somewhat terrifying, but although patience is certainly required, yet it is amply rewarded when a beautiful looking instrument, capable of being used on hundreds and hundreds of circuits, is the result.

The first step to take is to fix the terminal panel to the front panel. These two panels are joined together by three screws which pass through the front panel into tapped holes in the edge of the terminal panel (see Fig. 7). The heads of these screws may readily be seen in Fig. 6, which appeared last week.

A correspondent has suggested that this method of fixing is likely to be insecure. This, of course, is perfectly true, and no one would suggest for a moment that the two panels should be held permanently together merely by means of three screws. Those who prefer may use brackets to support the terminal board, but in practice it will be found that the screws will hold the two panels sufficiently rigidly together to enable the wiring to be carried out without any trouble. Once the wiring has been done, the whole weight of the panel is taken by the wooden cabinet, the inside of which is fitted with ledges on which the two panels rest. It is therefore not at all necessary to have any additional support for the panel, beyond that which is necessary to hold the two together while the wiring is carried out, and whenever the panels are taken out of the box to enable an inspection to be carried out.

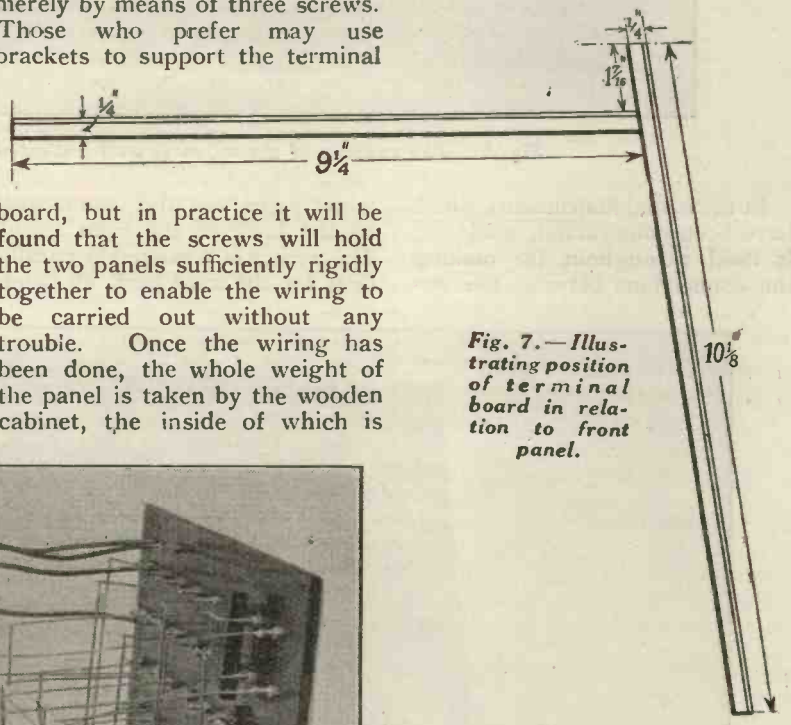


Fig. 7.—Illustrating position of terminal board in relation to front panel.

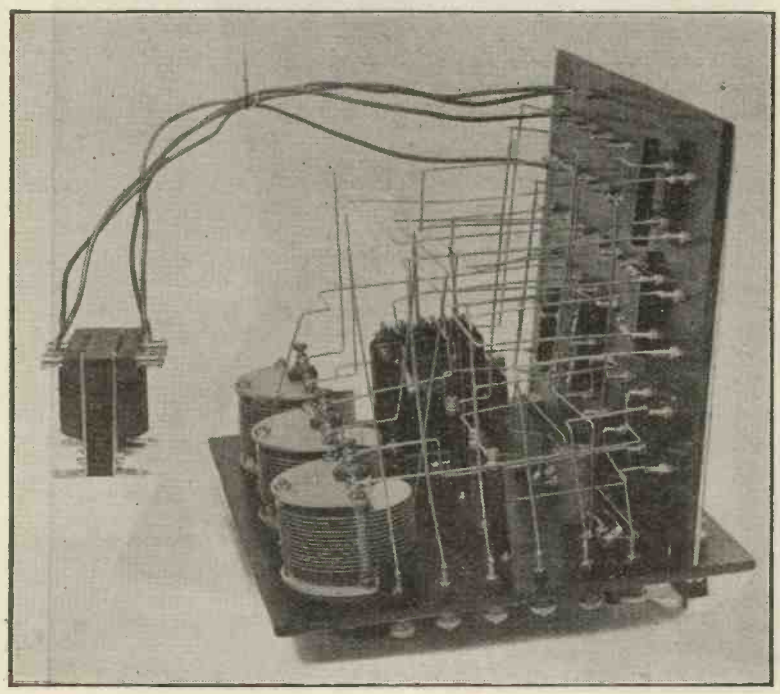


Fig. 8.—A side view of the receiver showing wiring.

The wiring is carried out by means of tinned copper wire, 1/16-in. square. This kind of wire is advertised in the small advertisement columns of this journal and will amply repay its use. The advantage of using square wire of this kind is that the wiring is perfectly rigid and all the wire is kept well apart so that there is a minimum of capacity effects between different wires.

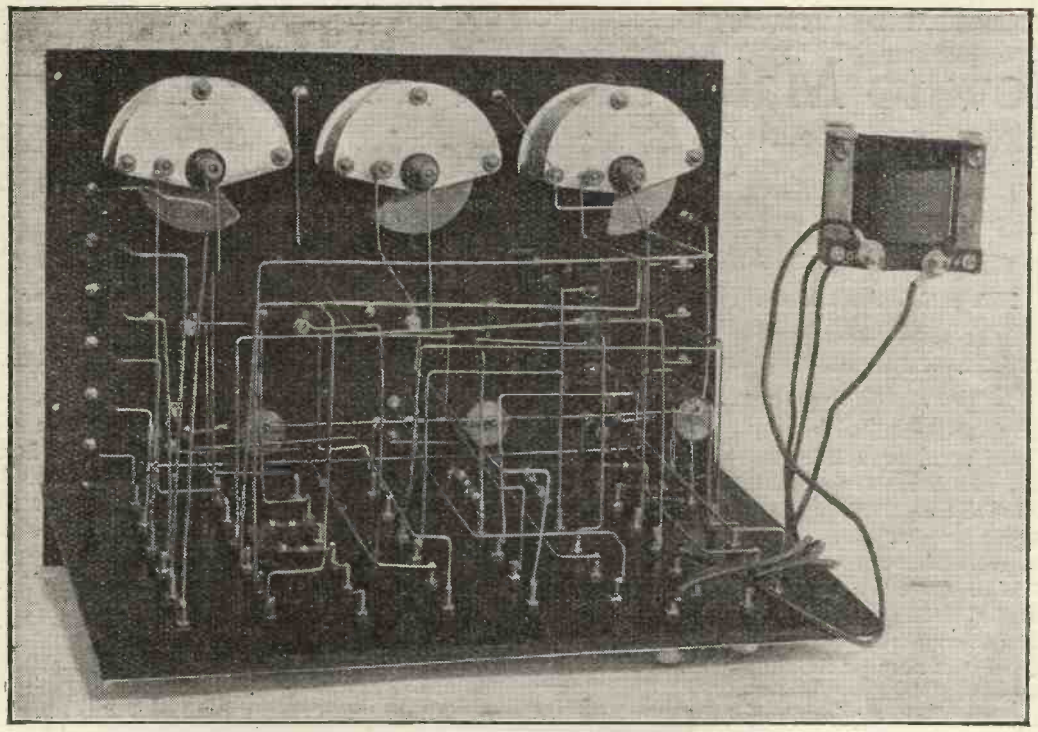


Fig. 9.—The spacing of the wires is well indicated in this picture.

In the actual instruments which have been constructed, soldering is used throughout for making the connections between the terminal panel and the components on the back of the front panel. The wiring is arranged in parallel lines for the most part, all bends being right-angle bends; each wire is kept well away from neighbouring ones.

Figs. 8—12 are photographs

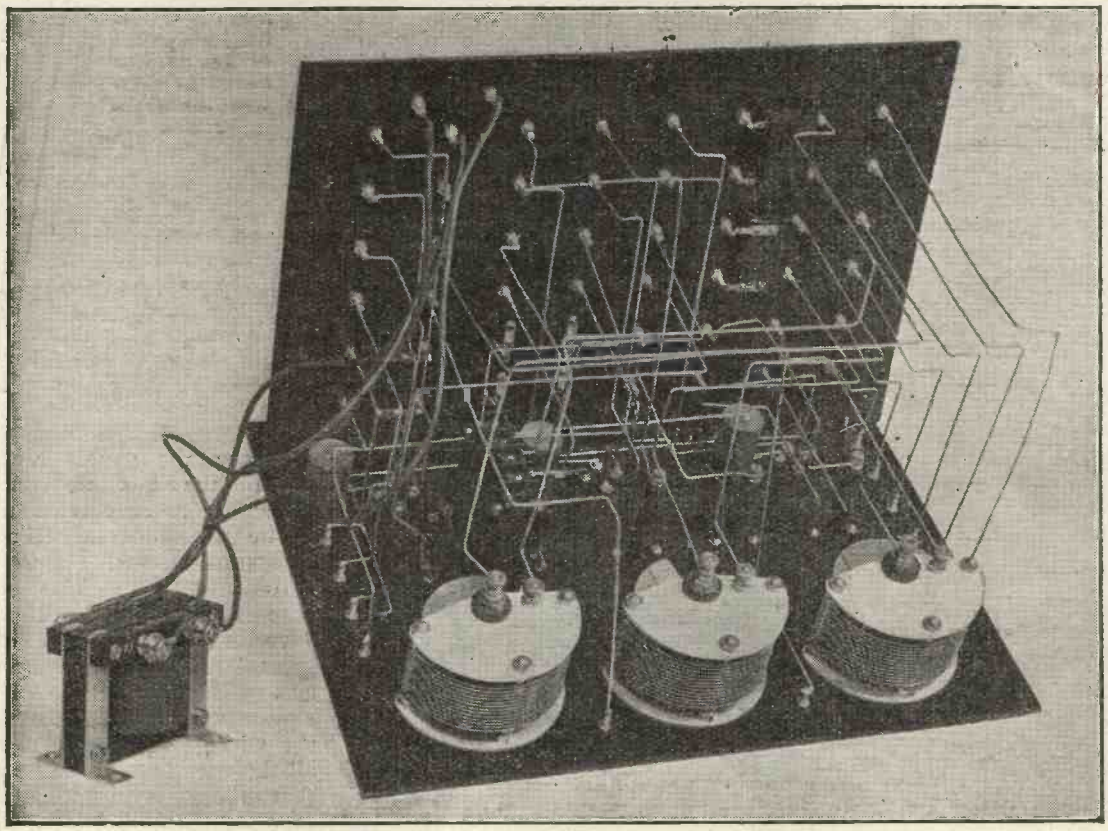


Fig. 10.—A further photograph which will be of help to the home-constructor.

of the wiring, and it would almost be possible to do the wiring from these photographs alone. Details, however, as to how the terminals are connected, are given in Figs. 5 and 4 in our last issue. Fig. 5 shows the bottom of the terminal board, while Fig. 4 shows the back of the front panel. The terminal 41 in Fig. 5 is joined by wire to the terminal 41 in Fig. 4. Similarly, the terminal 9 in Fig. 5 is connected to terminal 9 in Fig. 4; terminal 30 in Fig. 5 is connected to terminal 30 in Fig. 4, and so on; in other words, the figures in Fig. 5 and Fig. 4 correspond, and bare wire connections are made between corresponding points in the manner indicated in the various photographs. There is no need, of course, to follow out the wiring exactly as given, provided the wires are kept as far apart as possible.

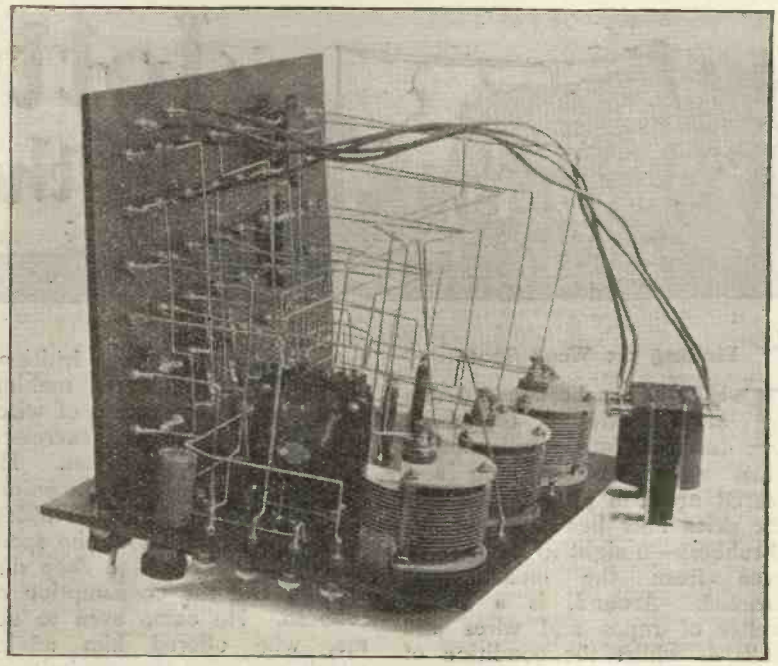


Fig. 11.—Showing the disposition of some of the components upon the panel.

SPECIAL NOTE

In our next issue, details will be given of the cabinet, and the method of fitting the two panels into it. This will conclude the constructional part of these articles, but further operation notes will be given. For the convenience of readers, a sheet of cartridge paper, with the various symbols printed on it for the terminal board has been prepared and two copies will be supplied to any applicant, the charge being 1s. 6d. for two, and 1s. 8d. post free from Radio Press Ltd., the publishers of this journal. Blue prints of the panel are obtainable at 1s. 6d. each, 1s. 8d. post free, from the same address.

As already announced, a special Radio Press Envelope is in preparation, but no date of publication can yet be given. Readers are requested to refrain from applying for this envelope until an announcement is made.

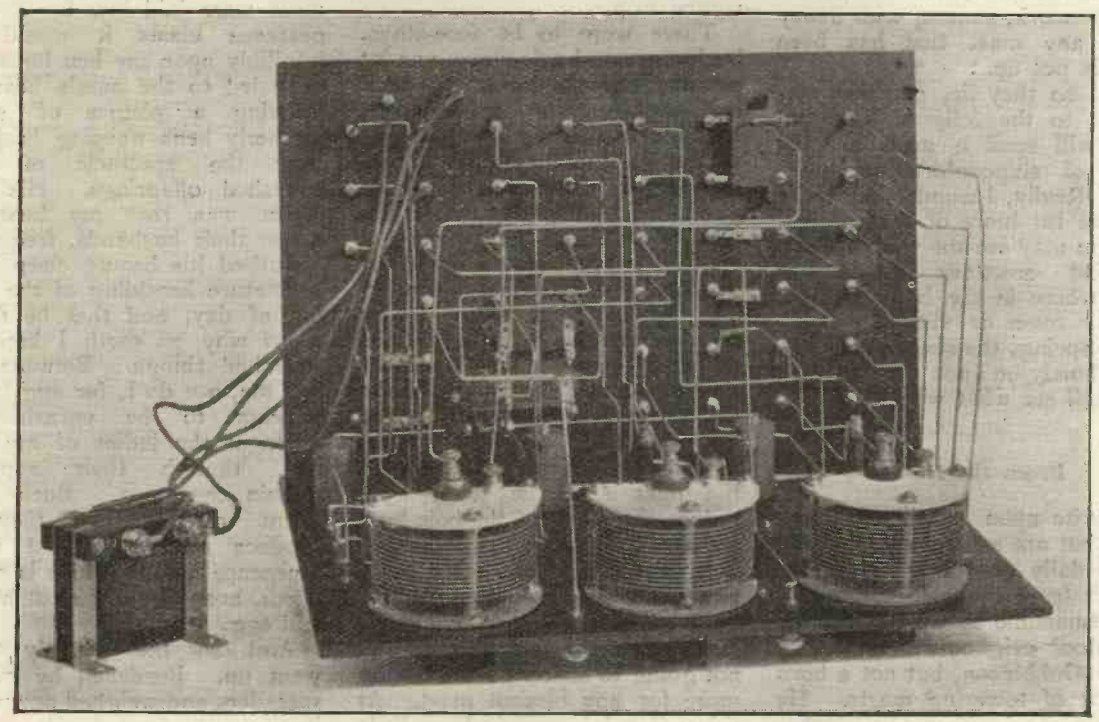


Fig. 12.—A full-face view of the terminal board.

Finding the Weak Spots

THERE has been a sad tale of casualties in the aerial forest of late. Full many a mast which not so long ago reared its head proudly towards the skies now lies prone in the shrubbery—a sight to bring tears even from the most stony hearted. Around, is a horrid welter of ropes and wires and pulleys, whilst the condition of the surrounding bushes, flower-beds and roofs bears witness to the fact that when it crashed it did the thing properly, leaving havoc in its wake. This falling of the mighty is not due as you might at first think to the activities of any band of slashers, such as I recorded a few weeks ago. It has not been caused by the hands of those who seek to bring down just vengeance upon the head of the confirmed oscillator. Æolus, the god of the winds, has been at work, smiting with heavy hand any mast that has been flimsily put up.

And so they lie, pathetic witnesses to the folly of mankind who will spoil a mast for the want of sixpenn'orth of back-stay. Really, I wonder that there are not far more of them down, for you may see the weirdest and flimsiest erections blossoming everywhere in the back gardens of any town or village. However, Spring, the season of gales, will shortly be upon us, and then we shall see what we shall see.

From the Heart

I write upon aerials with feelings that are rather poignant, for I am daily expecting to receive a visit from the pole erected at Christmastime by Gubbinson, my next-door neighbour. A worthy fellow Gubbinson, but not a born erector of towering masts. He is the sort of fellow who hatches wonderful schemes, but fails usually to bring them to fruition. When he contemplated making his entry into the realms of wireless he was not a little exercised over the aerial question. He consulted Snaggsby on the point; he communed with Winklesworth; with Snoopson he spent long hours devoted to deep discussion and the consumption of tobacco. He came even to see me, who offered him advice which, owing to the proximity of our abodes, cannot claim to have been entirely disinterested. Together we produced working drawings embodying the ideas of Snaggsby, Winklesworth, Snoopson and Wayfarer. To begin with there was a hole six (or was it eight?) feet deep in which it should stand firmly rooted. Then the mast itself was to be none of your light willowy spars, but something stout and solid, that would not have disgraced a full-rigged ship.

There were to be fore-stays, back-stays and side-stays, one lot coming from the top of the mast and another from half-way up; in fact, it was to be as firmly stayed as the masts of a full-rigged wind-jammer. So far so good. The morning after his visit I watched Gubbinson at work. I even lent a hand by leaning over the fence and offering useful suggestions. He tackled that hole with a will, wielding pick and shovel as though born to their use. At the end of half an hour he stopped for a rest, remarking that digging was hard work. After the next spell he decided to reduce the depth of the hole by a couple of feet. A third decided him, that having made it a good two and a half feet deep, he had done all that a man could be expected to do, and that he was not going to blister his hands any more for any blessed mast. At this point I began to be a little apprehensive.

On Deaf Ears

His visit to our local builder in search of a suitable pole resulted in a further paring down of the estimates, and I was horrified to observe the delivery to his demesne of a long, floppy thing that was far from inspiring confidence. Having made his first essay in the splicing of wire rope, he came rapidly to the conclusion that four stays instead of eight would be ample. He retired to smoke a pipe over the question at this point, and came to the decision that no mast could possibly require more than one, and that it was absurd to anchor even that one to a ridiculous concrete block. It was no use, he informed me, making a pain of one's pleasures. I spoke to the man quite calmly of his duties towards his neighbours. I pointed out the direction of the prevailing wind and assured him that if the mast were laid low by its tempestuous blasts it would fall infallibly upon my hen house. I appealed to the man's heart by drawing a picture of stout, motherly hens weeping brokenly over the spectacle of their squashed offsprings. His only retort was that my hens, or rather their husbands, frequently disturbed his beauty sleep by a premature heralding of the coming of day, and that he didn't know why on earth I kept the wretched things. Between you and me, nor do I, for egg laying appears to be unfashionable amongst the ladies of my hen-run, though their appetites remain enormous. Such infrequent offerings as they do produce appear to cost about ninepence apiece, which is rather much, even for the most newly-laid egg.

And so the ghastly thing went up. Burdened by mighty spreaders and weighed down with its span of wire it bends as does one's fishing rod when one hooks

that huge trout which turns into an old boot just before it reaches the landing net. The gentlest zephyr now sends cold shivers down my back. It is not the hen house that I care about so much as the greenhouse, the cold frames and the asparagus beds, whose early promise is threatened by that swaying horror. In a breeze it bends now this way, now that, groaning the while like a demented soul. When a really good wind springs up it swings and sways and lurches and reels till I can no longer bear to look at it. Some day I am sure that it will pay me a totally uninvited visit, and my erstwhile trim garden will give a faithful imitation of a devastated area after intensive bombardment.

Atmosphere Again

I referred recently to the B.B.C.'s bright idea that to appreciate programmes properly one must obtain the correct atmosphere. It seems such an excellent suggestion that I have given it an extended trial with the most wonderful results. In fact, I am thinking of putting on the market a compact little device for producing the necessary noises which will make the listener-in able to capture precisely the right atmosphere. For example, if we are switched over to the Savoy, a turn of the crank labelled No. 1 produces a perfect imitation of the popping of champagne corks; at the same time an ingenious little machine whose chief ingredients are a board and a piece of sandpaper, enables one to hear the gliding of a myriad feet over the polished floor. A pair of bellows wafts abroad the odours of three or four smouldering gaspers mingled with those from a sponge damped with eau de Cologne. And there you are. Simple, is it not?

A second lever is labelled theatres. This will, of course, be more useful in the future when the great ban has been removed. Still, it comes in very handily for Covent Garden and the "Old Vic." A press descends upon an orange whose scent is again wafted towards the listener's nose by the bellows. Simultaneously, a gramophone record comes into play bringing the sounds of the auditorium to the ears. At about every five seconds it cries "chorklits." You hear the rustling of programmes, the frou-frou of silken dresses and exclamations from the injured, such as "Damme sir, that's my toe." I have not quite worked out the idea yet, but I feel sure that there is money in it. A Radio Press Envelope dealing with the construction of the atmosphere producer would, I am confident, have a record sale.

Hard Lines

But even without the machine one can do a very great deal if members of one's family enter thoroughly into the spirit of the thing. If, for example, a lecture on Arctic exploration is advertised, one should make proper preparations by letting out the fire, opening the windows and dining off raw seal blubber. It is curious, though, how one's best efforts are apt to go astray. We had made all these preparations the other night, but when the time came for the speaker to entertain us we were dismayed to hear that he had been held up owing to the railway strike, and that his place had been taken at short notice by Professor Goop, who was to lecture upon "Life Under the Tropic Suns." A little hard, was it not?

An Improvement

I begin to see signs of improvement in the nature of the little demons that inhabit the wireless set. Possibly they have got rather sick of working off the same practical joke over and over again. Or possibly they have become discouraged by our increasing skill in frustrating their worst efforts. However, I wish to place on record the fact that when I asked two friends to come in who have never previously heard wireless my set surpassed itself in excellence by its performance.

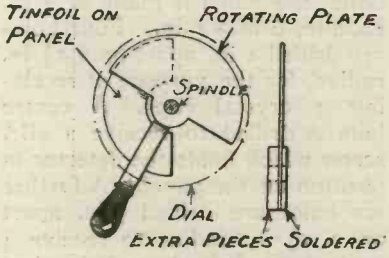
Prior to their arrival the local howling fiend had been hard at work. As they crossed the threshold he closed down and troubled the ether no more. The battery did not run down, no connection came unstuck, there was no fusilade of crackling noises, such as heralds the dying gasp of a worn-out high-tension battery, no valve burnt out or otherwise misbehaved itself. In fact, everything was precisely as it should be. This is a hopeful sign, but I have been touching wood whilst writing these words. Probably something awful is in store for me to-night when other friends are coming in.

WIRELESS WAYFARER.

A Vernier Condenser

This vernier condenser consists of a small semi-circular piece of tinfoil glued to the panel front and connected to the stationary plates of the variable condenser. The rotating plate of the vernier is a small circular piece of sheet brass with another piece of brass soldered to the centre to make the whole ⅛ in. or a little more in thickness. Through this centre is drilled a hole the size of the shaft. It should fit snugly on the shaft and be just tight enough so that it will not jar out of position. A composition handle is fastened to the movable plate and is long enough to extend out past the circumference of the dial. The space between the tinfoil and the movable plate should be about 1-32 in., but care must be taken that this arrangement does not short circuit the condenser. To prevent this, a small insulating washer can be placed on the condenser shaft so as to be between the stationary and movable plate of the vernier.

R. C. H.



This vernier attachment is mounted directly behind the knob and dial and is adjusted by means of the insulating knob.

An Experimenter's Unit Receiver

By H. BRAMFORD.

The following is the third of a short series of articles, which began in Vol. 3—No. 9, dealing with the construction of a progressive unit receiving set. This should prove of considerable utility to the home constructor and experimenter.

Unit No. 2

This unit takes the form of a crystal detector especially adaptable for the quick changing of crystals, and is shown as a completed unit in the photograph Fig. 11.

Materials Required

Materials necessary for the construction of this unit are as follows :—

1 piece of ebonite measuring 6 in. × 4 in. × ¼ in.
4 crystal cups.
4 contact studs.
2 stop pins.
1 switch arm with knob.
1 detector standard.
2 terminals.

The Panel

As in the case of the previous units, the panel is made of ¼ in. ebonite, 6 in. × 4 in. Four holes are drilled 1 in. apart on a 1½ in. radius, for the purpose of receiving 4 crystal cups. A centre hole is drilled to receive a 4BA screw which holds the detector in position on the panel. A further six holes are drilled ⅜-in. apart on a 1½ in. radius to receive 4 contact studs and 2 stop pins. The centre hole is drilled to receive 2BA rod for the switch arm. The drilling dimensions for the panel are given in Fig. 12.

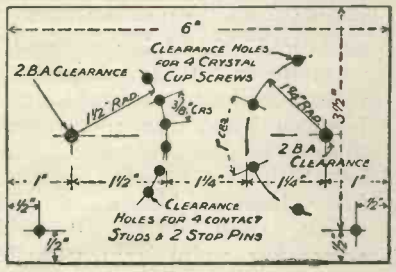


Fig. 12
Drilling Diagram

Assembling

At this point, mount the crystal standard upon the panel in the manner indicated in Fig. 13. Now fix into position the four crystal cups, the switch arm, contact studs, stop pins, and terminals, T1 and T2, as shown in Fig. 14.

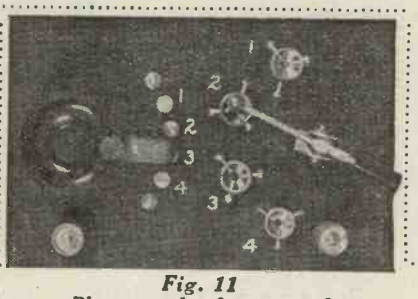


Fig. 11
Photograph of top panel

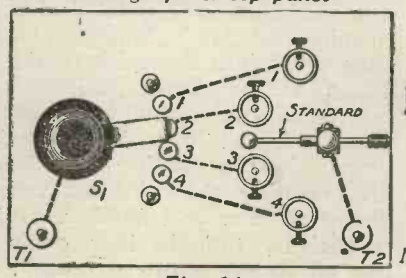


Fig. 14
Connections.

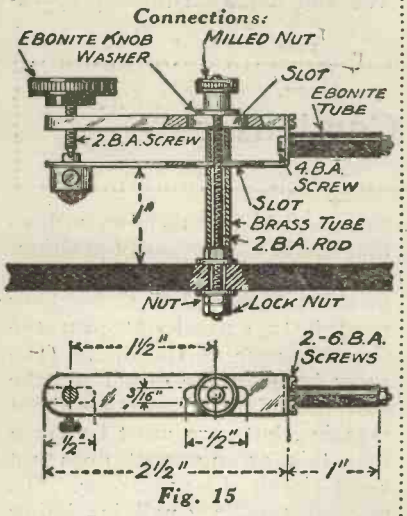


Fig. 15
Perikon modification

Connecting-Up

The connections of this unit are made in the following order :—

The switch arm is connected to terminal T1.

Contact stud 1 is connected to crystal cup 1, contact stud 2 to crystal cup 2, and so on until the four cups are connected to their corresponding studs.

The detector standard is then connected to the terminal T2. The studs and cups are numbered and the connections clearly shown in Fig. 14.

Operation

The operation of this unit is quite simple, in that which ever crystal it is desired to use may be placed in circuit by turning the switch arm on to the stud corresponding in number to the cup containing the crystal, when the standard is moved radially to the desired point.

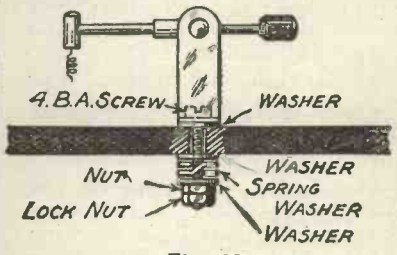


Fig. 13
Method of mounting detector standard

Perikon Detector

Those who prefer the perikon detector will find a suitable design fully described in Fig. 15. The panel drilling is practically similar to that of the cat-whisker detector, but only 3 cups and 3 studs are employed. The connections are also made in a similar manner. The construction in detail of the detector standard is given in the diagram.

Works we have Visited

No. 2.

The Sterling Factory.

Recently, at the invitation of the Sterling Telephone and Electric Co., Ltd., we had the opportunity of visiting their Works at Dagenham, Essex, and of seeing their various productions in process of manufacture. On arrival at the works the party was introduced to Mr. Max R. Lawrence, Works Manager, Mr. D. Ward Miller, Chief Radio Engineer, and Mr. F. R. Griffiths, Chief Telephone Engineer. These gentlemen were unfailing in their courtesy and took the utmost pains to make every process quite clear to the visitors. The works, which cover twelve acres, are largely devoted to the manufacture of telephone instruments of the well-known pattern used by the Post Office, but with the growth of the interest in wireless and broadcasting an important proportion of the factory is now given over to radio activities. The Sterling Company, unlike many firms now manufacturing wireless sets, design and make almost every detail in their own plant, and thus are able to exercise a very thorough supervision.

It was particularly interesting to watch the production of the Sterling telephone receivers, in the making of which a large number of highly ingenious automatic tools are used. In one large shop powerful presses were seen stamping out the magnets from sheet steel, whilst nearby furnaces were preparing the metal for annealing. In sharp contrast to the noise and heat of this part of the works was the winding shop where rows of young women were deftly guiding the fine enamelled wire upon tiny bobbins spun by electric motors. The correct number of turns of wire, by the way, is indicated on a special turn-counter, and a further test of actual resistance is made before the magnets are assembled into their cases.

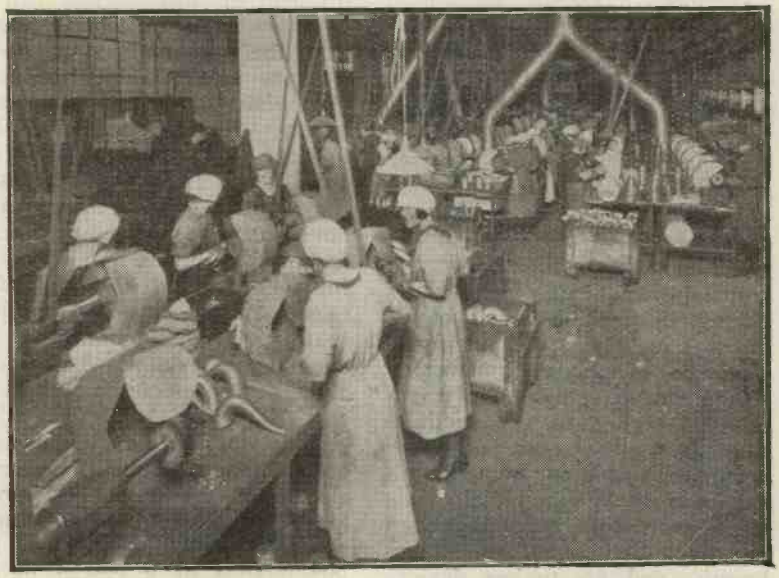
Most fascinating, too, was to watch the production of loud-speaker horns, from what appeared to be squat aluminium basins. These were placed on a special former rotated at a high speed, whilst a muscular workman with a large iron bar in his hand pressed the spinning metal against an appropriate former and gradually "spun" it into the correct shape. The other processes in the manufacture of loud-speakers, such as finishing the castings of the metal swan-neck, enamelling the horns, and assembling, were also watched in detail.

The wood-working shops alone were well worth a visit. The high finish on the woodwork of the cabinets of the Sterling receivers is produced (after, of course, the preliminary rubbing down or "sanding"), by spraying the surface with a special varnish. This method enables a perfectly even varnished finish to be given, all roughness which might come from brush marks being eliminated. The pleasing matt finish on the woodwork is also produced in the same way.

The popularity of Reflex receivers is well deserved, particularly when we come to consider their great economy in filament current, an advantage still further enhanced with the introduction of the latest dull emitters using .06 ampere. The Sterling Company is fully alive to this aspect of wireless, and have produced an excellent instrument, the "Three-flex," incorporating dual amplification. The construction, wiring-up and testing of these instruments attracted much attention, and the high quality of workmanship throughout was noticed.

Mr. Dudley Ward Miller, the designer of the Sterling sets, took particular pains to explain various processes, and was justly proud of the inspection which all the parts and finished sets undergo before delivery to the firm's customers. Certain parts of the works seem festooned with testing aerials, so that every set may be tried on actual signals with a minimum of delay.

Our photograph shows one of the many interesting processes in the production of loud-speakers.



Our photograph shows the process of "finishing" loud-speaker castings at the Sterling Works.

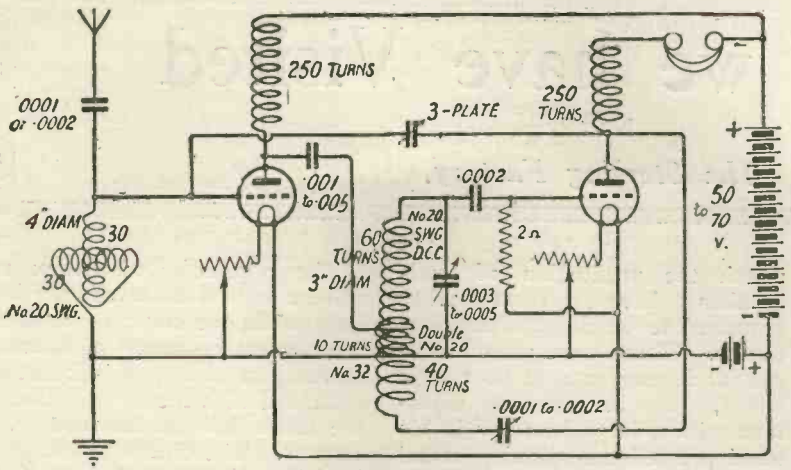


Fig. 1.—An easily-handled circuit giving remarkable selectivity.

Extreme Selectivity

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

INTERFERENCE in telephony reception can be broadly divided into two classes: *A*, that by either the fundamental frequency or a powerful low-order harmonic of a near-by station, which is sufficiently near the wavelength of the wanted signals to be included in the effective resonance band of the receiver; *B*, the general mush of ill-tuned sparks and higher harmonics of innumerable stations, together with atmospherics and other casual effects.

Means of Elimination

The *A* type can be eliminated by sufficiently sharp tuning, so as to narrow the resonance band of the receiver, unless, indeed, the other station is right on top of the telephony station's wave, when there is no immediate remedy possible, since note-selecting devices do not apply to telephony. Type *B* can be decreased enormously by so limiting the width of the peak of the resonance curve of the receiver that the general "mush" which still comes in represents an exceedingly small per cent. of the noise in the ether; the wanted transmission being included, is therefore given a much better chance in consequence. Actually the telephony transmission forms a narrow band of wavelengths, owing to the modulation at audio-frequencies which it carries, and is not tunable with the sharpest accuracy itself. This band represents only about an effective half-meter of wavelength, and no tuning devices available for, say, broadcast reception, at present, begin to even approach this fineness of tuning. It is idle accordingly to discuss possible distortions that might be introduced in a practical receiver of the utmost selectivity possible at the present moment. Practical experience shows that the more selective a circuit can be made by proper design and the use of really low-resistant freely-resonating circuits, and with the absolute minimum of brutal reaction, the clearer and more distortion-free reception can be obtained with it. The common confusion between "resonance" and "self-oscillation" must be guarded against.

The Problem of Interference

In either case, therefore, the problem of interference can be best tackled by religiously adopting the principle of low-resistance freely-resonant circuits throughout a receiver, and using, therefore, only the lightest of reaction to wipe out part of the H.F. resistance still left in these circuits, so as to have merely sufficient natural damping to ensure a fairly faithful following of the audio-frequency waveforms by the fluctuating H.F. oscillations. To avoid shock-excitation, the principle of loose-coupling must be carried out to the limit, when serious loss of signal-strength begins to appear. With an aerial circuit of minimum resistance, loosely coupled to a finely-tuned secondary circuit, most of the interference of a casual nature will be filtered out before it reaches the receiver at all.

The form of semi-aperiodic auto-transformer aerial coupling indicated in Figs. 1, 2, and 3 provides an exceedingly simple and cheaply constructed type of the effective loose-coupling desired. For good resonance and the sharpest possible tuning this has a coil wound with No. 20 S.W.G. d.c.c. wire, on a cardboard former 3 in. or so in diameter, and is tuned over the broadcast wavelength band by a parallel variable condenser of 0.0003 to 0.0005 μF in the usual way. A total of 70 turns gives the requisite inductance to tune, with but small parallel condenser, so that a good voltage build-up is obtained across the valve. This is loosely coupled to the aerial semi-periodically by actually having the ten lowest turns in common. These should be of the minimum possible H.F. resistance.

Sizes of Wire

As the larger sizes of wire, No. 18 to 15, are sometimes hard to procure in small quantities, the simple expedient is adopted of making these 10 turns of doubled No. 20 wire. It will be found that this coupling gives excellent signal-strength, when properly tuned and with the application of the right amount of reaction; further, it has the great advantage of making the tuning of the secondary circuit, and its reaction-demands, sensibly independent of aerial characteristics. This is particularly valuable in an extremely selective circuit, on account of the tuning difficulties involved.

Those readers who experience interference from Morse and Leafield "mush" will find in this article much to interest and assist them.

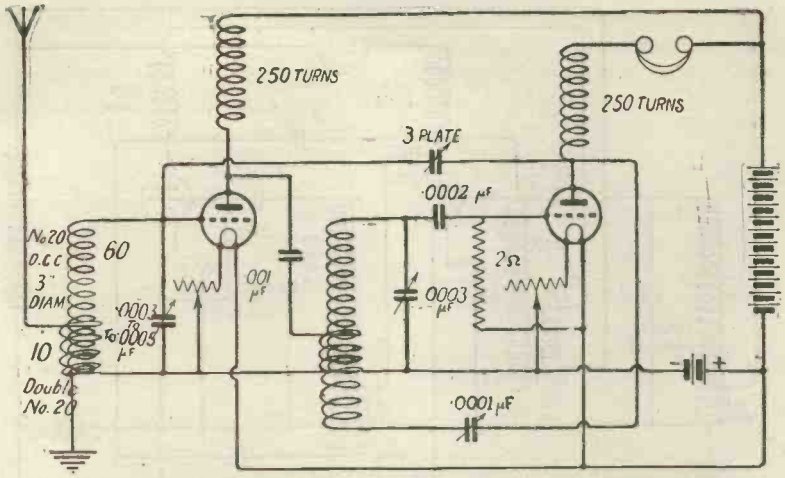


Fig. 2.—A modification of Fig. 1 circuit, sharper in tuning, but more difficult to handle.

Whilst very little but the narrow band for which it is adjusted passes this tuner, particularly when the small amount of reaction required is properly applied, by introducing another stage after the same style, the selectivity is increased to a point where even a third such stage will not improve it.

Tuning Limits

In fact, actual trial of a three-step receiver showed a marked disadvantage in the form of excessive loss of signal-strength, as well as considerable operating difficulties on account of the razor-sharp tuning. The signal-impulse is handed on from the plate of the first valve by the radio-choke and coupling-condenser shown. It would appear that there would be a prohibitive loss of signal-strength in this slender aperiodic type of coupling, the impedence from the plate of the first valve to earth being extremely low. Actually, with the sharp tuning possible with No. 20 coils and a little reaction judiciously applied, there is not so large a loss and very decided H.F. amplification is obtained with complete stability.

It is interesting to make comparison with the Grebe H.F. circuit, described in *Wireless Weekly*, Vol. 3, No. 8, p. 248, and the recent experiments of Mr. P. W. Harris with a similar type of H.F. transformer-coupling with loose-coupled aperiodic primary.

Radio-choke Coupling

There is, of course, nothing new in the use of a radio-choke and coupling-condenser to divert the D.C. component of the plate-current from a parallel-tuned secondary grid-inductance; it has, for instance, been used in the well-known Marconiphone dual for some time, and in several other circuits that have been published from time to time. Auto-transformer coupling has also been described, with the expressed purpose of getting some "step-up" effect. The point here is the use of extremely loose, semi-aperiodic auto-transformer coupling, with a view to obtaining the utmost selectivity.

Reinartz Reaction

Reaction is best applied to the secondary coil after the Reinartz fashion, by a fixed small reaction-coil (40 turns No. 32 S.W.G. enamel wire) below and continuous with the main windings, fed through a variable condenser from the plate; a radio-choke being introduced into the plate-circuit to give the necessary impedence. This is found in practice to give a delightfully smooth reaction-effect, and is exceedingly easy to work with. Using two valves, the small reaction necessary in the first grid-circuit is readily provided by direct electrostatic reaction through a small three-plate or vernier condenser from the plate of the second valve to the top of the grid inductance, as shown. This is found to demand an exceedingly low minimum in the small three-plate coupling condenser, and in some cases it may be necessary to cut down the effective capacity by putting another small condenser in series with it to avoid continuous oscillation.

Practical Circuits

Practical circuits of extreme selectivity are those indicated, Fig. 1 being the easiest to work with, as the aerial-tuning arrangements are of conventional type, though of unusually low resistance and are not particularly selective. The intervalve coupling is as described, and provides the selectivity in connection with the enhanced signals handed on from the first valve. On a good P.M.G. aerial and R valves, with, say, 65 volts H.T., this circuit will give moderate loud-speaking from the neighbouring broadcast station and completely eliminate the same station 20 metres either side, though the extinction is less sharp *below* than *above* the interfering station. Thus, Bournemouth, with careful tuning, is easily read in London whilst 2LO is transmitting, and the round of all the B.B.C. stations can be made in comfort, signals being clear though not strong. The elimination of Morse around Birmingham is very noticeable, even with this circuit.

A High Selective Circuit

Fig. 2 is very much more selective, and proportionally harder to work with. A wavemeter is absolutely essential for the preliminary tuning, which is done by first tuning the second grid circuit, then the aerial secondary. If installed in a permanent receiver, this difficulty largely vanishes, as

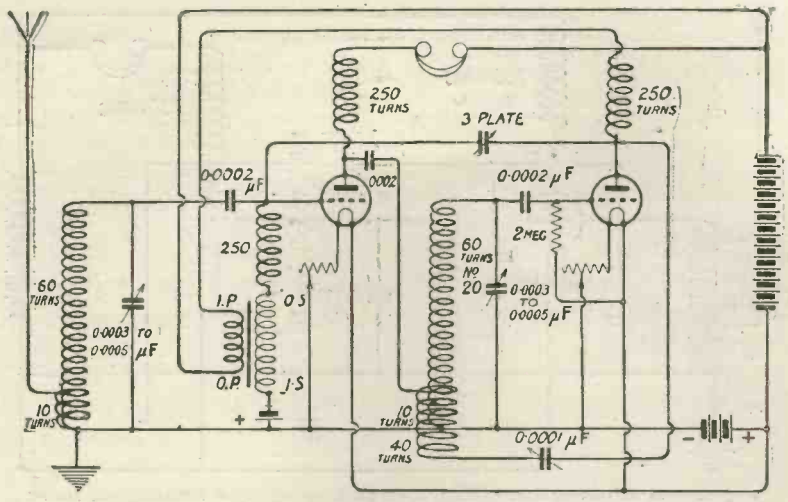


Fig. 3.—The same principle introduced into a dual circuit.

the tuning is "wavemeter," and only requires properly-calibrated scales to make it positive for any one station. Very little reaction will be found necessary for the first valve; a small part of the capacity of a low-minimum 0.0001 μF variable condenser sufficed for the second valve reaction-control. The two similar tuning inductances should be arranged at least a foot apart, and at 60 degrees from the horizontal.. With this circuit, using a good double 40-ft. outside aerial at 13 miles from 2LO, that station came in at a strength justifying the use of a loud-speaker in a small, quiet room; 5 metres either way he vanished completely in the 'phones. Manchester on 375 metres was clearly and comfortably audible, speech being intelligible whilst 2LO was working. As the Manchester station is somewhat hard to pick up in London, even when 2LO is silent, this represents a certain degree of effective selectivity. The tuning for these results was of a fineness that involved extension handles on the tuning condensers, and adustment by tapping these lightly with a foot-rule, and when neither valve was oscillating no distortion could be observed; a milliammeter in the plate-circuit is extremely useful in this connection. Every other station was picked up, against a background of perfect silence almost uncanny in effect.

A Selective Dual Circuit

Fig. 3 shows an effective dual circuit, which, in certain particulars, resembles very closely the Marconiphone dual previously mentioned. This circuit loses a little of that extreme selectivity, but with a coupling-condenser of low value is actually relatively easy to work with, and some of the signal-strength necessarily lost in the H.F. coupling is made up by the L.F. stage. Whilst it will oscillate quietly in the dual position, it is better and safer to search with the latter cut out. Fig. 4 shows a simple switching arrangement to perform this operation. The switch can be of the type of the Dubilier Minicap, or the panel-mounting D.P.D.T. type.

The Fig. 3 circuit gives moderately-good loud-speaking on the near-by stations, and with good selectivity will bring in the other stations at will on anything like a good aerial. The reaction control is also rather less fine than in No. 2.

With either of the last two circuits, and with a little experience in tuning, those who have suffered the miseries of ship's Morse

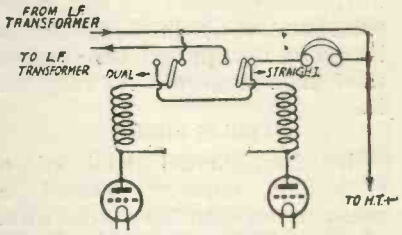


Fig. 4.—A simple switching arrangement for the dual.

and Leafield's mush will find such relief as is physically possible whilst our tuning devices are confined to the selectivity corresponding to the width of the effective resonance peak in a thick-wire resonant circuit of small dimensions and assisted by a little reaction.

NEXT WEEK'S ISSUE

Our next issue will contain in addition to its usual attractions the following constructional articles :—

A CABINET THREE VALVE RECEIVER FOR LOUD-SPEAKER USE.

A SIMPLE CRYSTAL-VALVE RECEIVER.

AN EASILY CONSTRUCTED WAVEMETER FOR ALL BROADCASTING.

Broadcasting News

LONDON.—By the time these words appear in print arrangements will have been made to broadcast time signals from Big Ben at least twice a day.

□ □ □

Mr. Arthur Burrows, perhaps better known as "Uncle Arthur," is rarely heard from 2LO these days, the reason being that he is spending most of his time in visiting the provincial stations. He has been greatly impressed and encouraged by the enterprise which is shown in the provinces by the various directors.

□ □ □

We are given to understand that we may expect to hear shortly that the B.B.C. have made arrangements with one of the American stations whereby a programme will be relayed once a month. It seems that nothing that the B.B.C. has ever done has touched the public imagination so much as have these American transmissions.

□ □ □

We much enjoyed on Feb. 10 Major Tosswill's homely examples of Devon speech, and his explanation of the dialect was most interesting and instructive.

In the evening of the same day we had the privilege of listening to one or two selections by Lady Maud Warrender, and we must confess that we enjoyed her singing very much indeed; and once again we had the good fortune to be able to listen to that mistress of the pianoforte, "Auntie Sophie," formally known as Miss Cecil Dixon.

□ □ □

On Monday, Feb. 11, we thoroughly liked the Popular Concert. Especially good was "The Lost Chord" cornet solo played by Charles Leggett, and never have we heard German's "The English Rose" to greater advantage, Sydney Coltham, tenor, being simply splendid in this effective little number.

Good also were the Novelty Trio, the duet "My Arabian Maiden" being noticeably fine.

Dr. Saleeby's talk on "Light and Life" was doubtless enjoyed by thousands, for his calm, deliberate words must have carried conviction to all who heard him. Let us hope that some of the Housing Authorities were "listening-in" and took his advice to heart, to plan houses and towns so as to give us the maximum of sunlight, and, as a result, improved health.

BROADCAST TRANSMISSIONS

	Call-Sign	Wavelength
LONDON	2LO	365 metres
ABERDEEN	2BD	495 „
BIRMINGHAM	5IT	475 „
BOURNEMOUTH	6BM	385 „
CARDIFF	5WA	353 „
GLASGOW	5SC	420 „
MANCHESTER	2ZY	375 „
NEWCASTLE	5NO	400 „

TIMES OF WORKING

Weekdays ..... 3.30 to 4.30 p.m. and 5.0 to 10.30 p.m. G.M.T.

Sundays ..... 3.0 p.m. to 5.0 p.m. and 8.30 to 10.30 p.m. G.M.T.

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Forthcoming Events

FEBRUARY.

20th (WED.).—Miss Gladys Naish, soprano. Mr. Madoc Davies, baritone. Mr. Jack Rickards and Miss Violet Stephens, entertainers.

21st (THURS.).—Mr. Bernard Turner, entertainer. Mr. John Collinson, tenor. Mr. Norman Greenwood, clarinet.

22nd (FRI.).—First series of symphony concerts given by the B.B.C. at the Central Hall, Westminster, the Royal Albert Hall Orchestra performing. Miss Daisy Kennedy, violinist. Address by Lord Cecil of Chelwood on "The League of Nations."

23rd (SAT.).—The "Roosters" Concert Party. The Wireless Orchestra. Savoy Orpheans.

24th (SUN.).—Rev. F. R. Barry, M.A., of King's College, Address. 2LO Light Orchestra.

25th (MON.).—B.B.C. Literary Critic. Operatic Evening.

26th (TUES.).—Miss Mavis Shellshear, Songs at the Harp. The Ensemble Singers.

□ □ □

ABERDEEN.—The experiment providing a vocal interlude to the afternoon orchestral concert has proved a success, and even the few disgruntled critics who would seem never to be pleased are for the moment silent.

□ □ □

One of the most popular items of recent weeks was that of Madame Murray's Jazz Band; the rhythm and timing approximated the perfection reached by the Savoy Orpheans and Havanas Bands, and listeners were not slow to show their appreciation.

□ □ □

Forthcoming Events

FEBRUARY.

20th (WED.).—Popular Concert.

21st (THURS.).—Operatic Night.

22nd (FRI.).—Popular Night.

23rd (SAT.).—Orchestral Night.

24th (SUN.).—The Right Rev. Lord Bishop of Winchester, M.A., D.D., s.b. from Bournemouth.

25th (MON.).—Programme s.b. from London.

26th (TUES.). — Modern English Composers' Night.

□ □ □

BELFAST.—The improvement made at the Manchester Station by the elevation of the

transmitting aerial has made considerable difference in the reception of that station in this district. Hitherto Manchester tuning was uncertain, but now Northern Ireland listeners find a very pleasurable difference.

□ □ □

BIRMINGHAM.—5IT has once more proved itself a pioneer by the introduction of a new feature, the " 'Teens Corner." It is aptly named, for it is designed to appeal to listeners in their 'teens. Its scope will be wide enough to meet the diversity of interest and enthusiasm of young people, and will include talks on hobbies, elementary science lectures, reviews of juvenile sport, talks on " birthdays of the great " and so on. The " 'Teens Corner " will be given regularly between 6.15 and 6.45.

□ □ □

Forthcoming Events

FEBRUARY.

20th (WED.).—3.30, Song Recital. 7.30, Choral and Orchestral Programme. Readings from Shelley by Mr. Sidney Grew. 8.45, Station Repertory Chorus in the choral ballad, " Thorberg's Dragon Ship " (Edmunds).

21st (THURS.).—3.30, Piano Quintettes. 7.35, Popular Classics Programme.

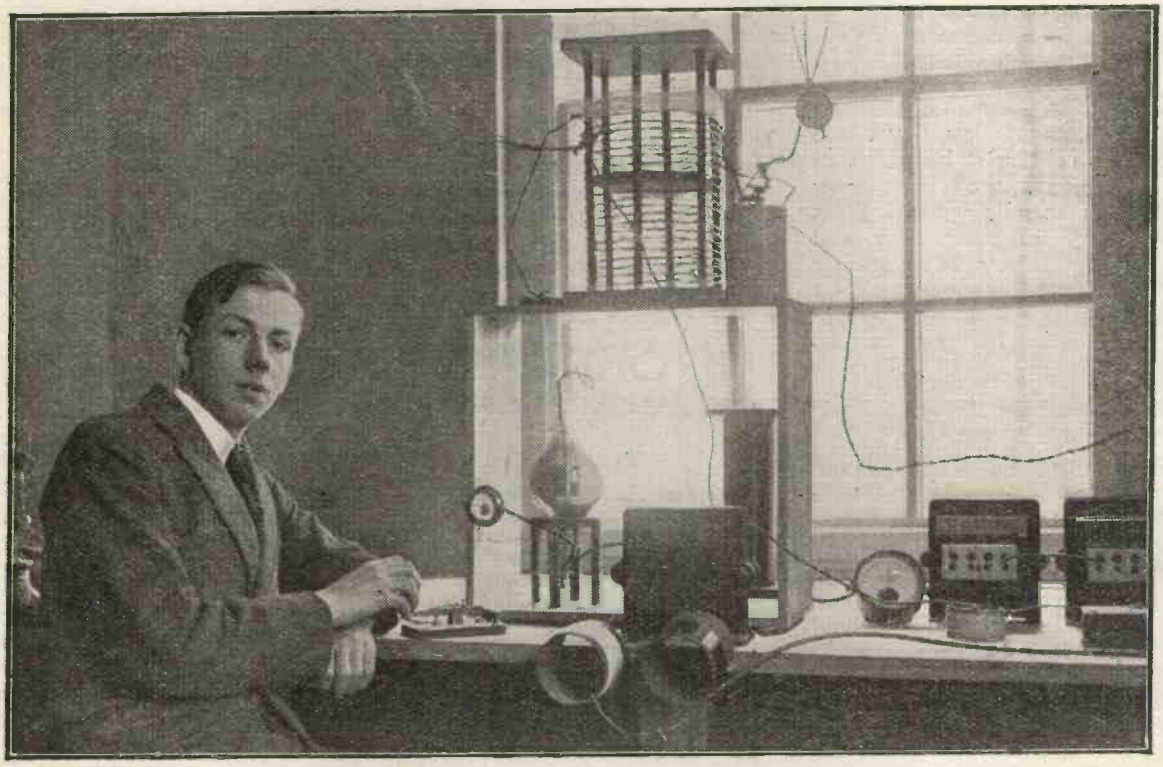
22nd (FRI.).—7.30, Symphony S.B. from the Central Hall, London.

23rd (SAT.).—3.30, Kiddies' Concert. 7.30, Orchestral Programme. 10, Dance Music.

24th (SUN.).—8.30, Programme of Schubert Music.

25th (MON.).—7.30 S.B. from London.

26th (TUES.).—Miscellaneous Programme



Our photograph shows Master C. W. Goydon, an 18 year old schoolboy, of Mill Hill School, near Hendon, who has succeeded in communicating by radio with an American amateur, at the Maine University, U.S.A.

□

BOURNEMOUTH.—The Director of the Bournemouth Station has been the recipient of many letters of appreciation of a concert broadcast from 6BM on Sunday, February 3. The trio of two flutes and cor anglais seems to have caused a great deal of pleasure to a large number of listeners.

□ □

Forthcoming Events

FEBRUARY.

20th (WED.).—Transmission from the King's Hall. Mr. George Stone, entertainer.

21st (THURS.).—S.B. from London.

22nd (FRI.).—Popular Night.

23rd (SAT.).—Request Night, Classical. Bournemouth Wireless Orchestra. Miss Nellie Fulcher, solo violinist.

24th (SUN.).—Bournemouth Wireless Orchestra.

25th (MON.).—S.B. from London.

26th (TUES.).—Popular Orchestral Night.

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CARDIFF.—We deeply regret to lose one of our Uncles, in the person of Mr. Page (Uncle Leslie), who has been transferred to the Bournemouth Station. In his place we welcome the coming of Mr. A. H. Goddard.

□ □ □

Forthcoming Events

FEBRUARY.

20th (WED.).—Popular Night, Station Orchestra.

21st (THURS.).—Station Orchestra.

22nd (FRI.).—S.B. from London.

23rd (SAT.). — Pontypool Silver Band.

24th (SUN.). — Rev. J. Henry Thomas, address. " Scouts' Own " Symphony Concert.

25th (MON.).—S.B. from London.

26th (TUES.).—Shakespeare Night.

GLASGOW.—The Corporation of the City has granted an important concession by permitting for the first time the linking up of St. Andrews Hall to 5SC. The occasion was the rendering of Parry's "Blest Pair of Sirens" by the Glasgow Choral and Orchestral Union. In spite of the difficulties inseparable from choral transmission from public halls, the reception was remarkably fine, the music being heard clearly throughout.

□ □ □

Another notable transmission from the Glasgow Station was that of the 1-act play "Campbell of Kilmohr," written by J. A. Ferguson. The play was produced by 5SC Repertory Company, under the direction of Mr. George Ross, and the cast was a very able one. As the title indicates, there was a real Highland flavour about the play, which was cleverly interpreted.

□ □ □

Forthcoming Events

FEBRUARY.

20th (WED.).—Classical Night.
21st (THURS.).—Popular Orchestral Night.
22nd (FRI.).—Prof. Martin of Glasgow University. S.B. from London.
23rd (SAT.).—Popular Night.
24th (SUN.).—The Westbourne Church Choir.
25th (MON.).—S.B. from London.
26th (TUES.).—The Parkhead Forge Silver Prize Band.

□ □ □

MANCHESTER.—The Covent Garden operatic transmission has been particularly good recently. The land-line from London has been well-behaved and now great purity of tone and clearness are enjoyed. The principals' voices are especially good. The "Magic Flute" and "Samson and Delilah" were exceptionally delightful, even to the extent that many listeners, who formerly never appreciated this kind of music, are now becoming opera lovers.

□ □ □

Forthcoming Events

FEBRUARY.

20th (WED.).—2ZY Orchestra. Mr. Foden Williams, entertainer. Prof. E. Weiss, D.Sc., F.R.S., "A Talk on Trees." Spanish Talk.
21st (THURS.).—11.30, Concert by 2ZY Trio. 6.30, Girl Guides and Boy Scouts' Bulletin. 6.40, French Talk. Concert by the "Gay Paree" Concert Party. Keyboard Kitty. Dance Music S.B. from London.
22nd (FRI.).—3.30, Concert. 6.40, German Talk. Symphony Concert from London.
23rd (SAT.).—3.30, Oxford Picture House Orchestra. 7.30, All-British Concert by 2ZY Orchestra. Miss Rachael Hunt, contralto. Mr. Victor Smythe and "Algy." 9.45, Dance Music S.B. from London.
24th (SUN.).—3, Concert. 8, Talk to Young People by Mr. S. G. Honey. Rev. J. A Reardon, Address Classical Music.
25th (MON.).—S.B. from London. French Talk.
26th (TUES.).—Mr. George Dave Frank's Band. Savoy Band from London.

□ □ □

NEWCASTLE.—Future programmes show a marked decrease in the amount of simultaneous broadcasting. Not only will the Sunday afternoon programmes be local transmissions, but those of Monday evenings also. This arrangement will not, however, preclude the transmission of music or speeches of special interest.

Forthcoming Events

FEBRUARY.

20th (WED.).—3.45, Miss Jessie Bishop, piano. Miss Doris Brantingham, contralto. Mr. Arthur Robins, cornet. 7.30, Orchestra. Mme. Ethel Fowkes, soprano. Mr. John Oliviere, baritone. Mr. Babbs, violin.
21st (THURS.).—3.45, Mr. Porter, 'cello. Mr. and Miss Golightly, vocal duets. 7.30, Orchestra. Miss Rowlands, soprano. Mr. Tom Kinnibergh, bass. Mr. Ernest Sharp, violin.
22nd (FRI.).—3.45, Miss Leonie Storm, piano. Miss Phyllis Rickard, contralto. Mr. W. Acroft, clarinet.
23rd (SAT.).—3.45, Miss Cathleen Green, soprano. Mr. Herbert Henderson, concertina. 7.30, Orchestra. Billie Bates, entertainer. Mr. David McFadzean, baritone. Miss Beatrice Paramor, soprano. Dance Music from Tillye's.
24th (SUN.).—8.30, Mr. Edward Hind, baritone. Rev. T. Miller Johnson, address. Miss Olive Tomlinson's Trio.
25th (MON.).—3.45, Clay-Page Trio.
26th (TUES.).—3.45, Mr. W. A. Cross, piano. Mme. Charles Foster, soprano. Mr. Ben Jacobs, euphonium. 7.30, Orchestra. Mr. Archibald Fairburn, elocutionist. Mme. Betty Humble, soprano. Mr. Hudson Barnsley, bass-baritone.

□ □ □

Simultaneous Broadcasting Events

FEBRUARY.

20th (WED.).—B.B.C. Dramatic Critic. Talk by Mr. J. C. Stobart.
21st (THURS.).—B.B.C. Music Critic. Talk by Radio Society of Great Britain. Savoy Bands.
22nd (FRI.).—B.B.C. Film Critic.
23rd (SAT.).—Savoy Bands.
24th (SUN.).—2LO Light Orchestra. Time Signal and Bulletin.
25th (MON.).—B.B.C. Literary Critic.
26th (TUES.).—French Talk. Savoy Bands.

The Radio Society of Great Britain

An Ordinary General Meeting of the Society will be held at 6 p.m. (tea 5.30), on Wednesday, February 27th, at the Institution of Electrical Engineers. "A Practical Demonstration of some applications of the Cathode Ray Oscillograph" will be given by Mr. N. V. Kipping. Among the applications to be demonstrated are the following:—(1) Charting of thermionic valve characteristics; (2) Study of percentage modulation in a transmitting circuit; (3) Examination of wave-forms; (4) Accurate frequency calibration (two methods); (5) Hysteresis curves.

CONFERENCE OF AFFILIATED SOCIETIES

The postponed Conference of Affiliated Radio Societies is to be held on Saturday, March 1st, at 2 p.m., at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2.

"Mush" and "Fading"

By W. K. ALFORD, A.F.R. Ae.S., A.M.I.R.E.

A Review of the conditions affecting Radio Reception.

EFFICIENT reception of radio-telephony at the present time is governed by three conditions :—

(i) Jamming from other stations :—

(*a*) Spark interference.
(*b*) Harmonic C.W. interference.
(*c*) Arc hash or mush.

(ii) Atmospherics.
(iii) Fading.

Observations on these conditions have been made by the author during the latter half of the year, chiefly on the broadcast range of wavelengths and downwards, and the results of certain comparative tests are appended to this article.

Spark Interference

In pre-war days, when the number of stations operating was few compared with that of the present day and when the crystal or Fleming valve were used for reception, the problem of selectivity did not present such a difficulty as is now the case. The aspect becomes quite different when the triode valve is used, owing to the extraordinary degree of sensitivity to which it may be brought in the circuits of modern receivers.

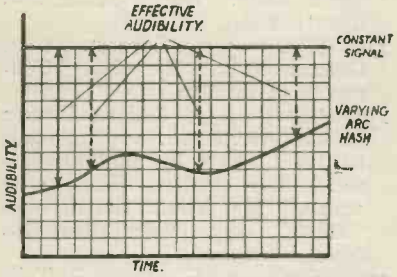
In interference of this kind suitable loosely coupled aerial and closed circuits are quite effective, especially if the interfering station is emitting a sharply resonant wave—a somewhat rare thing, however, as the "double hump" characteristic seems to be scorned by operators at the present time.

The now popular filter, absorption, and trap circuits are all effective to a degree, but from the writer's experience, by the time the circuits are adjusted the interference has ceased !

We now come to a far more difficult form of interference to deal with, viz. :—

C.W. Harmonic Interference

Interference from a C.W. station on its fundamental wavelength, provided it is emitting a wave of pure sine form, *i.e.*, not forming a violent series of harmonics, is fairly easily eliminated owing to the sharp resonance, but great annoyance is



ig. 1.—Illustrating the swamping of a signal by arc hash.

caused to-day by the number of stations emitting a *large* number of harmonics; *i.e.*, referring, of course, to GBL (Leafield) and GKB (Northolt), as grand masters in the art, and followed closely by FL and UFT. A published oscillograph record of the wave-form of the former two stations would be an historic

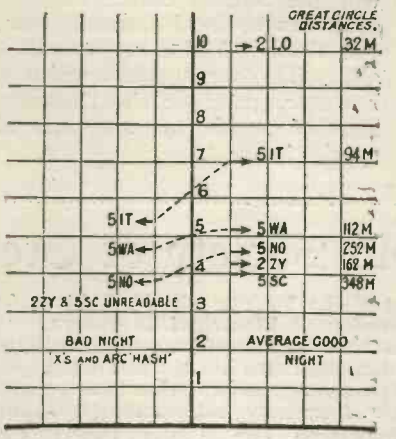


Fig. 2.—The amount of variation in signal strength between good and bad nights.

document if the oscillograph stood up to its requirements.

A great many of these harmonics congregate on the broadcast band of wavelengths, and, to make matters worse, heterodyne each other, which, on certain wavelengths, absolutely prohibits the introduction of regeneration, which makes matters infinitely worse.

The "hash" of "arc" stations seems to be a region where this heterodyning of harmonics is occurring indefinitely and beats of all frequencies are set up.

The use of highly selective circuits on this type of interference does not seem to solve the problem, and the harmonics occur with equal or greater strength as a series of sharply resonant points, a condition which is equally or more annoying than the "flat" hash as given by a more aperiodic circuit.

Atmospherics

The question of the elimination of "atmospheric" interference is one which presents the greatest difficulty, and up to the present no really satisfactory scheme has been put forward. The only method of tackling the question within the scope of the experimenter without going to the complexities of Weagant and others is to use high-frequency amplifying valves in what is known as a "limiting" condition, *i.e.*, they respond disproportionately to a strong and weak grid impulse—strong pulses being subdued and weak pulses being amplified. This condition is attained to quite a marked extent with ordinary types of valve with their filaments quite dull.

The great work of the Radio Research Board in actually determining the characteristic of the "X" will ultimately do much to eliminate its inopportune presence.

Fading

This phenomenon is at present inadequately explained, but two things are distinctly manifest :—

(*a*) Fading is always confined to distant signals (not necessarily weak signals).

(*b*) Fading is very dependent on wavelength.

The first case would immediately suggest that in some way the Heaviside layer is responsible owing to the very small angle of reflection of a distant station, and it may be supposed that any small change in the surface of this layer due to ionisation would produce the striking effects noticed.

At any rate, fading is unquestionably periodic at times; in fact, in one or two cases, absolute periodicity has been noticed extending over a period of five minutes. Regarding the second case—as the wavelength decreases the phenomenon of fading decreases—on 360 metres it is extremely marked at times, as people who habitually listen to the American broadcast transmissions will testify; on 200 metres it is not so marked, and on 150 metres only slightly so, till on 100 metres or less it is entirely absent. The writer, together with a well-known investigator, has for some time observed the transmissions of a French experimental station over 700 miles distant working on 08 and 78 metres —in no single instance has fading been observed even while 200 metre signals are swaying markedly at the same time.

Another point worthy of note is that both undamped and damped wave signals fade to the same degree.

Fading is often confused with the fact that a signal very often becomes submerged in an " arc hash " which is constantly varying in intensity; an illustration explaining this statement is appended.

During observations on the transmissions of the Glasgow Broadcasting station, which fade quite periodically at times, the writer established the fact that when fading occurred there was a consequent change of observed bearing. Arrangements are being made for a further investigation of this, using reliable D.F. equipment so that actual quantitative observations may be taken.

General Inferences

It is generally agreed that the conditions of reception on the broadcast and experimental wavelengths are deplorable—the more so as the chief factor in the interference is due to arc stations, the characteristic of whose wave form seems quite uncontrollable.

The usual methods of tackling the problem of elimination seem quite inadequate and, in addition, extreme selectivity is bound to bring about distortion in telephony reception owing to lack of breadth for the " speech band " on the resonant point.

It should be remembered that the " audibility factor " of a signal in an interference band is given by :—

$$A = \frac{\text{Signal Strength.}}{\text{Interference Strength.}}$$

Thus A is independent, up to a point, of the actual signal and interference strength, and the use of selective tuning devices is an attempt to make the ratio greater although the actual signal strength may be far from the maximum attainable.

Diagrams are appended showing :—

(1) The comparative audibility of broadcast stations on " good " and " bad " nights.

(2) The meaning of " submersion " of signals.

(3) The relative strength of " arc hash " and harmonics on various wavelengths.

In these experiments, a receiver giving practically uniform amplification over the whole range of wavelengths was used, viz., an Armstrong supersonic heterodyne employing 8 valves—5 amplifying at radio-frequency.

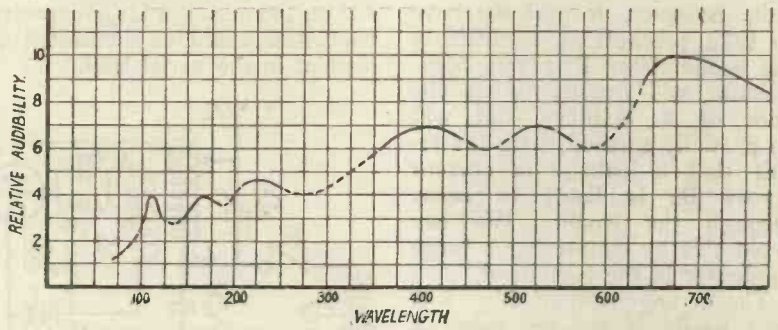


Fig. 3.—Showing the relation between wavelength and signal strength of the hash and harmonics of a certain station.

A 26 in. loop was employed throughout, and for comparative strength measurement the well-known method of the shunted telephone was used.

A further paper is being prepared giving comparative figures of strength of fading signals, but the above method is quite unsuited to the purpose as it is almost impossible to take "spot" readings.

The writer would welcome the collaboration of an investigator in the North of England who would undertake to make observations on the lines indicated in this article, especially on the relative strength of "arc" mush.

C.W. and Telephony Transmission Using Valves

No. VI.

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

This series of articles began in Vol. 3, No. 6, with a consideration of the theoretical principles underlying valve transmission

BY connecting B2 as shown in Fig. 8, the aerial is not at a high D.C. potential. One disadvantage of this circuit, however, is that we have to take precautions to insulate the accumulator B1; this accumulator will usually be on the floor of a building and will be partially earthed, with the result that a leakage of current across B2 is liable to occur through the earth. We can avoid this by connecting a large condenser in the earth-lead.

The arrangement of Fig. 8 is very useful if we are using a source of direct current, the positive pole of which is permanently connected to earth. This is frequently the case in lighting systems for towns; houses are often supplied with a direct current supply (commonly 230 volts) on the three-wire system; alternate houses have the positive and negative poles of their supply permanently connected to earth. If, then, we are using supply mains having their positive pole connected to earth, we can, with advantage, use the arrangement of Fig. 8. In such cases K will require to be connected on the right-hand side of B2.

To avoid the leakage of current we can use the arrangement of Fig. 9. The anode battery B2 is now connected across a large capacity C2 (say, 0.02 μF). This condenser does not affect the tuning of the circuit, but merely acts as a by-path for the high-frequency currents. This circuit has the disadvantage that the aerial would be at a high positive potential to the earth, and anyone standing on the ground who touched the lead-in, for example, would be liable to receive a shock; this disadvantage, however, is not important in the case of small sets, and the arrangement of Fig. 9 may be recommended. If it is absolutely desired to avoid a positive potential on the aerial, a large capacity condenser could be connected at a point in the aerial lead.

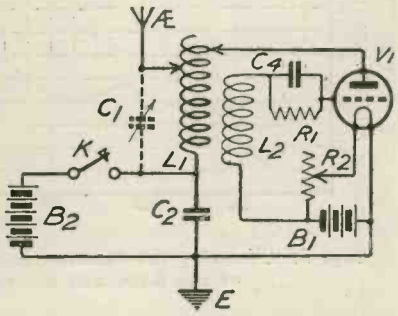


Fig. 9.— A circuit in which the filament battery is kept at earth potential.

Another disadvantage of the circuit is that, as the source of anode voltage is connected directly in a circuit where high-frequency oscillating currents are passing, there is always a tendency for these currents to work their way into the direct current source, and if this is a dynamo, injury to the windings is liable to result. This, however, may be remedied by connecting an air-core choke in each of the leads to the dynamo. The circuit of Fig. 9 may be used when the source of direct current supply has its negative pole permanently connected to earth. If this is not the case, the key is preferably connected between the negative side of B2 and the earth.

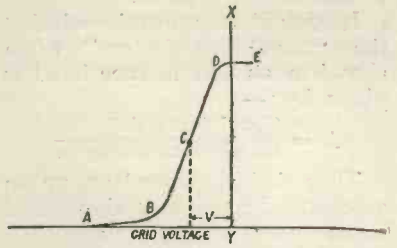


Fig. 10.—Characteristic curve of a typical transmitting valve.

It is desirable in all wireless valve transmitters to operate with a negative grid potential. We can obtain this by connecting a battery next to the filament in the grid circuit of the valve; on the other hand, if we employ a leaky grid condenser we can obtain a suitable negative grid potential without the use of a battery. In Fig. 9 the condenser C4 is shown shunted by a resistance R1, which will usually have a value of about 8,000 ohms. When the valve is oscillating, the grid G will, at every half-cycle, be given a positive potential; these positive potentials will draw electrons from the filament to the grid, and these electrons will charge up the right-hand side of the condenser C4 to a negative potential. Since the oscillating potentials across L2 are continuous, there will be a rapid accumulation of electrons on the right-hand side of C4; in other words, the grid potential will rapidly drop, the action being very similar to that of the grid condenser in a receiving circuit. If there were no leak R1, the grid would become so negative that it would cut off the anode current of the valve; to avoid this, we provide a leak of suitable value in order to maintain the grid at a convenient negative potential while the valve is oscillating.

Fig. 10 shows a typical characteristic curve of a transmitting valve. It will be noticed that we arrange the curve so as to lie preferably completely to the left of the vertical ordinate X Y through zero grid volts. We then operate the valve at

some such point as C on the characteristic curve. It will usually be found, however, that provided the reactive coupling of the circuits is sufficiently tight, the maximum output oscillatory current is obtained when the normal operating point is betweeen C and B. The oscillations generated by the

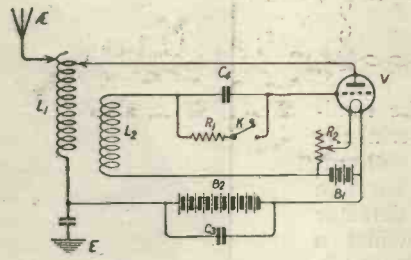


Fig. 11.—A method of preventing leakage to earth.

valve will cause the grid potential to vary over the whole of the steep portion of the curve and even round the bends. Maximum output is often obtained when the normal operating point is to the left of B. In these cases it is only the positive half cycles of grid potential which maintain self-oscillation.

Another method of preventing leakage across the anode battery or dynamo is shown in Fig. 11. A large capacity condenser is now connected in the earth lead so as to insulate the positive terminal of the anode battery from earth. In this circuit we show a very common method of keying a valve transmitter. The key K is connected in series with the leak resistance R1. When the key is up, the oscillations in L2 almost instantaneously cause such a high negative charge to pile up on the grid that the anode current is cut off and the valve stops oscillating; on closing the key this high negative charge leaks away and the valve once more commences to generate oscillations. Sometimes the key is connected across an extra condenser in the grid circuit, the action of the arrangement remaining the same.

When using voltages up to about 400 it is not necessary to take any particular precautions, but when we use higher voltages it is advisable to protect a dynamo if it is used for supplying the high-tension current. Fig. 12 shows how we may protect a D.C. generator B2. Two fuses, F2 and F3, are provided, each consisting of a very fine tungsten or other wire. In one of the leads is connected a resistance R3, which is intended to limit the maximum load, which the generator may have to take. For example, if the condenser C3 were accidentally shorted, the maximum current which could be drawn from the generator B2 would depend upon the value of the resistance R3. If the voltage supplied by B2 were 1,000, and the available current 100 milliamperes, we might conveniently give R3 a resistance of 5,000 to 10,000 ohms; this resistance would not be too great compared with the resistance of the valve, but it will, of course, cut down the available anode voltage to some extent; a resistance of even 2,000 ohms would be better than nothing, and it is usual to connect such a resistance, which may take the form of ordinary lamps, in each lead to the generator. Finally, it is desirable to connect two air-core chokes Z1, Z2, in between the generator and the anode circuit of the valve; these will protect the generator from high-frequency surges.

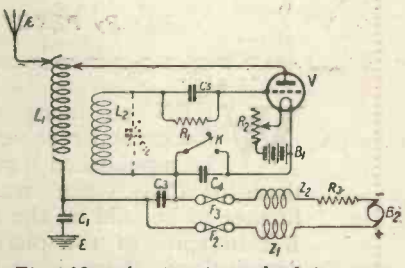


Fig. 12.—A circuit embodying protective devices and a good method of keying.

In Fig. 12 we also show an ingenious method of keying a high-power valve which eliminates sparking at the key contacts. The key K is connected so as to open and close both grid and anode circuits of the valve; when the key is down, the grid circuit is closed and an anode current can flow. As the key is raised, an arc tends to form across the contacts; this arc path is equivalent to a resistance and the voltage drop across it is considerable and is in such a direction as to make the grid negative; this high negative potential is communicated to the grid and cuts off the anode current, thus immediately stopping the arcing at the contacts. A condenser C4 is usually connected across the key.

A Sharp Tuning Crystal Set.

By PERCY W. HARRIS, Assistant Editor

WHEN so many designs for crystal receivers have been published it might be thought that there was little further to be said on the subject, but in spite of the plethora of descriptions, there is still room for improvement in minor details. It must be remembered that a design which will suit one reader may be quite unsuitable for another, as conditions vary so greatly in different localities. The man who is situated within two or three miles of a broadcasting station in a district free from interference may be quite satisfied with a volume of signals, which, although not the maximum obtainable on a crystal receiver, is yet sufficient to operate the number of headpieces he has in use. Another reader, living in the Bournemouth, Newcastle, Cardiff, or Aberdeen area may find that a receiver which gives excellent volume on broadcasting is yet so susceptible to other interferences that his pleasure is completely spoilt. The coast-dweller in particular is troubled by interfering signals from ships working near by, and often from an adjacent coast station. With a valve set it is a comparatively simple matter to sharpen the tuning, but with crystal sets selectivity is usually obtained with a loose-coupled set requiring at least two tuning adjustments for successful operation.

Coast Dwellers' Difficulties

The set about to be described is particularly suitable for the coast dweller, using, as it does, a circuit which, whilst possessing the single control characteristic of the ordinary direct coupled circuit, has the selectivity of the two circuit receiver and one or two additional points of advantage.

The circuit utilises the semi-tuned or "impulsing" aerial circuit and a secondary circuit tuned by means of a variable condenser. The crystal detector is of a new pattern, whilst a minor improvement is the addition of two terminals by means of which it is a simple matter to try out another crystal detector without interfering with the wiring or general connections of the set. This little point, by the way, can be incorporated in any crystal set, and will be found of distinct value to the reader who is experimentally inclined.

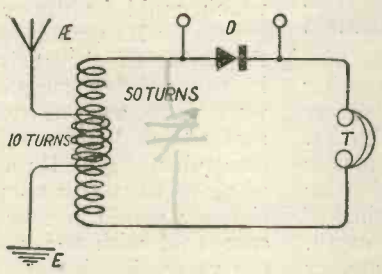


Fig. 3.—The circuit of the receiver.

Components Required

There are no vital measurements in this set, and therefore the reader can utilise any convenient panel and box. The box shown in the photograph measures 9 in. by 5½ in., and is 5 in. deep. The top is covered by ¼ in. ebonite panel, on which all of the components are mounted. We therefore require, before starting to build the set, the following:—

1 box.
1 ebonite panel.
1 variable condenser .0003 μF capacity.
1 crystal detector.
6 terminals (8 if it is desired to have two pairs of telephone terminals).

Fig. 1.—Note the simplic

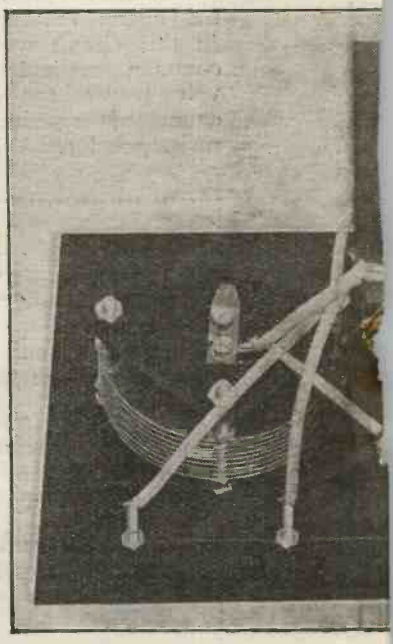
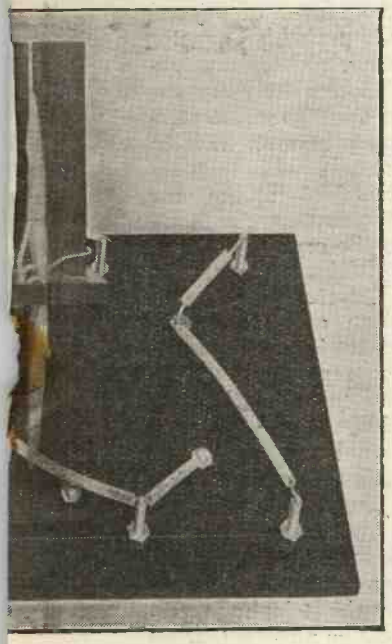


Fig. 2.—Showing how the coi

ity of the panel lay-out.



l is placed beneath the panel.

Novelty in crystal receivers is rare, but in this design several new points of interest and value will be found

1 former of a shape to be described.

Small quantity of No. 26 d.c.c. wire.

Small quantity of No. 20 d.c.c. wire.

1 or more pairs of high resistance telephones (4,000 ohms is a suitable figure).

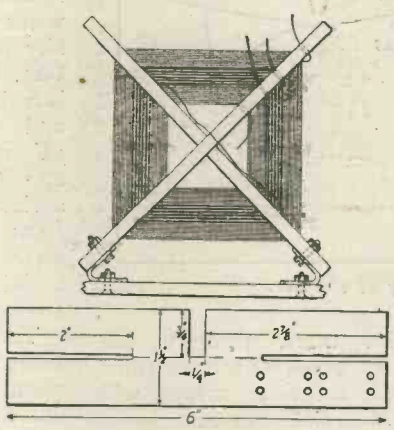


Fig. 4.—Constructional details of the square coil.

Details of Components

Any good quality components can be used, but as so many readers like to know the actual components used in constructing these sets, the following details may be of interest :—

Variable condenser.—This was made by the Bowyer-Lowe Co., Ltd., and is provided with a drilling template so that the holes may be accurately drilled.

Crystal detector.—This is the "Micmet," which has several constructional advantages. The cat-whisker is carried forward by a screw adjustment, whilst the crystal itself is held in a special cup with a flanged rim against which the crystal is pressed by a strong spring. The crystal cup can be moved forwards and backwards on a screw fitting, and the cat-whisker can be moved in such a way that by adjusting both the crystal cup and the cat-whisker holder any point of the crystal surface can be found.

The former on which the coils are wound is of a type described by me previously in *Wireless Weekly*, Vol. 2, No. 16.

In the actual instrument shown it is made of ebonite, but can almost equally well be of wood. It is made by taking two strips measuring 6 in. by 1½ in. wide by about ¼ in. thick, and cutting them in such a way that they can be pushed together in the middle forming a cross. Saw cuts are made for a depth of 2 in. in the manner shown in the illustration, and into the slots so formed the wire is wound. The actual width of the slot is not a very important matter as there is plenty of space in the former, but if ebonite is used the width of the ordinary hacksaw blade is the minimum, and, if possible, the slots should be made a little wider than this.

Winding the Coil

Before beginning to wind the coil four pairs of small holes should be drilled in the positions shown so that the wires can be held securely. First of all take the No. 26 d.c.c. wire and thread the end through the hole in the way shown, leaving at least 18 in. for subsequent connections. Now winding 25 turns of the No. 26 d.c.c. wire (do not worry if the turns are not quite even or if you get two side by side in the slot), and as soon as the 25th turn is reached stop winding the thin wire and thread into the second pair of holes the end of the No. 20 d.c.c. wire, leaving, as before, a considerable length for subsequent connec-

tions. Wind in in the same direction as before ten turns of the No. 20 wire, and pass the end through the third pair of holes, and cut off the wire when you have left about a foot for jointing up. Now take the wire, of which the first 25 turns are wound, carry it over the 10-turn coil, and wind on for a further 25 turns. Now thread the end of this wire through the fourth pair of holes, once more leaving a length for further connection.

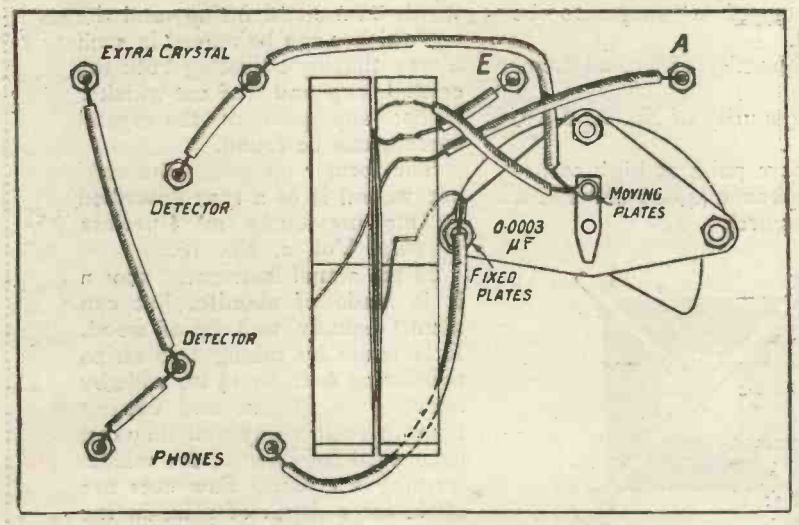


Fig. 5.—The very simple wiring of the set.

Brackets for Holding the Coil to the Panel

Some means will have to be found for holding the former to the underside of the panel. It is very easy to make a pair of brass brackets out of strip brass from which they can be cut with a pair of scissors. Cut two strips each about 1½ in. long by about ⅜ in. wide, and drill two pairs of holes, one hole at each end of each strip. Now bend the strip brass round in V shape, and bore two holes in the ebonite or wood former, through which you can pass No. 6 BA. metal screws Push such a screw through the hole in each brass bracket and through the former, and secure it in place with a 6 BA nut.

The next step is to drill the holes in the panel for the six terminals and for the crystal detector. The particular detector shown is held on to the panel by two metal screws, which are passed through clearance holes and held at the back with nuts. Four BA metal screws with cheese heads will suit this purpose quite well. Now carefully mark out the position for the holes of the condenser by means of the paper template supplied (if you use the particular condenser referred to), or by careful measurement, and lay the condenser on one side ready for mounting later. When the other holes have been marked out and drilled place the former carrying the coil, complete with its brackets on the underside of the panel in the position it is to occupy. With a sharp-pointed instrument mark through the holes in the brackets the positions where the securing screws will go, and then drill clearance holes for 4 BA metal screws. When this has been done pass metal screws through the panel from the upper side and secure the coil in place with a pair of nuts. Now mount the condenser and terminals together with the crystal detector, and the set will be ready for wiring.

Connecting Up

Most of the wiring can be carried out with the loose ends of the coils themselves, thus obviating much soldering, and although the set shown has been soldered at every point quite satisfactory results can be obtained if the wire is bared of its insulation at the various points and secured to the different components with nuts. Insulating tubing should be used wherever there is any possibility of two wires coming into contact with one another, or if the reader is skilled in soldering and the use of stiff wire, the set can be made up with No. 16 or No. 18 square tinned copper busbar wiring.

Characteristics of the Set

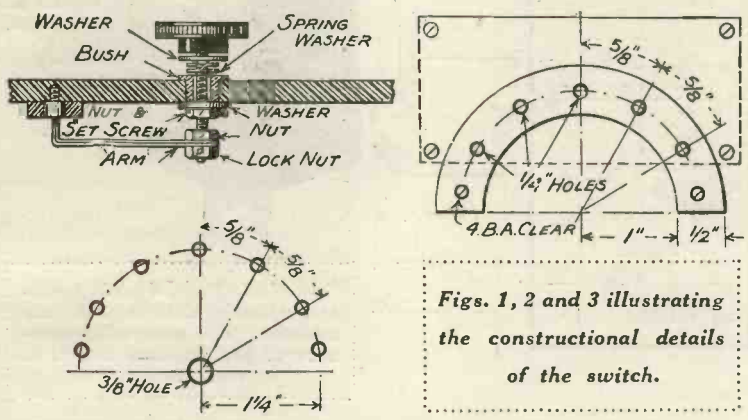
It is one of the advantages of the circuit shown that a very large range of wavelength can be covered with a small condenser. Some time ago I described in *Wireless Weekly* a crystal receiver on novel lines, using an aperiodic aerial coil with which the same advantage was indicated. In the present receiver the form of winding is somewhat different, and there is a larger number of aerial turns, which in this case are of thicker wire. The very close coupling given and the additional number of turns differentiates this set from that previously described. In the previous crystal receiver *Wireless Weekly*, Vol. 2, No. 10) the removal of the aerial and earth wires from the set made practically no difference to the calibration, but in the present set there is a slight difference. With aerial and earth connected the .0003 μF condenser tunes from about 270 to 600 metres; with the aerial and earth removed it tunes from about 230 to 570 or 580 metres. Thus the capacity of the aerial does not affect the set to any great extent.

The set will be found very sharp in tuning, and on the best point of adjustment the strength will be as great as that obtainable with any other form of crystal receiver, and probably greater than with many. The sharpness of tuning will completely remove very much of the Morse interference so frequently met with in seaboard towns.

The two terminals at the rear of the instrument are simply placed across the crystal detector so that, for trial purposes, any other crystal detector may be connected in place of that in the instrument. It is, of course, necessary to remove the cat-whisker from contact with the first crystal when trying a second detector, otherwise no change is needed. If it is desired to work a loud-speaker any ordinary one or two-valve note magnifier can be added to this set, the input terminals of the magnifier being connected to the telephone terminals. It will be noticed that no telephone condenser is used. I have not found any advantage from using one in this set.

A Novel Selector Switch

THOSE who like to stow their various gadgets which form part of the set neatly away beneath their panels, leaving nothing in view but the necessary adjusting knobs, will welcome the selector switch about to be described. Fig. 1 gives a general idea of its appearance as well as the details of the spindle and the arm. It will be seen that every part of the switch, with the exception of the knob, is concealed beneath the surface. It is easy enough to design or make a sub-panel selector switch which looks quite well, but there is one little point that is not always realised at first. This is that since the arm cannot be seen one has no indication of its position if the switch is made up in the ordinary way with the studs placed close together. We must devise something which will make the arm click as it passes from stud to stud, so that when it makes contact the fact may be both heard and felt. Fortunately it is not at all a difficult matter to do this.



Figs. 1, 2 and 3 illustrating the constructional details of the switch.

Begin by laying out and drilling the panel as shown in Fig. 2, spacing the holes for the studs $\frac{5}{8}$ in. apart on the circumference of a circle with a radius of $1\frac{1}{4}$ in. These holes should be drilled from the underside. They do not go quite through the ebonite and they are tapped with a 4 B.A. plug tap. The shanks of the studs are then shortened until their heads touch the panel, when they are screwed home. Now cut out a piece of $\frac{1}{4}$-in. ebonite, drilling it as shown in Fig. 3. The strip need not be semi-circular as shown there, but may be rectangular, as indicated by the dotted lines. All that matters is that it should be large enough to contain the necessary number of $\frac{1}{4}$-in. holes with their centres spaced $\frac{5}{8}$ in. apart standing on the circumference of $1\frac{1}{4}$ in. This strip is now passed over the studs and fastened down by means of screws. Studs vary a little in the length of their heads. Usually these are about $\frac{1}{4}$ in. in depth. If they are rather less, so much the better; but if not they must be filed down until they are only 3/16 in. deep. The top of each stud will thus be a little below the ebonite strip.

Now to make up the spindle and switch arm. The spindle is a 2 in. length of 2 B.A. screwed rod to one end of which is fitted a knob of the usual pattern. On to the spindle are passed a flat washer, a spring washer and a second flat washer. It is passed through the bush, a third flat washer being then put on. To keep it in position use a nut provided with a setscrew. It is quite an easy job to make this fitting, which comes in useful for all sorts of wireless jobs. Fix the nut in a vice and drill and tap a 6 B.A. hole through one of its faces right into the central hole.

The arm is made from two or three strips of springy sheet metal and is secured between two nuts which can be locked one against the other when the correct position has been found. Owing to the hollows in which the studs lie the arm when moved will drop into each with a distinct click which is quite perceptible. In order that the action of the switch may be as smooth as possible the corners of the end of the arm should be rounded off with a file.

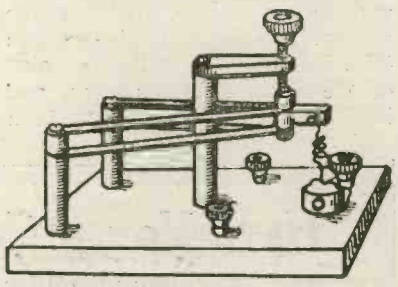
If desired a pointer may be fitted to the knob, marks corresponding to the studs being made upon the upper side of the panel and numbered by means of a figure punch.

R. W. H.

A Good Crystal Detector Stand

The following is a description of a crystal detector with which, when set on a sensitive spot, pounding on a table is possible without losing that sensitive spot. The convenience of having a very light contact on silicon and heavy contact on galena can be obtained with this detector. The bronze springs have a tendency to go upwards and are held in the right position by the knob for adjusting the cat-whisker. A base of dry wood or composition, two knobs, some sheet bronze, brass tubing and a few screws are all that are needed for this remarkable detector. Dimensions are not given, as they may vary with constructor's desires.

W. W. S.



A very stable and serviceable type of crystal detector stand. The arrangement prevents the possible jarring off of a sensitive point.

An Improved Holder for V24 Valves

ANY who use V24 Q or QX valves and their low temperature counterparts the DEV and DEQ will probably have had reason to anathematize the ordinary spring clip holder supplied for them. Whether the clips are mounted directly upon the panel or made up into an adaptor to enable the valve to be used in a 4-pin holder, the same nuisance is noticed. The two clips which make the filament contacts at opposite ends of the valve answer well enough, but those which make connection with the little bosses attached to the plate and the grid are not at all satisfactory.

The contact which they make is not sufficiently positive. One not infrequently traces noises in the set to the valve which has moved a little in its holder, which causes the grid connection in particular to be faulty. Further, these holders are apt to make one think that the valves are much more microphonic than they really are, for any jarring will make the valve jump a little in the clips and so produce a noise in the receivers.

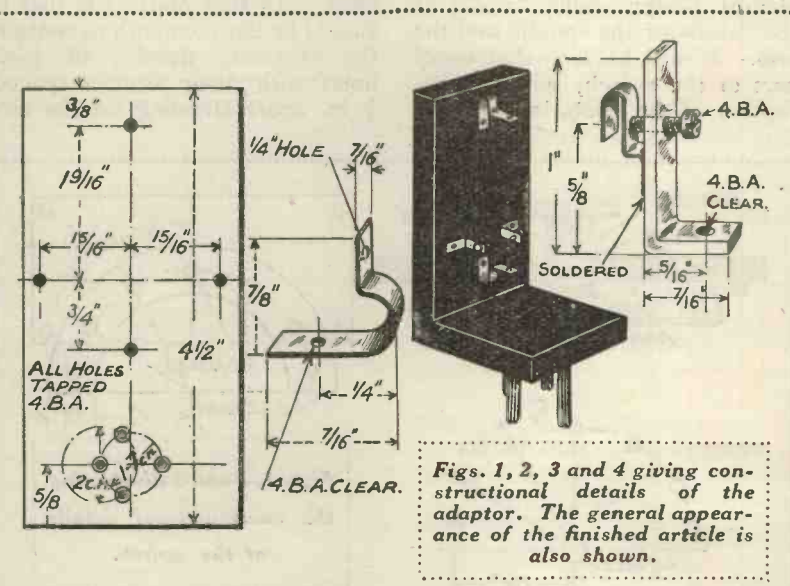
The writer has found that it is preferable to use the holder described below which permits a much more positive form of contact to be made. The filament clips are of the usual kind, but those for the grid and plate are provided with adjusting screws which make it possible to secure a firm, even pressure upon the bosses of the valve. Details of the clips are given in Figs. 2 and 4. The filament clips are cut from springy sheet metal 7/16 in. wide, and are bent to the shape shown. In the vertical part is a ¼ in. hole through which the point of the filament boss passes, and in the horizontal part there is a 4 B.A. clearance hole to take the screw securing the clip to the ebonite. The clips for plate and grid connections are made similarly from sheet metal. They are mounted, however, not directly upon the panel, but upon L-shaped pillars made of angle brass of the dimensions shown in Fig. 4. The clip is soldered to the pillar so that the middle of its face is ⅝ in. above the panel. Through the pillar is inserted a 4 B.A. screw, the point of which rests against the back of the clip. By means of this screw one can obtain just the right amount of pressure.

Fig. 1 shows the drilling layout for a horizontal adaptor. For mounting directly upon the panel the dimensions will be the same except, of course, that the valve pin-holes will not be required. If it is desired to make upright adaptors this may be done very easily, as shown in Fig. 3.

To mount a valve in one of these holders first of all slacken off the adjusting screws of the plate and grid clips. Then insert the valve in the ordinary way and turn the screws in until it is firmly gripped. Take care not to use too much force or the valve may be injured; a firm, tight contact is wanted, but nothing like a crushing pressure. It will be found that it is so fixed that the valve is quite unaffected by jarring, and that it shows no tendency at all to move in the holder.

There is, by the way, one little point about valves of the V24 type and their holders which is not always realised. The little bosses do not become very dull, though if there is any grease upon them on account of their having been handled, a thin coating of dust may collect, which will not make for a good contact. Both the valve bosses and the faces of the clips should be given a slight polish up every now and then with a piece of old, worn emery cloth.

R. W. H.



Figs. 1, 2, 3 and 4 giving constructional details of the adaptor. The general appearance of the finished article is also shown.

A Simple Home-Made Jack

Most of us realise the convenience of jacks for permitting one to tap the low-frequency side of the set with the telephones so that either the whole or only a portion of the note-amplification available may be used. The trouble is that jacks are expensive to buy, and that owing to their length they require a considerable amount of clearance

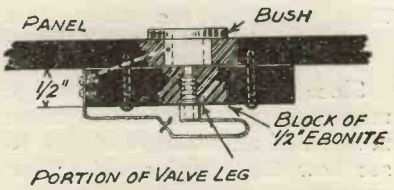


Fig. 1.—Details of the socket.

room below the panel. Here is a very simple jack which can be made up for the outlay of a few pence and which needs only just over 1 in. of clearance below the panel. Fig 1 shows the detail of the socket portion. Into the panel itself is inserted a metal bush with a $\frac{3}{8}$-in. hole. The bush must not protrude at all below the panel. A block of $\frac{1}{2}$-in. ebonite 2-in. long and $\frac{1}{2}$ in. wide, is now cut out

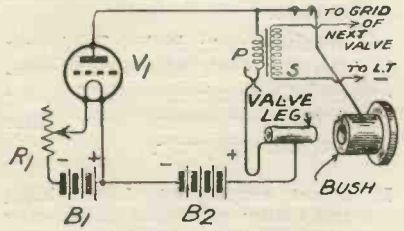


Fig. 2.—Method of connecting up.

and fixed to the panel by means of screws as shown. The shank of a valve socket is cut off, and the part containing the hole for the valve prong is cut down to the length of $\frac{5}{8}$-in. A suitable male thread is put on to one end of the socket for a length of $\frac{3}{8}$-in. A hole is now drilled through the ebonite block in the centre of the hole in the ebonite bush and is tapped to take the threaded valve socket which is screwed home into it.

To the protruding end of the valve socket is soldered a contact strip made as shown in the drawing from a piece of springy sheet metal. The strip should stand away for about $\frac{1}{8}$-in. from the base of the valve leg. The other contact made of the same material is secured to one end of the ebonite block by means of a pair of short 4B.A. screws, and a wire connection is taken from it to the bush. A glance at Fig. 2 will show the way in which the connections are made. It will be seen that until the plug is inserted the two springy contacts allow the plate circuit of the valve to function in the ordinary way.

Fig. 3 shows the way in which the plug is made. The core consists of a piece of $\frac{1}{8}$-in. round

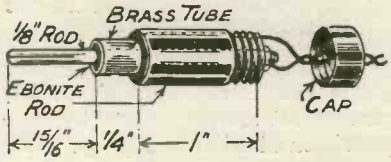


Fig. 3.—Details of the plug showing insulating bushing.

brass rod $2\frac{1}{8}$ in. long, $1\frac{1}{2}$ in. of which are threaded with a Whitworth die. The end not threaded may be split like that of a valve prong with a fine hacksaw, but this is not absolutely necessary. The part of the plug which makes contact with the bush is made from a ferrule $\frac{1}{2}$-in. in length of $\frac{3}{8}$-in. external diameter brass tubing. Into this a piece of ebonite rod of the same length with an $\frac{1}{8}$-in. tapped hole is forced tightly. The contact pin, made of $\frac{1}{8}$-in. brass rod is now screwed tightly into this hole.

The handle is a piece of $\frac{1}{2}$-in. ebonite rod 1 in. in length. Through the long axis of this is drilled an $\frac{1}{8}$-in. hole to take the shank of the pin contact, and the end is secured in place by means of a nut. A small hole to take a lead from the brass ferrule is drilled down the long axis of the handle, a wire being passed through it and soldered to the ferrule. The top end of this wire may be fixed to a small screw. The telephone leads are fastened to this screw and to the end of the pin contact. A still neater job can be made if a lathe is available. About $\frac{3}{8}$-in. of the

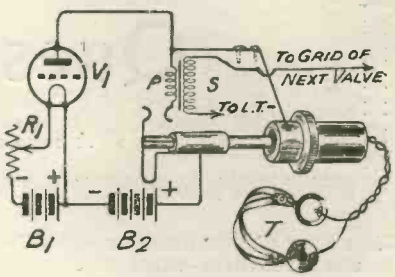


Fig. 4.—Illustrating the action of the jack. The primary circuit is broken as shown.

end of the handle is threaded. An ebonite or wooden cap is turned up and threaded to screw on to it, the leads passing as shown in Fig. 3, through the hole in the cap.

Fig. 4 shows the action of the jack. When the plug is pushed home the end of the $\frac{1}{8}$-in. rod forces the two springy contacts apart. The rod itself makes connection with the valve leg and the ferrule with the bush. Hence current must now flow through the leads attached to the plug.

R. W. H.

Swiss National Wireless Exhibition

An exhibition of wireless apparatus will be held at Geneva between May 21 and June 1, and will comprise twelve groups of exhibits of wireless apparatus and machinery used in its production. One group will contain statistical and instructional information, including the results of exploitation, patents and inventions, apparatus for instruction, diagram, tables, models, plans, projects, etc., besides periodicals and literature on the subject.

It is expected that much interest will be displayed in the exhibition, as showing the development reached in Switzerland in the production of all the mechanism connected with wireless transmission.

Some Simple Wireless Questions Answered

A page of particular interest to the Broadcast Listener

What size of accumulator shall I use for a three-valve set?

Assuming that the ordinary high temperature valves are to be used, it is best to use a 6-volt accumulator, and its size should be not less than 30-ampere hours actual capacity. (NOTE.—This corresponds to 60-ampere hours ignition capacity.) If dull emitter valves of the type which work from a 2-volt accumulator are proposed, 20-ampere hours actual capacity is a suitable size. If an accumulator is used for the newer type of valve taking only .06 of an ampere on the filament, a very much smaller size can be employed, about 10-ampere hours actual capacity being sufficient.

How can one tell when the low-tension battery requires re-charging?

The voltage of the battery will have fallen to about 1.8 volts per cell (reading to be taken with the voltmeter while the battery is actually delivering its normal current) and the colour of the positive plates will probably have become a palish brown.

How can one tell when an accumulator is fully charged?

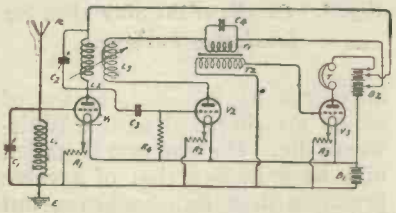
This depends upon whether it is desired to ascertain the completion of a charge while the battery is still on charge, or whether one wants to form an opinion as to the state of charge of a battery which has been returned from the charging station. When the battery is charging and the process is complete a quantity of gas will rise from the plates, this process being known as gassing. The colour of the positive plates forms a fairly good indication of the condition of the battery when it has been returned from a charging station. They should be extremely dark, practically black, in colour.

How can one calculate the safe maximum current which can be taken from an accumulator of given size?

Ascertain the actual ampere hour capacity (this is half the ignition capacity), divide this figure by ten. It can thus be calculated that a 40-ampere hour battery will give 4 amperes safely.

If it is desired to use different voltages on the anodes of different valves in a set, must separate high-tension batteries be employed?

Not necessarily. Usually two plugs only are supplied with a new H.T. battery, but, by the provision of additional plugs with,



How to apply a different anode voltage to each valve.

for instance, a 100-volt battery, it is quite practicable to use, say, 60 volts on the R.F. valve, 45 on a rather soft rectifier and the full 100 volts on the L.F. amplifying valve or valves.

Is it possible to locate an oscillating valve set?

The problem is an extremely difficult one, and has occupied the attention of the postal authorities and others for some considerable time. If the offender will oscillate steadily for some minutes it may be possible to locate him by the ordinary direction-finding method, using frame aerials, but the radiation is usually too fitful and varying for such measurement. Nevertheless, the Post Office and the B.B.C. hope to devise a successful method ultimately.

What would be the effect if a lightning flash actually struck an amateur aerial?

Since a lightning discharge may represent a current of some millions of amperes, it is hard to see how the aerial could escape complete destruction. The enormously high temperature generated by the passage of so great a current would certainly fuse the wire, and it may be concluded that the remainder of the discharge would pass along the streak of copper vapour which would instantly replace the wire. It may be noted that no authenticated report of the striking of an amateur aerial by a direct flash has been published.

Is it an indication of a defective valve when the bulb is blackened or coated inside with what appears to be a metallic deposit?

Certainly not; it is simply an incidental result of certain processes of manufacture, indicating that the processes have been carried out properly.

In a set employing both high frequency and low frequency amplification, is it necessary to use different types of valves for the different functions?

Most of the valves now on the market will operate satisfactorily in either duty, but some advantage may be gained by using a valve specially designed for either purpose. For the high-frequency side, for example, it is desirable to use a valve of low internal capacity.

Do wireless waves of different wavelengths travel at the same speed?

Yes, the speed of the wave depends upon certain properties of the ether, and is 186,000 miles a second.

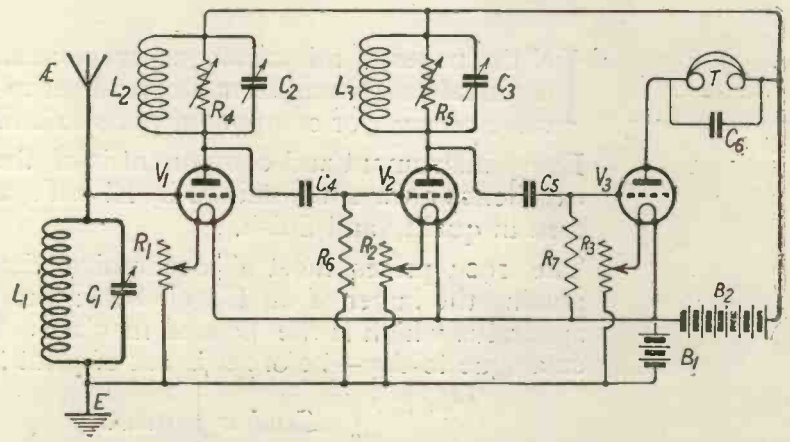
A 2H.F. Circuit

THE problem of providing two stages of high-frequency amplification is not yet satisfactorily solved. The theoretical degree of amplification is never obtained, and consequently much disappointment is frequently experienced.

Although the ideal state of affairs has not yet been realised, quite good results are obtainable by introducing the variable 100,000 ohm resistance mentioned in these notes. It was suggested that this variable resistance be connected across the tuned anode circuit of a receiver to prevent the valve from oscillating when not desired. It was also suggested as an alternative that the variable resistance be connected across the grid circuit. When two valves are being used for high-frequency amplification, self-oscillation troubles are greatly increased, and to obtain stability it is necessary to introduce some factor which lessens the degree of amplification per valve. Two tuned anode circuits, although so simple, are particularly difficult to hold down, and I am not sure that I have seen any description of a method of preventing self-oscillation with this type of circuit. When operating such a receiver one tries to prevent self-oscillation by using large values of the variable condensers across the anode inductances and by lowering the filament current or high-tension voltage. It is also necessary to keep all the coils well apart, and the same applies to the leads which go to the coils. A certain amount of reverse reaction coupling between the two tuned anode coils helps stability, but reverse reaction is a ticklish matter at the best of times when the two inductances to be coupled are both shunted by variable condensers. The reverse reaction effect is generally only obtained when the coupling is loose, and then it may not be sufficient to carry out our object of preventing self-oscillation.

Of course, when an aperiodic reaction coil is used, the reaction (or reverse reaction) adjustment is easily made, but when trying to obtain reverse reaction with a tuned circuit, the capacity coupling between the inductances, and between the electrodes in the valve and the leads to them, masks, and frequently more than balances, the inductive reverse reaction which we are trying to obtain. Anyone who has worked with a tuned-anode circuit finds sooner or later that he can obtain a reaction effect whether the coil is the right way round or not. He will generally find that there is a best way round; nevertheless, it sometimes happens that it does not matter which way round the reaction coil is connected, equally good signals may be obtained.

It is because of the peculiar effects obtained with tuned-anode coupling, or, in fact, whenever a tuned-anode circuit is used (*e.g.*, in the ST100 circuit), that a reversing switch for the reaction coil is desirable. The simplest way of doing this is to provide a couple of terminals and to take short flexible leads from the coil holder to these two terminals which are on top of the panel. It is only a matter of seconds to reverse the connections to the reaction coil. This is much more convenient than having to rewire the underneath of the panel for the purpose of comparing the results obtained with the connections to the reaction coil reversed. By the time the change over has been made on the underneath side of the panel, one has forgotten what the previous signal strength was like, whereas immediate comparison is possible when the reversal terminals are provided as suggested.



The use of high resistances to control self-oscillation in two stages of high frequency amplification.

In the accompanying figure, the two tuned-anode circuits are kept stable by means of the resistances R4 and R5. There are several variable types of 100,000 ohm resistances which have come into being for use with the ST100 circuit, but which have now an added usefulness.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

The Thorpe K.I. Valve

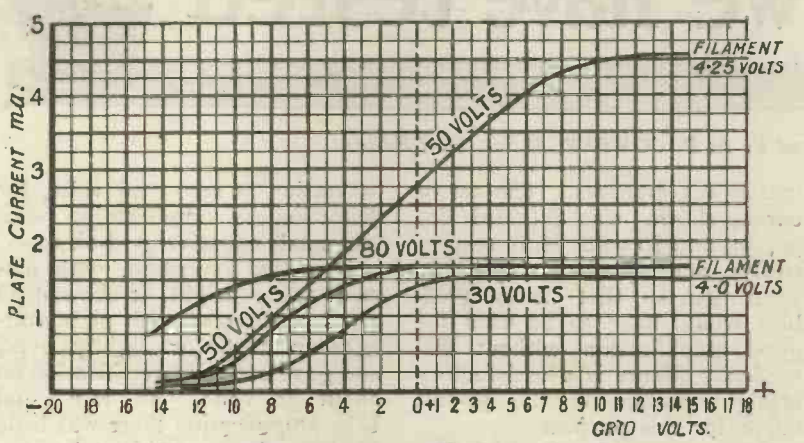
The Thorpe valve, a sample of which has been submitted for test by Messrs. G. Street & Co., Ltd., is rated at 4 volts and 0.4 amperes by the makers, with anode volts 30 to 80. The sample submitted, the characteristic curves of which, as determined by the writer, are appended, gave a milliampere plate current at 3.5 volts on the filament, but little or no grid-control under these circumstances on ordinary plate voltages. The H.T. had to be reduced to an extremely low figure to avoid saturation. With 4 volts on the filament, the current consumed was approximately 0.3 amperes. The set of curves shown was obtained for 30, 50, and 80 volts H.T. respectively, and show a very early saturation, so that heavy grid-bias would have to be used for good amplification without distortion. There is a satisfactory straight portion in the 50-volt curve for this purpose.

With 4.25 volts on the filament the valve was pretty bright, although it would apparently stand over 4.5 volts for a short period. The plate current showed a saturation value of 4½ milliamperes, whilst the 50 volts curve gave a very satisfactorily long straight portion, well below saturation at zero grid volts, for distortionless amplification with but small negative grid-bias.

In actual reception, with filament fairly bright, it showed no signs of distress with plate voltages up to 80 or slightly over, and gave excellent rectification on about 50 volts. In H.F. and L.F. amplification there was little to choose between this and an excellent French R valve, whilst the filament current was less than half. The calculated amplification factor was around 6 in the formal test, whilst in practice excellent amplification was obtained. For L.F. work 80 volts H.T. and 1.4 volts negative

grid-bias appeared to be most favourable. In dual amplification the valve replaced a standard R valve without noticeable effect on signals, whilst in the Armstrong super circuit on one valve with "capacity" aerial alone a moderate measure of loud-speaking was obtained at 13 miles from 2LO, using 65 volts H.T. and a high value of grid-leak resistance.

While a six-volt accumulator is indicated for supplying the L.T. for this valve, in economy both of filament-current and first cost it presents marked advantages; it was, however, noticed to be somewhat microphonic, especially when used as a L.F. amplifier. The construction is somewhat unusual, in that both grid and plate take the form of open spirals of wire. In the valve submitted the filament sagged fairly close to the grid, so that care had to be taken in mounting the valve. It appeared, however, to be of strong construction, the legs being stout and firmly fixed.



Characteristic curves of the Thorpe K.I. Valve.

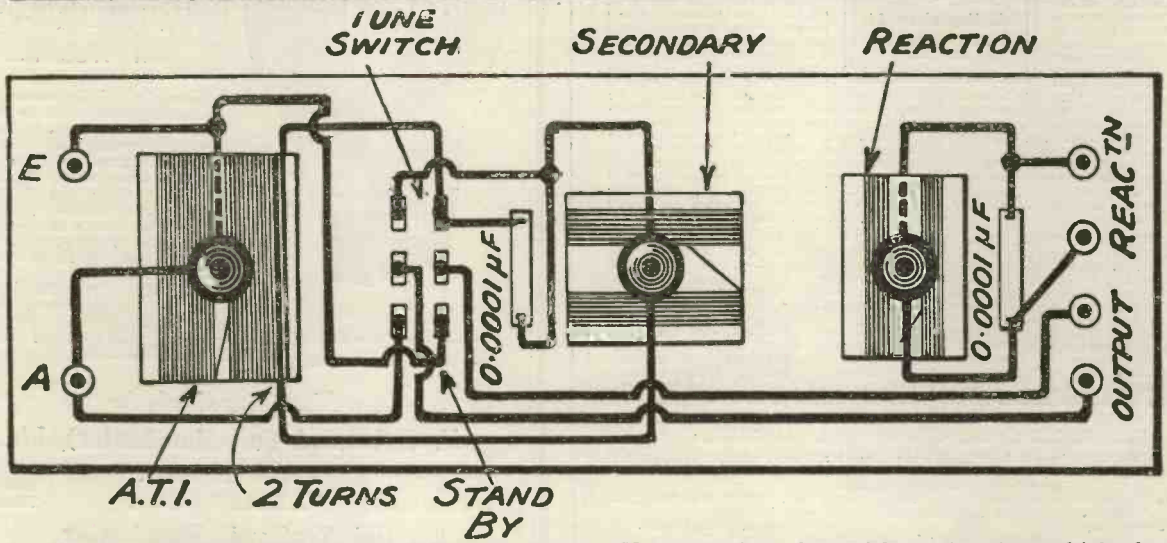
"L'Eccentro" Crystal Detector

Those who experience trouble in setting the conventional cat-whisker type of crystal will welcome the automatic feature of "L'Eccentro" crystal detector by Messrs. W. Joanes.

When a large fragment of galena crystal has been inserted in the holder, all that it is required to do to search the greater part of the exposed face systematically for good spots is the rotation of a small thumb-screw. The crystal is placed loose in its cup, being held in position by a spiral spring which also makes electrical contact.

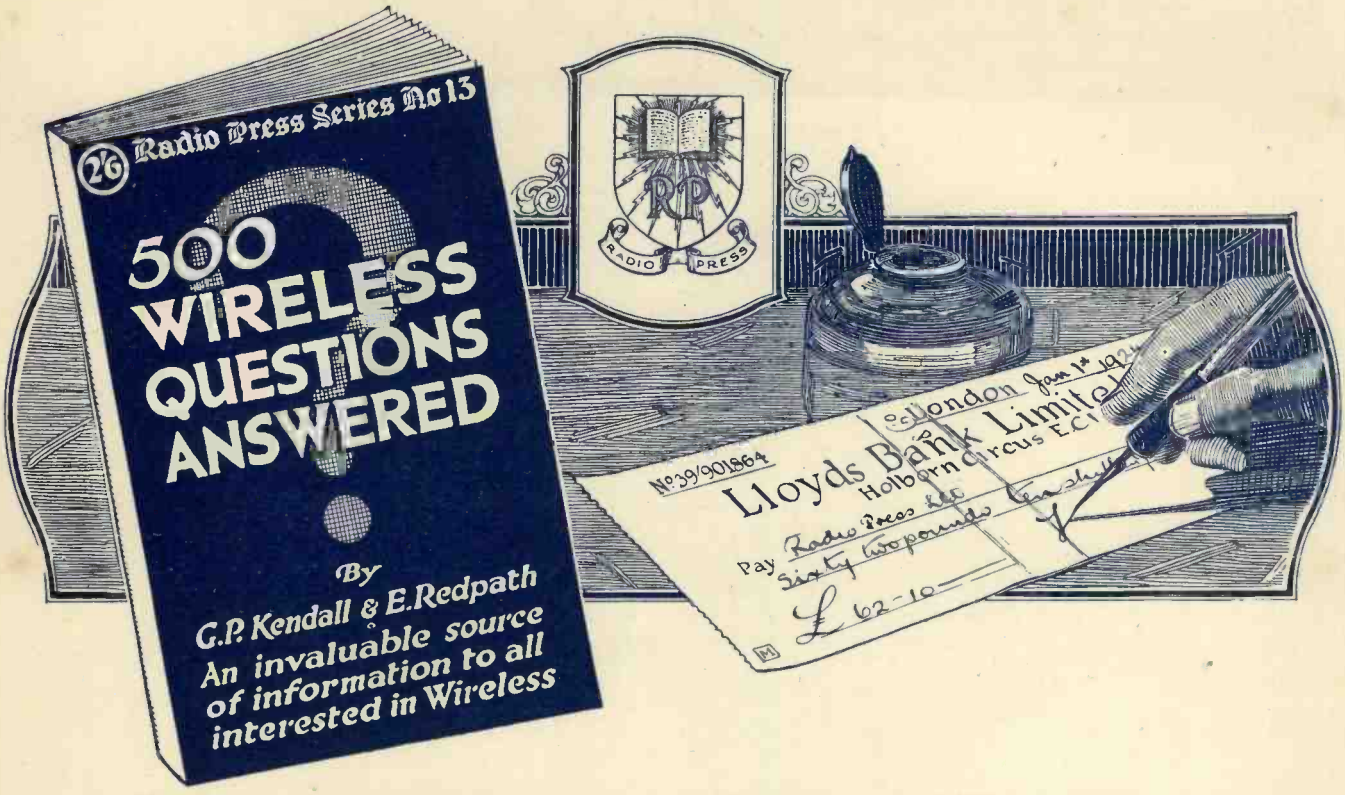
The ingenious mechanism which effects the searching is very simple; a small eccentric crank engages with a disc at every revolution of the thumb-screw, pushing it down against a spring, and at the same time giving it a partial rotation. The cat-whisker is thus withdrawn and re-applied at a fresh spot. A piece of fine gauze in front of the crystal guides and steadies the exploring cat-whisker point.

Information Department



J. R. H. (MARGATE) finds difficulty in reading the wiring diagram of the "Really Selective Tuner" recently described, and asks for the exact connections.

We reproduce herewith a drawing which should make things clear. Your attention is drawn to the note regarding this tuner which appeared in Vol. 3, No. 9.



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Wireless Weekly

and the Wireless Constructor.

Vol. 3.
No. 12.

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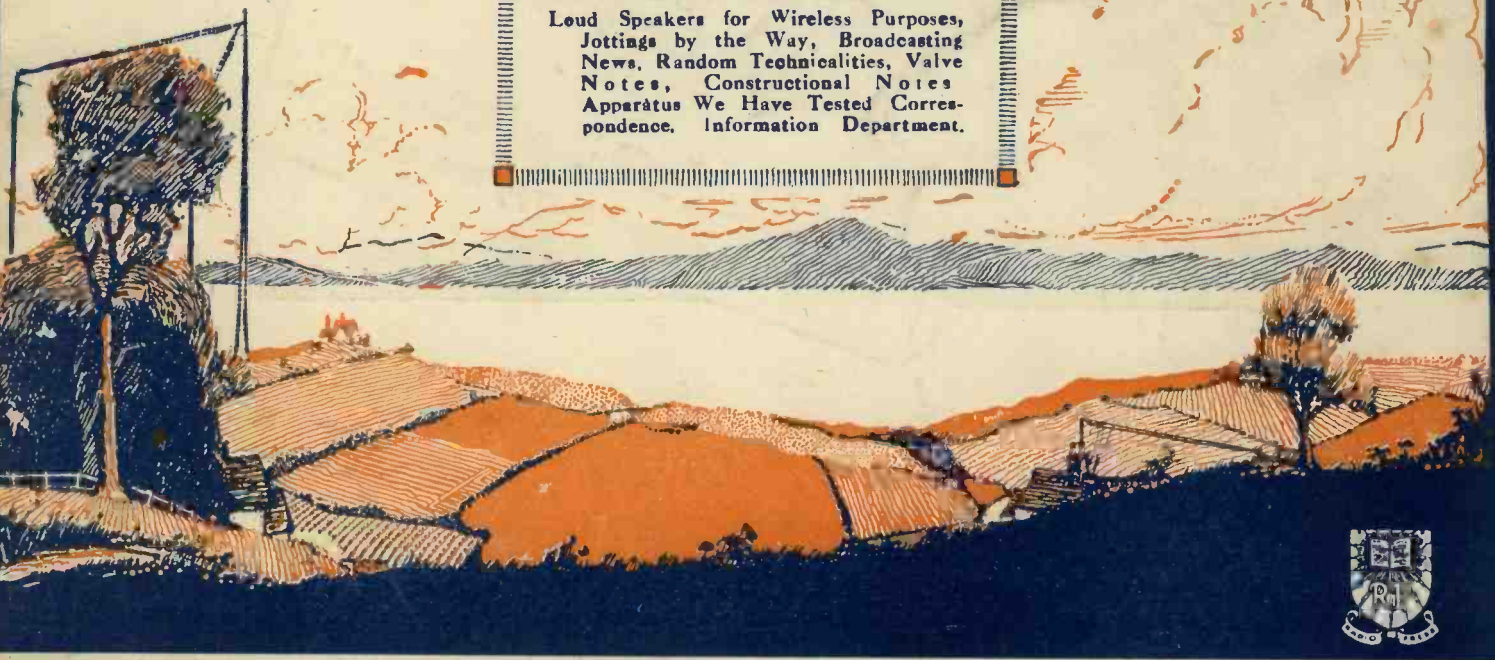

The 1,600 Metre Wave Station

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Feb. 27 1924

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Editorial

The 1,600 Metre Wave

THE British Broadcasting Company, having obtained a permit to erect a high-power transmitting station, are now discussing the arrangements under which this power will be used. A wavelength of 1,600 metres is proposed, and as might be expected, a large number of listeners-in have been considerably perturbed. Whilst it is pointed out by officials of the Company that the new transmissions will not in any way supersede the present short wave programmes, the fact remains that listeners will desire to hear both programmes, and will therefore need either to have their apparatus altered or, if as will frequently be the case, it is not practicable to alter it, will need to purchase new equipment. This is a serious consideration, but a new high-power station will be a great boon to many listeners.

We are not sure that the new wavelength is by any means so free from interference as would appear to be indicated in reports published in the Press. The longer the wavelength the wider the band occupied by telephony transmission, and consequently the less sharp the tuning. The tremendous power of 25 kilowatts is not perhaps fully realised by the listener. This power is about 17 times as great as that at present used, and will monopolise the ether so far as broadcast listening is concerned for a good many miles around the transmitting station wherever it may be located. Crystal sets will be the easiest to alter to the new wavelength, for in these cases an additional loading coil can be quite simply connected in circuit. Such sets, however, are by no means selective, and will not be able to tune out the local broadcasting station (if this latter is using a short wave) at 6 to 10 miles. This fact can easily be tested by anyone plugging in a suitable coil and listening on that wavelength at the present time. Multi-valve-sets, particularly those which are provided with high-frequency stages, are not so easily altered, but will have the advantage of a far greater selectivity. Since, however, the increase of power is presumed to be largely caused by the desire of the Broadcasting Company to give the crystal listener a good showing, care must be taken to prevent this highly important member of the broadcasting community from falling between two stools, or more precisely, between two waves, being jammed by both.

On the other side of the shield there are certain advantages in using the longer wave. High-frequency amplification, rather a problem on short waves if simplicity and efficiency are all to be obtained—is greatly facilitated. The cheap and efficient resistance capacity coupling which requires no tuning of individual stages, becomes practicable on this wavelength, and it is quite a simple matter to arrange two or three stages of high-frequency amplification which require no more attention than do corresponding stages of note magnification. Moreover, valve oscillation will matter less because radiation on this wavelength will be less.

We have been at some pains to listen-in on a 1,600 metre wavelength during those hours when broadcasting is most popular, and have found that in receivers which are not sharply tuned there is some danger of interference from PCH (Scheveningen, Holland), which frequently works to ships on a long wave; from the Air Ministry transmissions which, although c.w. and on a different wave, are sufficiently powerful to produce strong " key clicks " of a distressing nature; from Ongar, the Marconi transmitting station in Essex, and from other sources.

The station should work on from 1,200 to 1,900 metres, but not 1,600 metres.

Radiola on 1,780 would be entirely cut out, and as its power is going up to 20 kilowatts, we could not tolerate this. The wave-band of a 1,600 metre station would be 100 metres, and a reconsideration of the wave length seems necessary.

A Simple Buzzer Wave-Meter

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

Full instructions are given in this contribution for the making and use of a really simple and easily-made measuring instrument of the greatest value to even the inexperienced constructor. The instrument can be used for a variety of purposes, one of its unusual applications being as a wave-trap.

THE old dictum, "Science is measurement," is perhaps less true in wireless than in many subjects, since so much can be done by the purely qualitative, as opposed to quantitative, observation of phenomena; but the importance of measuring instruments is very great, notwithstanding. Even the simplest of instruments will enable one to check all sorts of observations and to carry out innumerable interesting experiments impossible to the experimenter who possesses no means of measurement, however skilled he may be.

The commonest measurement required is that of wavelength, of course, and the possession of a wave-meter opens up a vista of fascinating possibilities little realised by the average experimenter, who is apt to conclude that a wave-meter of even the simplest sort is too expensive an instrument to buy and too difficult to make and calibrate for himself. Now, this latter is by no means the case, as I think the reader will agree when he has finished reading this description of a successful instrument of a very elementary type. A wave-meter, we must remember, is essentially a miniature transmitter emitting weak wireless waves whose length can be accurately set to known values. A simple meter consists of a tuned circuit containing a coil and condenser and a means of throwing this circuit into oscillation, so that it shall emit waves of the length to which it may be tuned. If the condenser is variable, waves of any length between those given by the maximum and minimum values of the capacity can be generated, and if the coil is made variable, or, better still, interchangable, the whole range of waves now in use can be covered.

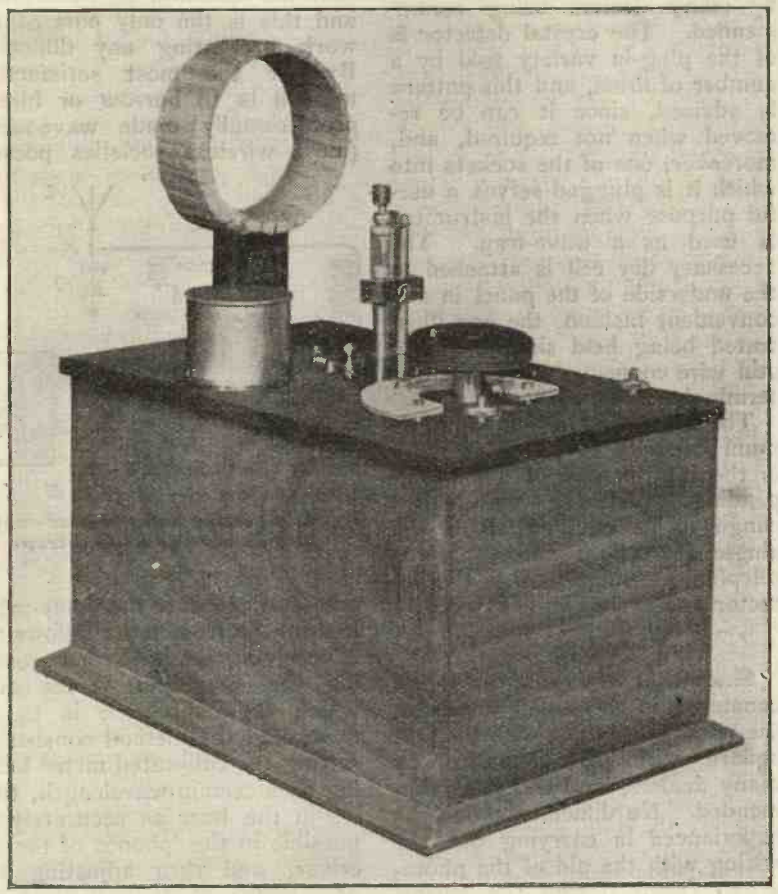


Fig. 1.—A photograph of the completed wave-meter.

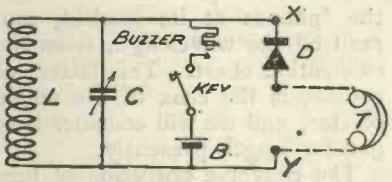


Fig. 2.—The circuit.

Production of Oscillations

There are two principal methods of setting up oscillations in the tuned circuit, the buzzer excitation method and the heterodyne method. In the latter case a buzzer and battery are connected, so that the interrupted current passes through the coil, each interruption setting up a series of oscillations and causing a group of waves of definite length to be radiated.

Methods of Measurement

To measure a wavelength with such an instrument one proceeds as follows:—First tune in upon the receiver the signals of the distant station whose wavelength is to be determined; then place the wave-meter near the set and switch on the buzzer. Revolve the knob of the wave-meter condenser until the buzz is heard in

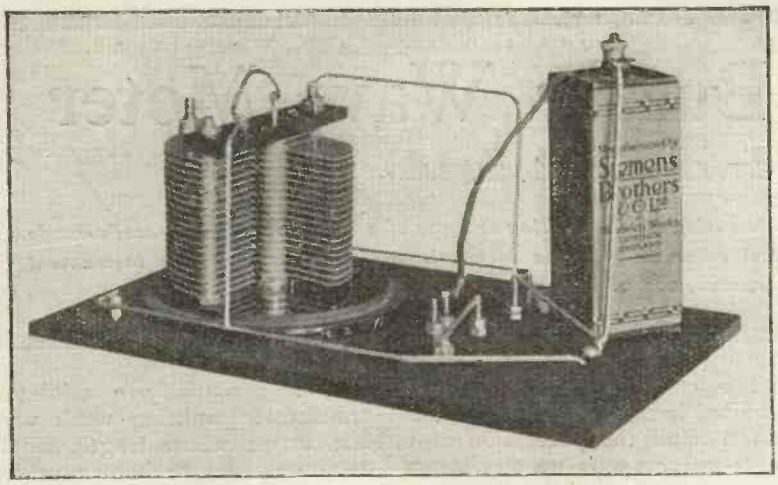


Fig. 3.—An underneath view of the panel.

the 'phones at its loudest, and read off the wavelength from the calibration chart. This latter, of course, is the crux of the whole matter, and we will consider it at greater length presently.

The converse operation of tuning the set to a given wavelength in order to pick up the signals of a station whose wavelength is known is carried out by setting the wave-meter to the correct point, switching on the buzzer and then varying the tuning of the receiving set until the sound of the buzzer is brought in as loudly as possible. On switching off the buzzer the desired signals should be heard.

Measurement of Transmitted Waves

Another use of a wave-meter lies in the measurement of the length of the waves emitted by a transmitting set, and here what we require is a calibrated *receiving* circuit instead of a calibrated miniature transmitter. To enable measurements of this sort to be performed it is usual to provide a crystal detector and terminals for a pair of 'phones, so that the wave-meter becomes a simple receiver whose variable condenser indicates the wavelength just as before. We shall see how these arrangements work out in detail when we come to consider the actual construction of the simple instrument illustrated on this page.

Constructional Considerations

The basis of the instrument is a quarter-inch ebonite panel, 9 ins. by $5\frac{3}{4}$ ins., forming the lid of a convenient box supplied by Messrs. Bowyer-Lowe. Upon this are mounted a coil socket L, a small on-and-off switch to control the buzzer, a crystal detector, buzzer and pair of terminals for 'phones. The buzzer must be of the high-note type, one of the small ex-Government pattern sold by many dealers being recommended. The crystal detector is of the plug-in variety sold by a number of firms, and this pattern is advised, since it can be removed when not required, and, moreover, one of the sockets into which it is plugged serves a useful purpose when the instrument is used as a wave-trap. The necessary dry cell is attached to the underside of the panel in any convenient fashion, the one illustrated being held simply by the stiff wire connected to its positive terminal.

The condenser C has a maximum capacity of 0.0005 μF; L is the plug-in coil of a size depending upon the wavelength range to be covered; B is the single dry cell; T and T are the telephone terminals; D is the detector and B the single dry cell.

Wiring

Since it is important to secure constancy in wave-meter circuits, the wiring was done with the stiff square wire now supplied by many dealers, and this is recommended. No difficulty should be experienced in carrying out the wiring with the aid of the photograph (Fig. 3) and the wiring diagram (Fig. 5).

Wave-trap Applications

A most useful application of a wave-meter of this type is as a wave-trap, and a brief explanation of this may be of value. The instrument is connected in series between the aerial and the aerial terminal of the receiver; in the manner shown in Fig. 4, by removing the detector from its sockets, plugging a valve pin carrying a lead from the aerial into the socket nearest the buzzer and taking a lead from the left-hand telephone terminal to the aerial terminal of the receiving set. The two points in question are indicated by X and Y in the theoretical diagram. The condenser is then set to the wavelength of the station which it is desired to eliminate, and the required station is tuned in by manipulating the controls of the receiver. Considerable reduction of interference can be achieved in this way, but a little practice in handling is usually needed.

Calibration

There remains for consideration the question of calibration, and this is the only part of the work presenting any difficulty. By far the most satisfactory method is to borrow or hire a professionally made wave-meter (most wireless societies possess

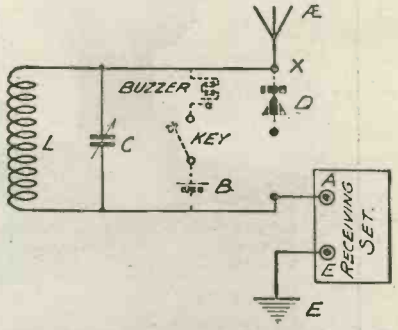


Fig. 4—Showing how the wave-meter may be used as a wave-trap.

one) and calibrate the home-made instrument from it as follows:—A receiving set is needed covering the range of waves over which the calibration is to be done, and the method consists in setting the calibrated meter buzzing on a certain wavelength, tuning-in the buzz as accurately as possible in the 'phones of the receiver, and then adjusting the new meter so that its buzz is heard with maximum intensity

with the same adjustment of the set. In this way the equivalent reading on the dial of the new instrument may be ascertained and recorded, and if this is done over the whole range at intervals of, say, 10 metres on the shorter waves and 100 metres on the longer, a complete calibration chart can be drawn up, and preferably expressed in the form of a graph.

Failing a second wave-meter, the range covering the broadcast band can be calibrated with very fair accuracy by making use of the transmissions of known wavelength of the various B.B.C. stations. Tune in each station (a fairly sensitive valve set is obviously needed), and then adjust the wave-meter until its buzz is heard at maximum; the reading upon its dial is then that which corresponds to the wavelength of that station. If this is done for each station, a series of readings will be obtained for waves between 350 and 495 metres, which will enable a curve to be drawn upon squared paper. Plot wavelength vertically against dial reading horizontally, and a curve will result from which intermediate wavelengths can be read off.

Suitable coils were found in the Burndept S1, S4 and No. 300, the former covering the short waves from 100 to 250 metres, the second the broadcast band and 600 metres, and the third about 1,000 to 3,000 metres. The actual figures obtained will inevitably vary with the make of variable condenser employed, the particular coils used, and so on, but the following data may serve as a rough guide. The greatest variation will probably be found on the shortest waves, and therefore it will only be said that 100 metres comes in at about 10° on a one hundred and eighty degree scale, and 200 metres at about 90°.

Using the S4 coil, readings were as follow:—300 metres, 26°; Cardiff, 38°; London, 40°; Manchester, 46°; Bournemouth, 49°; Newcastle, 53°; Glasgow, 62°; Aberdeen, 96°; 600 metres, 148°.

Using the 300 coil the following table was obtained:—

Wavelength (metres.)	Dial Reading.
1,200	12°
1,500	28°
1,800	50°
2,000	62°
2,200	75°
2,400	90°
2,600	114°
3,000	165°

A somewhat irregular curve was obtained on plotting these values, and this was attributed to a rather irregular variation in the capacity value of the condenser for each degree of movement of the dial, which resulted from a slight deformation of the moving vanes consequent upon a fall. This, of course, does not affect the accuracy of the finished instrument.

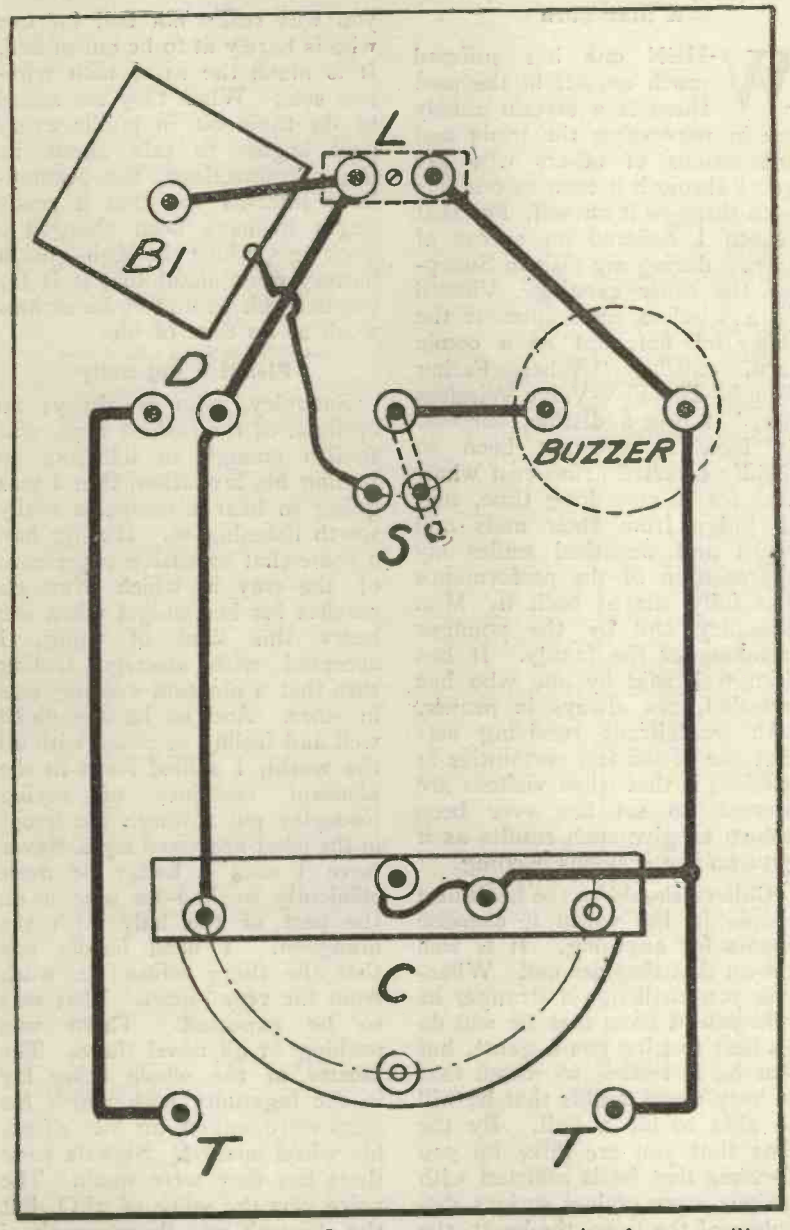


Fig. 5.—Wiring Diagram. S is the small switch or key for controlling the buzzer, and L is the coil socket.

A Star Turn

WHEN one has suffered much oneself in the past there is a certain unholy joy in witnessing the trials and tribulations of others who are going through it even as one has been through it oneself. For that reason I suffered no excess of sorrow during my visit to Snoopley the other evening. Viewed as a wireless entertainment the thing fell flat, but as a comic turn, entitled "When Father Fought The Five-Valve Wireless Set," it was a distinct success. In fact, I have not been so royally diverted at no cost whatever for a very long time, and to judge from their nods and becks and wreathed smiles my appreciation of the performance was fully shared both by Mrs. Snoopley and by the younger members of the family. It has been well said by one who has wrestled, not always in prayer, with recalcitrant receiving sets that one of the few certainties in wireless is that when visitors are present no set has ever been known to give such results as it gave on the previous evening.

Golfers should be the healthiest people in the world if exercise counts for anything. It is well known that they are not. Whenever you challenge a stranger he tells you at once that he will do his best to give you a game, but that he is feeling so rotten that he very much doubts that he will be able to hit a ball. By the time that you are three up you discover that he is afflicted with various more or less serious disorders of the liver, the heart, the nerves and the eyesight. Should he eventually turn the tables, you yourself will feel all kinds of terrible symptoms; and when you reach the club-house you are little more than a physical wreck, whilst he is explaining feebly that his performance in beating you was really not bad for one who is barely fit to be out of bed. It is much the same with wireless sets. When they are asked to do their bit in public every grid begins to talk about its shaky connections, the accumulator informs you that it really ought to have been charged a week ago, whilst the high-tension battery cries aloud that it is far too decrepit to undertake serious work at its time of life.

Fiendish Ingenuity

Snoopley, who is always an optimist of the rashest type, was foolish enough to tell me, on issuing his invitation, that I was going to hear a reception really worth listening to. Having had a somewhat extensive experience of the way in which Nemesis reaches for her cudgel when she hears this kind of thing, I accepted with alacrity, feeling sure that a pleasant evening was in store. And so having dined well and feeling at peace with all the world, I sallied forth in the pleasant certainty of seeing Snoopley put through the hoops in the most approved style. Never have I seen a better or more efficiently worked-out scheme on the part of the lady with the bludgeon. I need hardly say that the thing refused to work from the very outset. That was to be expected. There was nothing at all novel there. The beauty of the whole thing lay in the ingenuity with which his guns were spiked, his lute rifted, his wheel spoked. Signals were there but they were weak. The voice was the voice of 2LO, but the strength was the strength of Aberdeen.

Snoopley merely smiled weakly, saying, "Oh, well, of course, this always happens, but we will soon find out what is wrong." Being a methodical person he carried out every test in the proper way, and in each case the results were all that they should be. Aerial and earth connections were perfect, the batteries were delivering their full voltage, no tired filament leaned for support upon the grid, the loud speaker leads were not broken, he had not forgotten to twiddle the knob which controls its voice. Further investigations with a screw-driver and a pair of pliers disclosed no fault beneath the panels. Every circuit was tested out in turn. There were clicks where clicks should be, and no clicks where there should be no clicks. A knotty problem you will admit.

To the Rescue

At length, utterly defeated, Snoopley flung himself wearily into a chair, announcing that the fault was certainly not in his set but that 2LO must be limping along on about half his proper power. At this point his eldest offspring was heartless enough to tune in by turn GNF, GLD and finally FL. All of them were working on something less than half their wonted strength. Had some terrible catastrophe befallen the world's transmitting stations? Were the havoc-working beams of POZ, which, as is well known, stop anything from motor boats to aeroplanes, directed in malice upon transmitters far and wide? That, anyhow, was Snoopley's firm conviction.

It was at this juncture, whilst Snoopley was meditating retirement to the garden to eat worms, that I put my hand into my coat pocket in search for my tobacco pouch. It encountered something round and hard which I pulled out. You know the way in which you put gadgets of all kinds into your pockets at odd moments. When a suit of mine goes to the cleaners they generally return with it a neat parcel containing an assortment

of 4B.A. nuts, two or three condensers, a gridleak, some condenser knobs, a few lengths of brass studding, an odd terminal and the arm of a selector switch. In this case the object was a milliameter, which had probably been placed there by one of the few good fairies that do battle with the evil spirits which possess the wireless set. I handed it to the broken Snoopley, who pulled himself together and proceeded to use it. He found . . . . . well, I will give you a dozen guesses. Give it up? He found that the emission of the note magnifying valve had fallen right off. It was passing current enough to make all ordinary tests show quite satisfactory results, but not enough to do its job properly. Do you not agree that this was about as neat a blow as even Nemesis could have devised. This kind of thing does happen occasionally to certain types of dull emitter, so that if your signal strength should fall off mysteriously take my tip and clutch the milliameter as drowning men clutch straws.

Be Warned

Have you a boy? If so, let me, as the victim of many trials, give you a word of warning. Keep him away from wireless. Isolate him from the ravages of the germ of radiomania. Keep your wireless books and papers under lock and key. Disguise your set as a copying press or an expanding bookcase. Do not let him know that you have one, and never, never let him hear wireless anywhere. Go through the daily papers before he sees them, and black out any reference to it. Encourage his ears to stick out, so that even should he wish to, he cannot wear head-phones with comfort. Follow these wise counsels and yours will be the peaceful life of a happy English father. Neglect them, and you will be for it even as I have been.

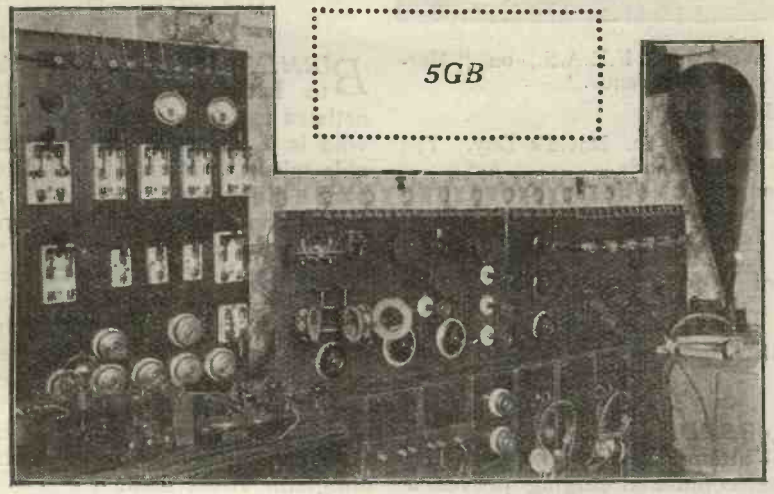
In my goodnatured, but entirely misguided, way I encouraged the young idea to shoot. I presented him with discarded valves and old high-tension batteries. I dug out two questionable L.F. transformers and crystal detector that had seen better days. All these and more I gave the lad. Further, in my folly, I drew him circuits and even their pictorial equivalents. Then he fared forth, joined forces with a fellow conspirator, and proceeded to erect a crystal and two note magnifier set at the latter's house. Nothing much in that you say. Ah! but listen.

The Limit

I do not mind when my bill from the garage contains frequently the item "Chg. acc. 2s. 6d." under dates when my acc. neither required nor received any Chg. I do not mind the disappearance of yards and yards of useless odds and ends of wire that one keeps so carefully in one's workshop. I do not mind a ceaseless flow of questions nor even the sullying of my wireless books with juvenile thumb marks. But what I do bar is being called in, in the capacity of consultant, when the blessed thing will not work.

Last night, in the midst of a snow storm, I was dragged from a comfortable arm-chair to go and doctor it. Imagine yourself confronted by the nightmare medley of loose connections, tangled wires and terminals sprouting haphazard like mushrooms in a field, that two small boys had concocted. Picture yourself faced with this horrid thing and asked to sit down beneath their critical gaze to set it right. You endeavour to trace out a grid lead. It straggles across the table, passes through the legs of a transformer, and is merged in a ghastly tangle of wire, whence it appears to run straight to H.T.+. You discover that it does, by getting a shock which makes your fingers tingle. On glancing under the table you find that they have got six of your old high-tension batteries connected in series. The combined voltage of these, despite their individual decrepitude, is sufficient to produce a certain liveliness in the staidest parent. Finally, you decide to pull the whole thing to pieces and rewire it. You send for your soldering-iron without realising that there is no means of heating it. The only pliers that they have got are of the kind that slip off nuts and pinch your fingers. The screw-driver has a semi-circular edge. The only means of cutting wire is found in two nasty little notches in the pliers which will not cut anything. But once started you must stick to your task or you will know no peace. You, too, I expect, have had some if you have been as unwise as I have. If it is not too late, take warning.

WIRELESS WAYFARER.



5GB

Our photograph shows the station belonging to Mr. Humphries, of Liverpool. The transmitter is seen to the left, the system of transmission being controlled by the switches seen at the foot of the panel. The circuit employed is the "Hartley." The receiver seen to the right consists of 3 H.F. detector and 3 L.F. valves, change-over switches controlling the number of valves in use.

Broadcasting News

LONDON. — The announcement that the Prince of Wales will broadcast on March 16 in connection with the British Empire Exhibition is both interesting and welcome news. The Prince has had several experiences of broadcasting; he was, in fact, one of the first laymen of this country to broadcast before the B.B.C. came into existence, at a function associated with the Boy Scouts.

□ □ □

The recent high-low programme was quite a success; the idea of assembling 20 people who had never been inside a concert hall, with a view to procuring their opinions on the programme submitted, was an ingenious one. The test proved to some extent that there is a demand for classical music of a popular order in which there is a fair proportion of melody.

□ □ □

The announcement regarding the high-power station has caused the biggest flutter in the wireless dovecot that has happened for a long time. It is well to bear in mind, however, that the station will at first be of an experimental character, and should results indicate interference with the Government or existing broadcasting services it will not be proceeded with.

It is anticipated that the station will be at Chelmsford, and use will be made of the apparatus already there. There will be two masts 250 ft. high, the power being 25 kilowatts and the wavelength 1,600 metres.

□ □ □

It is rather surprising that the B.B.C. should make this sudden announcement regarding a high-power station of an experimental character, yet say nothing about the new transmitting station for 2LO. It is now almost a year since they were politely requested to remove further from the Air Ministry, yet there seems no evidence of any such removal.

□ □ □

Forthcoming Events

FEBRUARY.

27th (WED.).—B.B.C. Dramatic Critic. Orchestral Concert.
28th (THURS.). — B.B.C. Music Critic. Mr. Philip Wilson on "Music." The Spencer Dyke String Quartette.
29th (FRI.).—B.B.C. Film Critic. Orchestral Concert. Mr. Reginald Waterfield, F.R.A.S., on "Mercury and Venus."

MARCH.

1st (SAT.).—St. David's Day. The Savoy Bands.
2nd (SUN.).—Organ Recital from the Central Hall of the National Institute for the Blind. The Rev. J. Scott Lidgett, religious address.
3rd (MON.). — B.B.C. Literary Critic. "The Dogs of Devon" and "Foiled Again."
4th (TUES.).—Nautical Programme.

BROADCAST TRANSMISSIONS

	Call-Sign	Wavelength
LONDON	2LO	365 metres
ABERDEEN	2BD	495 ,,
BIRMINGHAM	5IT	475 ,,
BOURNEMOUTH	6BM	385 ,,
CARDIFF	5WA	353 ,,
GLASGOW	5SC	420 ,,
MANCHESTER	2ZY	375 ,,
NEWCASTLE	5NO	400 ,,

TIMES OF WORKING

Weekdays .....3.30 to 4.30 p.m. and 5.0 to 10.30 p.m. G.M.T.

Sundays .....3.0 p.m. to 5.0 p.m. and 8.30 to 10.30 p.m. G.M.T.

□ □ □

ABERDEEN. — The first attempt in Aberdeen to broadcast communal singing proved a great success. A church service was chosen for the experiment and effective transmission provided a rare treat for listeners. Misfortunes with the land line on Sundays has led to the abandoning for the time being of the relaying from 2BD of the usual afternoon programme, and the substitution of a purely local service. This comes into operation on March 2.

A programme which is being looked forward to with keen anticipation is that to be provided by the students of the Aberdeen University on March 1.

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Forthcoming Events

FEBRUARY.

27th (WED.).—French Talk. Dance Night.
28th (THURS.). — Special Vocal Night.
29th (FRI.).—Popular Play Night.

MARCH.

1st (SAT.).—Students' Night. Savoy Bands.
2nd (SUN.).—Orchestral Night. Rev. Findlay Clarke, religious address.
3rd (MON.).—S.B. from London.
4th (TUES.).—Chamber Music.

□ □ □

BIRMINGHAM.—5IT is lucky to have among its regular artistes a young local organist who is a composer of considerable talent. He is Mr. Christopher Edmunds, organist at the Aston Parish Church, and one of the most ambitious of his efforts, "Thorberg's Dragon Ship," a choral ballad, was performed at the station recently. It is a work of marked originality and pronounced dramatic interest, and prior to this rendering had only been performed once before, at the Birmingham Town Hall.

Forthcoming Events

FEBRUARY.

27th (WED.).—Relaying of Concert at Birmingham Royal Society of Artistes, which will be provided by members of the 5IT Orchestra and Repertory Company.
28th (THURS.).—Popular Classics Programme by the Orchestra. Messrs. Robert Pitt and Langton Marks, entertainers.
29th (FRI.).—Programme of Chamber Music by the English Trio.

MARCH.

1st (SAT.).—St. David's Day Programme S.B. from Cardiff.
2nd (SUN.).—"The Creation" (Haydn), by the Orchestra and Repertory Company.
3rd (MON.).—Musical Comedy and Dance Night by the Orchestra.
4th (TUES.).—Grey's Concert Party.

The S.B. of "Cavalleria Rusticana" and "Pagliacci," on Saturday, February 16, was excellent.

□ □ □

Forthcoming Events

FEBRUARY.

27th (WED.).—"Picture" Night from London.
28th (THURS.).—The Crystals Concert Party. Dance Band from King's Hall. Savoy Orchestra S.B. from London.
29th (FRI.).—Gounod Night by the Orchestra.

MARCH.

1st (SAT.).—Welsh Night. The Wireless Orchestra.
2nd (SUN.).—Organ Recital. Address by the Rev. Father Armagh. Reading from Browning's Works.
3rd (MON.).—S.B. from London.
4th (TUES.).—Sir Arthur Sullivan's Night.

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Forthcoming Events

FEBRUARY.

27th (WED.).—Popular Orchestral Night.
28th (THURS.).—S.B. from London.
29th (FRI.).—Choral Night, The Eclipse Prize Singers.

MARCH.

1st (SAT.).—St. David's Day.
2nd (SUN.).—An hour of good music; this evening's performance will be mainly Choral.
3rd (MON.).—S.B. from London.
4th (TUES.).—Shakespeare Night.

□ □

An engineer of the B.B.C. fitting the microphone in the clock case of Big Ben, for the transmission of time signals.

BOURNEMOUTH.—The past week has been particularly trying to many listeners in the Bournemouth area, particularly in the neighbourhood of the Bournemouth Station itself. The interference caused either by ignorance or intent became so abnormal that a request was made through 6BM asking that the offenders would be a little more sportsmanlike.

□ □ □

A happy feature of the past week's concerts was the "Night of Memories." These concerts appeal most strongly to the more elderly folk, the hearing of such old favourites as "Alice, Where Art Thou," "Sally in our Alley," "Robin Adair," etc., recalls for them many pleasant memories.

CARDIFF.—February 13 was the anniversary of the Cardiff Station, and the transmissions on that evening, in keeping with the event, might almost be described as a "birthday affair." The Directors and Staff sought to revive old memories and create new ones. During the evening Mr. J. C. W. Reith, Managing Director of the B.B.C., gave an address, during which he stated that the reason they had decided to curtail simultaneous broadcasting was in order to experiment in this direction with a view to perfecting transmission. There would, however, still be operas, speeches of interest and other items S.B. to Cardiff and other stations.

□ □ □

GLASGOW.—The first birthday of 5SC will be celebrated on March 6 with a special programme, an excellent list of artistes having been secured for the occasion. The programme will be supported by Miss Beatrice Miranda, the operatic star; Mr. Robert Watson, baritone; Mr. Philip Halstead, pianist; and Miss Bessie Spence, violinist. The Wireless Orchestra will also be raised to full symphony strength for the occasion. A special sketch, written by Mr. George Woden, will be produced, and a march "5SC's Birthday," by Pipe-Major Ferguson, of Glasgow Pipe Band, will be played for the first time.

Forthcoming Events

FEBRUARY.

27th (WED.).—Orchestral Programme
28th (THURS.).—Orchestral Concert.
29th (FRI.).—Orchestral Night.

MARCH.

1st (SAT.).—Popular Orchestral Night.
2nd (SUN.).—Band of the 6th Battalion Highland Light Infantry. The Rev. W. H. Wiggett, religious address.
3rd (MON.).—S.B. from London.
4th (TUES.).—Nautical Programme.

□ □ □

MANCHESTER. — For the first time in this country the staff of a broadcasting station has appeared in public. The 2ZY Orchestra and 2ZY Opera Company gave a delightful concert in the Free Trade Hall, Manchester, on the 15th instant, and this was relayed from the Manchester broadcasting station. The orchestra came through very well, as did the soloists, but there was some blasting when the full choir and orchestra were performing together. We were particularly pleased with the organ music, and have heard none better since the Steinway Hall transmissions.

□ □ □

Forthcoming Events

FEBRUARY.

27th (WED.).—2ZY Orchestra. Miss Olive Mackay, contralto. The Sirfessor.
28th (THURS.).—2ZY Dramatic Company and 2ZY Trio.
29th (FRI.).—Vocal Night.

MARCH.

1st (SAT.).—Classical Orchestra Night.
2nd (SUN.).—The Rev. Principal Moulton, religious address.
3rd (MON.).—S.B. from London.
4th (TUES.).—International Dance Programme.

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NEWCASTLE.—An event for which the music-loving Tyneside listeners have long been hoping has taken place this week with the appearance of Mr. Edgar Bainton in the Newcastle programme. Mr. Bainton, one of the musical leading lights of the North of England, is Principal of the Newcastle Conservatoire of Music and Conductor of the Philharmonic Orchestra. His pianoforte solos and duets with Mr. Carl Fuchs, the brilliant cellist, were highly appreciated, and we hope the Directorate will frequently secure their services.

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Forthcoming Events

FEBRUARY.

27th (WED.).—Miss A. Armstrong, pianist. Mr. H. Wilson, baritone. Mr. S. Barraclough, cornet soloist. Orchestra. Mr. R. Strangeways, baritone. Miss M. Jobson, contralto. Mr. R. Gourley (London), entertainer. Miss E. King, soprano.
28th (THURS.). — Mr. Lambert Flack's quartette.
29th (FRI.).—Mr. Walter Barry's Trio. Orchestra. Mr. S. Hempsell, tenor. Miss M. Osborne, mezzo-soprano. Miss Rosina Wall, violin.

MARCH.

1st (SAT.).—Mr. H. K. Cutchie, piano. Misses L. Brook and M. Clark, duets. Mr. F. Wild, baritone. Orchestra. Miss E. M. Stanley, mezzo-soprano. Mr. F. Charlton, entertainer. Mr. T. Clough, Northumbrian Pipes. Walker's Band relayed from the Assembly Rooms.
2nd (SUN.).—Mr. W. A. Crosse's Military Band. Mr. G. Bainbridge, baritone. Mme. P. Howe, soprano. Bijou Orchestra. Mr. A. T. Nockles, tenor. Rev. Father G. C. Jefferys, religious address.
3rd (MON.).—Miss G. Willis, piano. Mr. T. E. Simpson, bass. Miss Rita Robinson, violin.
4th (TUES.).—Mansfield's Waverley Orchestra. Miss E. Sheard, contralto. Mr. G. Weallans, violin. Messrs. R. Pitt and L. Marks, entertainers. Newcastle Players Repertory Theatre Company in "Elegant Edward."

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Simultaneous Broadcasting Events

FEBRUARY.

27th (WED.).—B.B.C. Dramatic Critic.
28th (THURS.).—B.B.C. Musical Critic. Radio Society of Great Britain. Savoy Band.
29th (FRI.).—B.B.C. Film Critic.

MARCH.

1st (SAT.).—Savoy Bands.
2nd (SUN.).—Time Signal and General News Bulletin.
3rd (MON.).—Talk by Radio Society of Great Britain. B.B.C. Literary Critic.
4th (TUES.).—Time Signal and General News Bulletin.

Loud Speakers for Wireless Purposes

Below is given the discussion following a series of interesting papers recently delivered before the Institute of Electrical Engineers. Short summaries of these papers appeared in Vol. 3, Nos. 1 and 3.

IN opening the meeting the chairman stated that the interest shown at the previous meeting fully justified the continuation of the discussion, and he had much pleasure in calling upon Sir Richard Paget to open the proceedings.

Sir Richard Paget

Audibility is a matter of precision rather than of amplitude, and faithful reproduction is far more important than amplitude, from the point of view of intelligibility.

What is actually given by the loud-speaker must be true, but *constant* untrue sounds do not matter, since the ear becomes accustomed to them, as in the case of the scratch of a gramophone needle.

With sounds corresponding to the resonances of the horn, this latter accentuates these, and distortion occurs.

Mr. Sandeman's first arrangement is limited only to sibilants and explosives, but the curves would indicate the greater importance of the frequency of the upper and lower limits. With regard to the amplitude of the explosives, the difference is only one of relative amplitude; therefore the reproducer must be faithful to rapid changes of amplitude.

Turning to audibility, which we may synonymously term faithfulness, the system must be sensitive to the frequencies 2,580 to 6,500, but also to those between 200-2,500. If this sensitivity is obtained, amplitude may be reduced without loss of audibility.

Mr. Cohen

Some members will no doubt remember Sir Oliver Lodge's demonstration several years ago. His loud-speaker gave very good results, and consisted of a wooden vibrating plate, to the centre of which a coil, moving in an annular magnetic field, is attached.

Our fundamental problem, to my mind, is this: we require a perfect loud-speaker, and that is one in which the ratio of acoustic input to acoustic output is unity at all frequencies, amplitudes, and combinations of both.

The resistance amplifier gives fairly constant output, and telephone lines can be loaded to give accurate reproduction of the acoustic input. Loud-speakers perform their function by virtue of their resonance, and we find that where manufacturers deliberately fit a loud-speaker to an amplifier, very good results are obtained. It follows that the amplifier must have a uniform frequency-amplitude characteristic, and the input must be constant at all acoustic frequencies.

My apparatus consists of an oscillator giving the whole range of audio-frequencies by the rotation, through 180°, of a small air condenser.

The high-frequency components (27,000) are enclosed in iron boxes; the oscillations are amplified, combined, passed to a detector valve, and thence to a two-stage audio-frequency amplifier, with plenty of iron in the transformers. This amplifier could have been marked B.B.C.

The output of the oscillator was then shown to be constant over the whole range of frequencies, but when connected up to the two-stage amplifier, the output varied considerably.

The loud-speaker was now connected to the amplifier, and resonance points were shown. Replacing the amplifier by a resistance amplifier, an improvement in quality was obtained.

Mr. G. H. Nash

I am here representing the practical side of the argument. The question is, shall we use a horn or not? Prof. Rankine said: "Get rid of the horn if possible." And Capt. Eckersley produced one without a horn.

I contend that the horn is not solely to blame for distortion. The large diaphragm is inefficient, on account of mechanical resonance, and accentuates the lower frequencies unduly.

If the receiver is of low efficiency, more valves must be added, to give the loud-speaker the required input; thus the grid and anode volts must be increased, with a loss in truth of reproduction.

The horn has its resonances, but they can be made so small that the ear fails to detect them, and under these conditions let us not sacrifice the horn with its great power of amplification.

An Experimenter's Unit Receiver

By H. BRAMFORD.

The following article is the fourth of a short series which began in Vol. 3—No. 9, dealing with the construction of a progressive unit receiving set. This collection of units should prove of considerable utility to the home constructor and experimenter.

Unit 3

THIS unit is intended for connecting one or more pairs of telephones to the receiver, and is seen in the photograph Fig. 16, which shows the front of the panel. The materials necessary for its construction are merely one piece of ebonite measuring 6 in. by 4 in. by ¼ in., one fixed condenser of 0.002 μF. capacity and eight terminals.

The drilling of the panel should be carried out in accordance with the dimensions shown in Fig. 17, all the holes being terminal clearance.

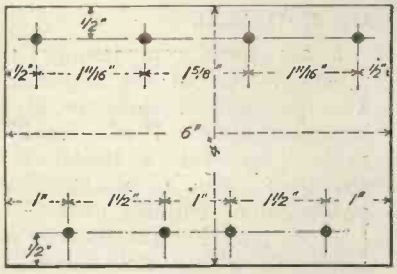


Fig. 17—Drilling dimensions.

Four of the terminals are mounted on the panel in the positions indicated by T_1, T_2, T_3, T_4 in the Fig. 18, whilst the remaining four terminals are mounted as shown at T_5, T_6, T_7, T_8. The wiring up of the unit is executed by connecting T_1 to T_5 and T_2, T_3 being connected to T_4 and T_8. Connection is also made between T_6 and T_7. A fixed condenser of 0.002 μF. capacity is connected between terminals T_2 and T_3. This arrangement permits the use of two pairs of telephones if desired, the connections being made as shown in the figure. In the case of one pair of telephones, these are connected at T_5 and T_8.

Operation

At this point we are in a position to operate the first three units, and a suitable circuit is that shown in Fig. 19. Our choice of circuits is, of course, as yet limited, but the addition of one or two further units will make for a selection of other arrangements.

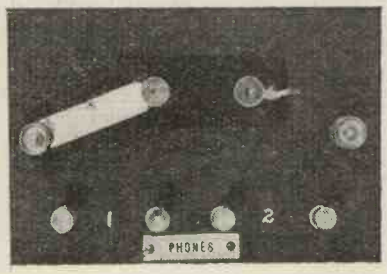


Fig. 16—Top of panel view of Unit No. 3.

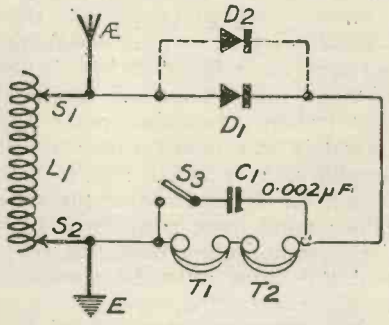


Fig. 19—A suitable circuit arrangement, using the first three units.

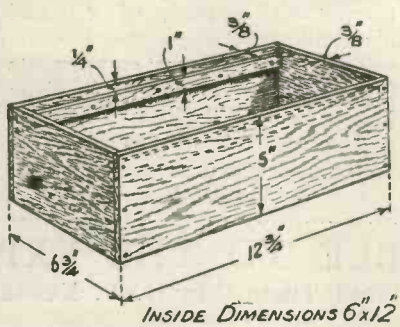


Fig. 20—Details of the containing box.

We have at present an efficient short range crystal receiver, to which a low-frequency amplifying unit will be added in due course. The circuit indicated in Fig. 19 shows by means of dotted lines a simple method of experimenting with either of the detectors, that is to say, the cat-whisker or perikon type, which were described in our last issue. The unwanted detector is thrown out of circuit by disconnecting the cat-whisker from the crystal, or, in the case of the perikon detector, breaking the contact between the two crystals.

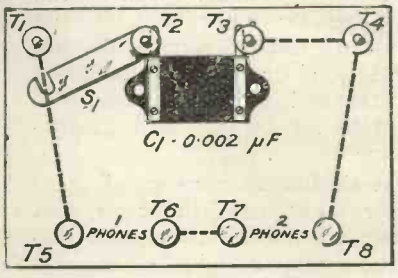


Fig. 18—The connections.

Containing Boxes

Constructional details of the first containing box are indicated in Fig. 20, and a very suitable wood for the purpose of their construction is dry mahogany finished with a plain wax polish. In all there will be four of these boxes required, all of them being of exactly similar dimensions, and each one being required to hold three separate units.

"A Sharp Tuning Crystal Set."

In last week's issue, under the above title, a variable condenser should have been shown across the fifty-turn coil in Fig. 3. This condenser is indicated in the practical wiring diagram.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor

Short-wave calibration—Variable condensers of guaranteed capacity

EXPERIMENTERS in short wave reception have found the calibration signals of the Radio Society of Great Britain of considerable use. The other evening I calibrated my short wave heterodyne (described in a recent issue of *Wireless Weekly*) with the aid of signals from 6XX. Below is a reproduction of the calibration curve. As indicated in my article, the "curve" is a straight line, and I was glad to find that the three calibration waves (191 metres, 153 metres and 121 metres respectively) fell exactly on the line. Any readers who have made up, or are likely to make up, this heterodyne can take this curve as a closely approximate calibration for their own instruments if they will only follow the wiring exactly and use the same condenser (the Sterling square-law pattern). The following are the calibration points for those who wish to draw their own curves :—

191 metres equals 123 degrees.
153 ,, ,, 93 ,,
121 ,, ,, 68 ,,

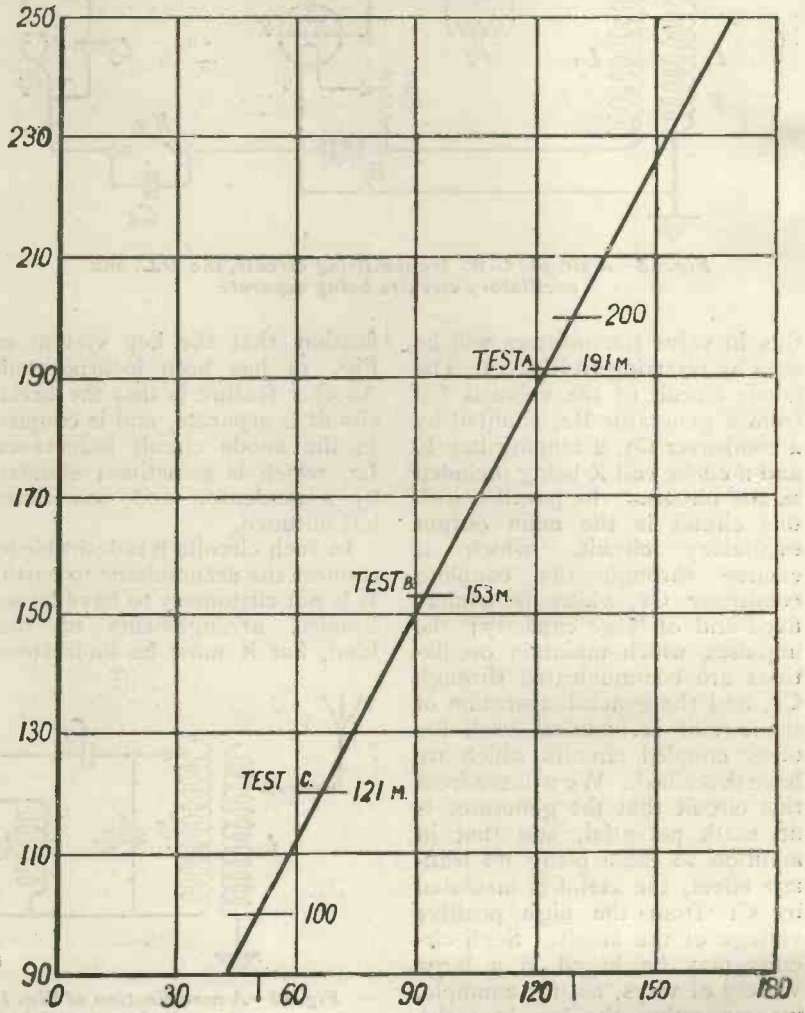
If the straight line is extended it will run at one end to about 264 metres and at zero would cut the wavelength scale at 30 metres, but owing to the fact that the condenser has a certain minimum capacity and as, furthermore, the small distributed capacities have an important effect on very short waves, I should not say the calibration could be relied upon below about 70 metres.

The scale is a fairly open one, there being 1.29 metres per degree or .78 degrees per metre approximately. The same design can be used for making a wavemeter to cover the broadcast band, in which case the inductance should have about 60 turns on the grid coil and the same number on the plate coil (using the same sized former). Finer wire could be used so as to economise space so that the finished instrument could have approximately the same dimensions.

□ □ □

I am glad to see that there are several additions to the number of firms who are prepared to guarantee the capacity of their variable condensers. This is as it should be. If you buy a pound of tea you expect to get 16 ounces, and if you want a capacity of 0.0005 μF there is no reason you should be jobbed off with 0.0003. If readers will only insist on accurate capacity ratings in their variable condensers and patronise those firms which will guarantee their condensers, it will be all the better for everyone.

I am moving into a south-west district reputed to be a hotbed of oscillators and unauthorised transmitters. However, these gentlemen (or otherwise) are hereby solemnly warned. Mr. G. P. Kendall is also moving into the same district, having acquired a house about half a mile from mine. We both have directional apparatus. *Verb Sap.*



Calibration curve of the "Wireless Weekly" short-wave heterodyne

C.W. and Telephony Transmission Using Valves

No. VII.

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

This series of articles began in Vol. 3, No. 6, with a consideration of the theoretical principles underlying valve transmission

Separation of D.C. and Oscillatory Circuits in Valve Transmitters

WE have seen how the direct anode current circuit may be separated from the oscillatory circuit, and the great advantages of doing this in valve transmitters will be seen by referring to Fig. 13. The anode circuit of the valve is fed from a generator B_2, shunted by a condenser C_3, a tapping key K and a choke coil Z being included in the circuit. In parallel with this circuit is the main output oscillatory circuit, which is excited through the coupling condenser C_1, which is usually fixed and of large capacity; the impulses which maintain oscillations are communicated through C_1, and the general operation of the circuit is identical with the other coupled circuits which we have described. We will see from this circuit that the generator is at earth potential, and that in addition to there being no leakage effect, the aerial is insulated by C_1 from the high positive voltage of the anode. Such circuits may be keyed in a large variety of ways, as, for example, by connecting the key in series with the gridleak which, incidentally, may in all valve transmitters be connected directly across grid and filament.

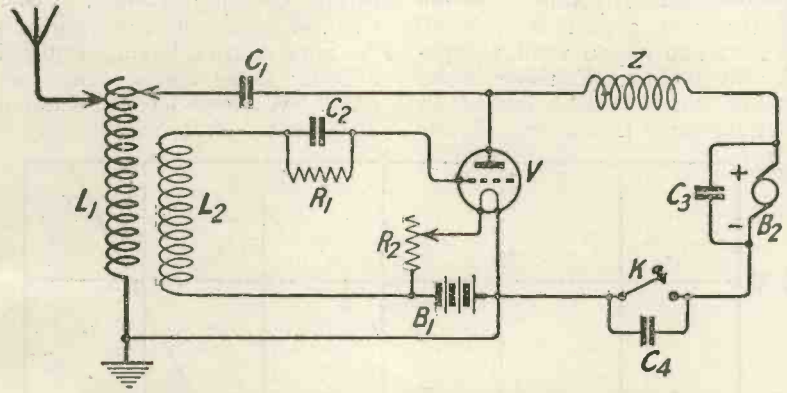


Fig. 13—A simple C.W. transmitting circuit, the D.C. and oscillatory circuits being separate

Fig. 14 shows a circuit of the general kind described in connection with Fig. 13, with the modification that the key system of Fig. 12 has been incorporated. Another feature is that the aerial circuit is separate, and is coupled to the anode circuit inductance L_2, which is sometimes shunted by a condenser and sometimes left untuned.

In such circuits it is desirable to connect the accumulator to earth. It is not customary to have loose-coupled arrangements of this kind, but it must be understood that all valve transmitters may be modified in this way, and also, incidentally, may employ a tuned or aperiodic grid circuit as may be found most suitable.

Single Circuit Valve Transmitters

We now come to a type of circuit which is very useful for low power work. A single oscillatory circuit is employed, and is so arranged that the inductance is connected across anode and grid while the filament is connected to a point between the ends of the inductance or between two condensers which shunt the inductance, and which are in series with each other.

Fig. 15 illustrates a simple transmitter of the kind described. A leaky grid condenser is used, partly to give the grid a negative potential, but chiefly to prevent the grid being given a high positive potential due to the particular position of the high-tension battery B_2. The arrangement shown has the disadvantage that the anode battery B_2, and the filament accumulator B_1, are both at a high-frequency potential to earth since they are connected to the point M on the inductance L_1. We can avoid this disadvantage to a certain extent by connecting the anode battery so that its

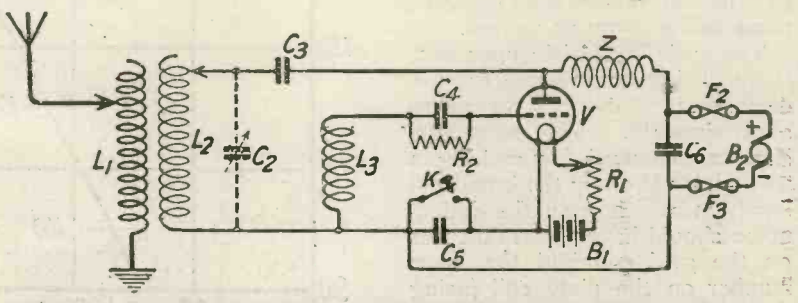


Fig. 14—A modification of Fig. 13, introducing protective devices and the keying methods illustrated in Fig. 12

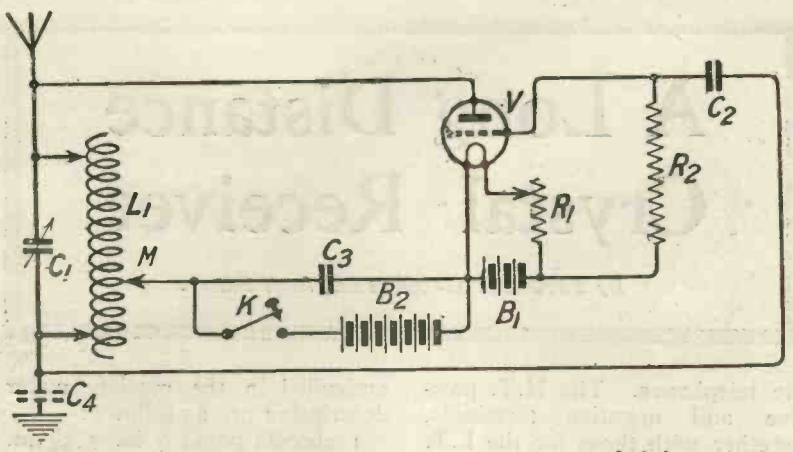


Fig. 15—A single-valve circuit for low-power work. The batteries B1 and B2 are however both at H.F. potential to earth

negative or positive terminal is connected directly to earth.

Fig. 16 shows an arrangement in which the negative side of the high-tension supply is connected directly to earth. It will be seen that it makes little difference how we connect the grid and anode, provided these two electrodes are situated across the inductance. The filament battery will have to remain in a position where it will be at a high-frequency potential to earth, but we can lessen one of the disadvantages of this by carefully insulating it. For example, the accumulator itself may stand upon a porcelain dish, or a piece of plate glass or sheet ebonite.

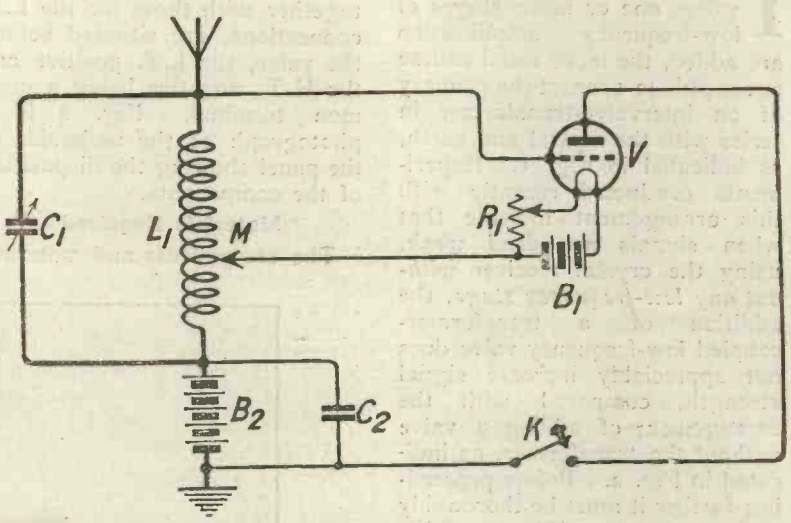
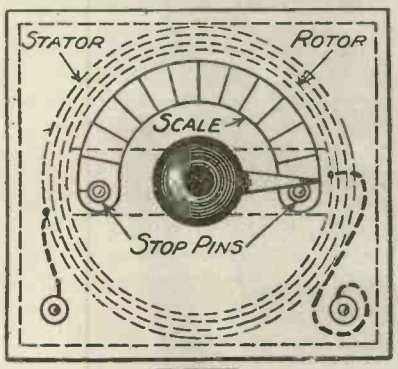


Fig. 16—A circuit which may be recommended. For the best results the accumulator should be well insulated

Cheap Variable Condensers



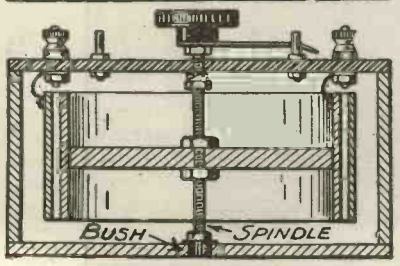


Fig. 1—Details of the finished condenser.

THE items required for the construction of this condenser are two cardboard formers, one having an internal diameter of say, 3 in., and the other having an external diameter of just under 3 in., some copper foil and mica, a piece of 2B.A. rod, and an ebonite knob, scale, and pointer. Cut both the formers to an equal length, which may be as desired, according to the capacity required. On the inside of the larger former lay one strip of copper foil and then one of mica; these should cover half the circumference, the mica overlapping the foil at each end. The strip may be fixed by pinning and glueing. Next fix a strip of copper foil round half the external diameter of the smaller former. A piece of wood is now fixed across the internal diameter of the inner former, as shown in Fig. 2. A piece of 2B.A. rod is passed through a hole previously drilled in the centre of this piece of wood and tightened up by means of a nut each side. The 2B.A. rod acts as a rotating spindle. The bearings for this spindle are provided by making a box which also encloses the condenser itself.

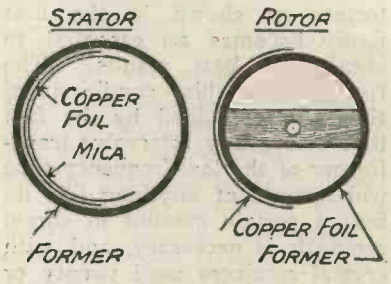


Fig. 2—The arrangement of the copper foils.

The spindle is then fitted with a 2B.A. bushed ebonite knob and pointer, and a scale of degrees is fixed to the top of the box.

H. B.

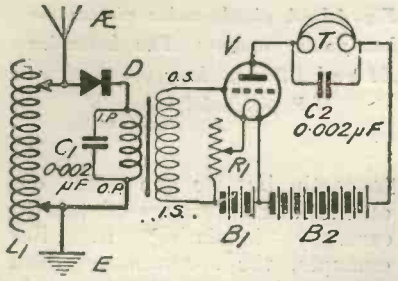


Fig. 1—Circuit showing usual method of adding a low-frequency valve, using a transformer.

A Long Distance Crystal Receiver

By STANLEY G. RATTEE, Staff Editor.

IN the case of crystal receivers where one or more stages of low-frequency amplification are added, the more usual course to adopt is to connect the primary of an intervalve-transformer in series with the crystal and earth, as indicated in Fig. 1. Experiments conducted recently with this arrangement indicate that when signals are *dead weak*, using the crystal receiver *without any low-frequency stage*, the addition of a transformer-coupled low-frequency valve does not appreciably increase signal strength, compared with the arrangement of adding a valve *without* the transformer, as indicated in Fig. 2. Before proceeding further it must be thoroughly understood that this condition only holds good so long as the signals, when using the crystal receiver alone, are dead weak. In the case of adding a low-frequency valve to a crystal set upon which loud signals can already be comfortably received, then the inclusion of the transformer as shown in the first figure becomes an essential to obtain the best results. The reason for this condition of things is explained by the fact that before any intervalve transformer of the low-frequency type will operate at anything like its best a certain amount of signal strength is necessary, and with crystal receivers used twenty or more miles away from a broadcasting station such a strength is not in many instances obtainable.

General Considerations

The photograph Fig. 3 shows the complete receiver, the form of tuning adopted being a simple tapped cylindrical inductance. The two terminals seen to the left of the photograph are for the aerial and earth connections, whilst those on the right are for the telephones. The H.T. positive and negative terminals, together with those for the L.T. connections, are situated behind the valve, the L.T. positive and the H.T. negative being a common terminal. Fig. 4 is a photograph of the underside of the panel showing the disposition of the components.

Materials Required

The components and materials embodied in the receiver under description are as follows:—

1 ebonite panel 9 in. × 5¾ in. × ¼ in.

17 contact studs.

4 stop pins.

1 cardboard former, 4 in. × 4 in.

½ lb. No. 20 S.W.G. d.c.c. wire.

2 laminated switch-arms with knobs.

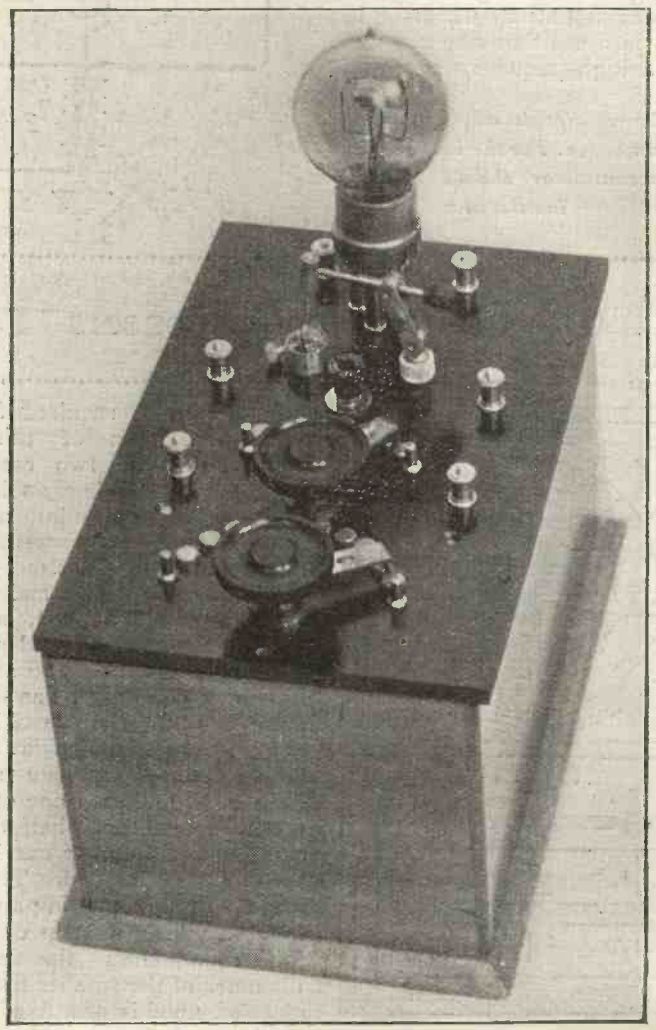


Fig. 3—The finished receiver.

To those readers who live almost out of the range of crystal receivers for broadcast reception, the points enumerated in the following article will prove both of interest and practical assistance.

1 valve holder or 4 valve legs.
1 Lissenstat Minor.
1 Refty crystal cup.
1 catwhisker detector standard.
7 terminals.
2 fixed condensers of 0.002 μF capacity.
Quantity of No. 20 tinned copper wire for connecting purposes and insulating sleeving.
1 containing box to fit panel and 4½ in. deep. That shown in the photograph Fig. 1 was supplied by the Bowyer-Lowe Co., Ltd.

The Inductance

The aerial tuning inductance consists of sixty-nine turns of No. 20 S.W.G. d.c.c. wire wound upon the 4-in × 4-in. cardboard former, the first nine turns being tapped at every turn, the remaining sixty being tapped at every tenth turn.

To commence the winding bore two small holes about ¼ in. along the former and thread the wire through, leaving about six or so inches free for making connection to the desired stud. The tappings are made by making a 6-in. loop of the wire after the required number of turns have been wound, and twisting sufficiently tight to prevent unravelling. The finish of the winding is secured in the same way as is the beginning by threading the wire through two small holes, again taking care to leave sufficient free wire for connecting purposes.

The Panel

The dimensions for panel drilling are given in Fig. 5, and after all drill holes have been made the panel should be treated to a very thorough rubbing with smooth emery paper in order to remove any conductive matter there may be adhering to the glossy surface.

The Circuit

The circuit used in the receiver is that shown in Fig. 2, wherein

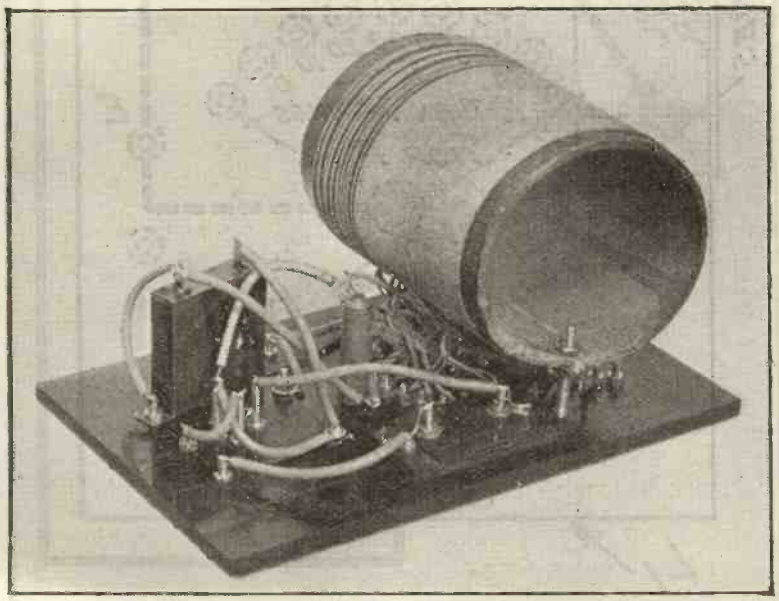


Fig. 4—The underside of the panel.

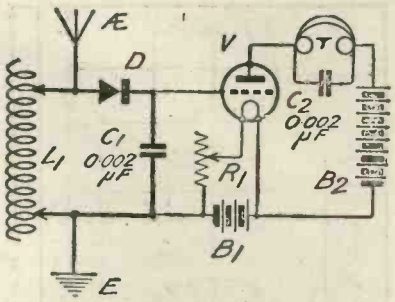


Fig. 2—Low-frequency valve added to a crystal receiver without the use of a transformer.

L_1 is the aerial tuning inductance, D the detector, C_1 a fixed condenser 0.002 μF capacity, V the valve, R_1 the filament resistance, B_1 the filament battery, B_2 the H.T. battery, T the telephones, and C_2 a fixed condenser of 0.002 μF value.

Connecting the Inductance

At this point secure into position upon the panel the seventeen contact studs, the four stop pins and two switch arms. Before fixing the former upon the panel, however, make all soldered connections to the studs so that the maximum amount of freedom may be enjoyed, the length of the tappings affording easy access.

The beginning of the winding is connected to the first stud of the ten intended for the single turn tappings, that is, the first stud seen on the bottom left of Fig. 3 and numbered 0 in the wiring diagram Fig. 6. The first single turn tapping is connected to the second stud of the same series, the second tapping to the third stud, and so on until the ninth tapping is connected to the tenth stud. The continuation of the winding is connected in a like fashion, the only difference being that there are ten turns between taps instead of one and connections are made to the seven studs situated above those previously referred to, viz. :— The tapping following the ninth tapping is connected to the first of the seven studs, numbered 0 in Fig. 6, the first ten-turn tapping is connected to the second stud, and so on until the end of the coil is connected to the seventh stud.

Wiring Up

The disposition of the various components may be gathered from the photograph, Fig. 4,

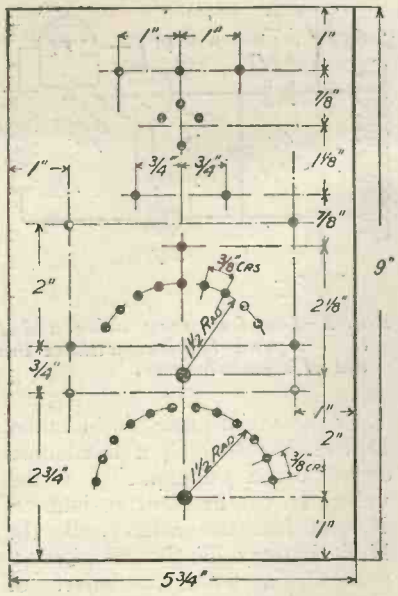


Fig. 5—Drilling layout of the panel.

and also from the wiring diagram, Fig. 6. The actual connections are made in conformity with this latter figure and should be soldered.

The switch S_2, controlling the single turn tappings is connected to the aerial terminal, whilst the switch S_1 controlling the larger end of the inductance is connected to the earth terminal. The reason for this arrangement is in order that no unduly large number of unwanted turns may be on the aerial end of the inductance.

Operating the Receiver

The tuning of this receiver is accomplished by adjusting the two switch arms until the proper number of turns of the inductance form part of the aerial circuit, the number of turns required being dependent upon the wavelength used by the station it is desired to receive. The switch controlling the larger tappings should be first placed on the second stud, whilst the single-turn switch should be on the first stud. With the switches in this position the number of turns in circuit is ten, and subject to no signals being heard with the switches so placed, the single turns should be added one by one.

In the event of nineteen turns being reached and there still being no audible signals, then the single-turn switch should be turned back to the first stud whilst the ten-turn switch is advanced to the third stud, thus putting twenty turns in the circuit. If signals are still inaudible, advance the single-turn switch as before, following, if necessary, with a further advancement of the other switch until the desired number of turns have been found. In this manner the whole range of the coil may be covered in single turns, commencing with ten turns and completing with sixty-nine.

Since this receiver is fitted with the Lissenstat Minor, for the control of filament current, the advantages afforded by the use of dull emitter valves may be enjoyed with safety and without the loss of efficiency.

With the use of such valves and consequent low current consumption, a receiver of this type, though increasing the received signal strength, calls for little more attention than does a crystal set of ordinary design.

Results

The receiver as illustrated and described has been used with very considerable success eight miles S.E. of London for the reception of 2LO, the only aerial employed being a length of flexible wire, some eight yards long, laid across the floor of the room. Signal strength was good and perfectly clear.

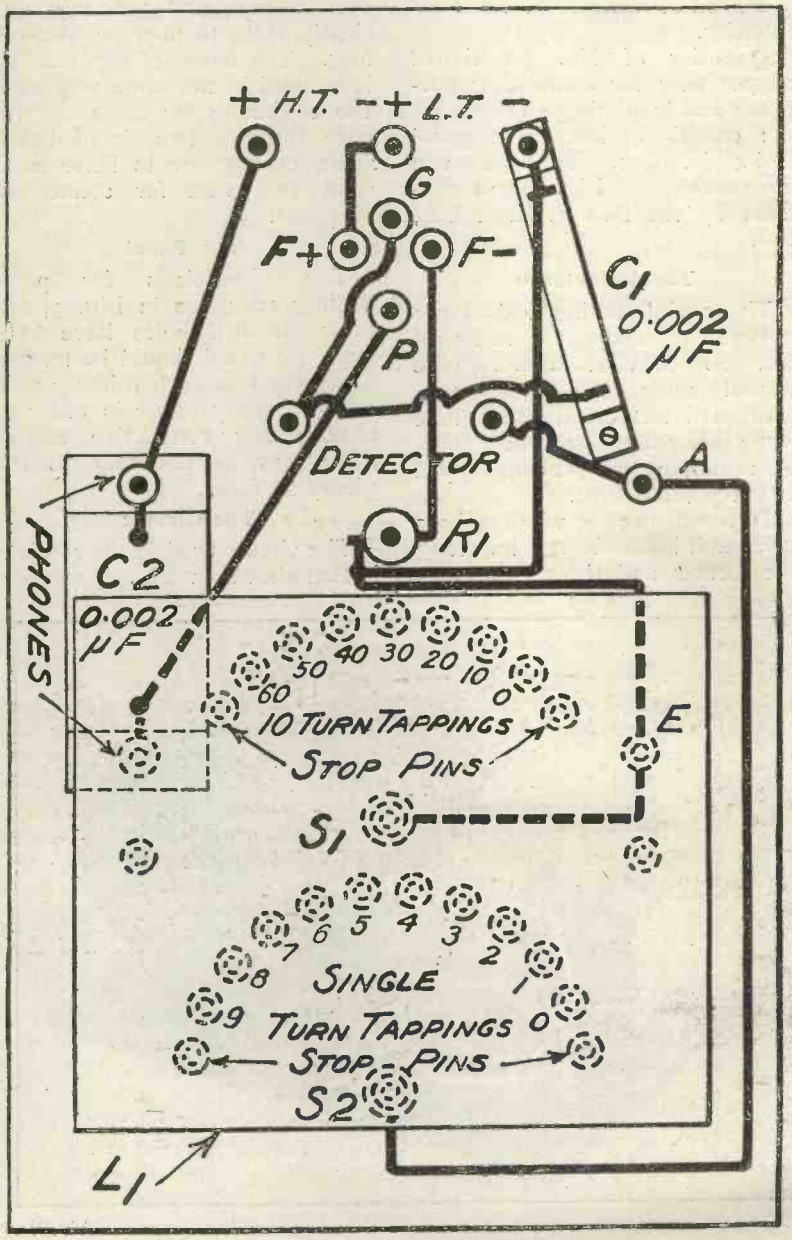


Fig. 6—The wiring diagram.

A Handy Instrument Board

IT is very convenient to have one's measuring instruments mounted upon a panel of their own, for if they are left lying about on the wireless bench they are apt to be damaged from either being knocked down or through having heavy things inadvertently placed upon them. Another point is that if the instruments are so fixed up that one can put one's hand upon them in a moment, there is never that exasperating search that so often occurs for a milliameter or a voltmeter which has managed to conceal itself so that it defies all efforts at finding it.

The instrument board may consist of a panel of ¼-in. ebonite 6 in. wide and 11 in. deep, mounted upon a hard wood box about 2 in. in depth. The wiring diagram is shown in Fig. 1. It will be seen that the board is intended primarily to be kept wired normally in series between the batteries and the set. Arranged in this way, it is a most useful aid not only to fault finding, but also to a great extent to tuning. Both the milliameter and the ammeter are in series with the positive leads and their respective batteries. One can thus read at a glance the total load that is being put upon the high-tension battery and accumulator when the set is in use with any particular combination of valves. The voltmeter is provided with a switch, details of which are given in Fig. 2, of the push-button type. It should be noted that the voltmeter test for accumulators is of absolutely no value unless the cells are under load, for even an almost run down one may show nearly its full voltage if it has been resting on open circuit for some time and is then tried with little or no load. With an instrument board of the type under description one always obtains the voltage reading with the battery under its full normal output.

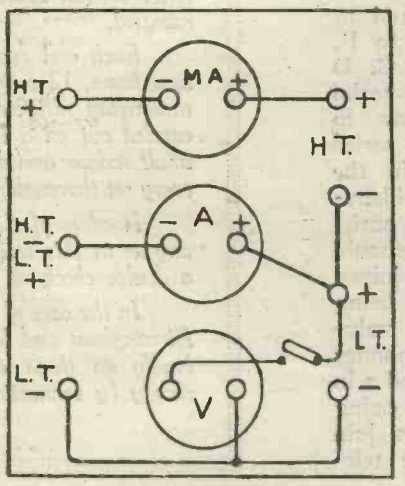


Fig. 1—The connections.

For tuning and fault finding purposes the milliameter is invaluable. A reading should be taken when the set is performing at its best at a given plate voltage. Any variation in the steady plate current on subsequent occasions will indicate that something is wrong and will aid the experimenter to track it down. When one is tuning the oncoming of oscillation will be indicated by a slight drop in the anode current, and as soon as the oscillation point is reached the pointer of the milliameter will make a distinct dip. With the help of the milliameter one can find the best ratio of coupling between primary and secondary of the tuner quite easily. If two or more stages of note magnification are in use signals can actually be read by watching the pointer, and the extent of its dips gives a very useful rough and ready indication of the strength of any particular signal.

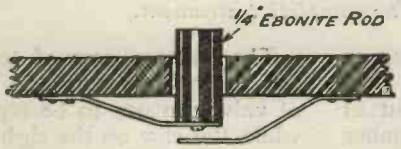


Fig. 2—Details of the voltmeter switch.

Fig. 3 shows the drilling layout of the panel. This will be suitable for many types of measuring instruments, but the dimensions given may have to be varied slightly in order to fit particular kinds of voltmeter, ammeter or milliameter. On the right side of the panel are four terminals for H.T.+, H.T.–, L.T.+ and L.T.–. On the left are three only, a common terminal serving H.T.– and L.T.+. The holes for these terminals are all 4B.A. clearance.

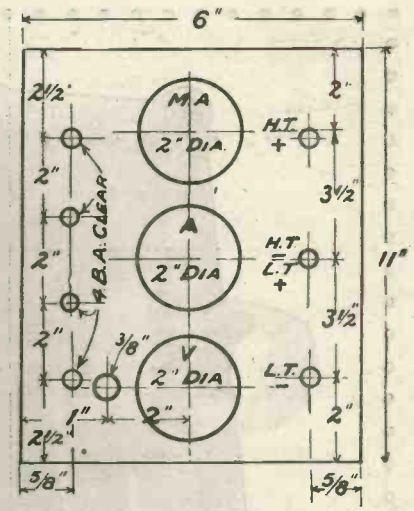


Fig. 3—Panel drilling layout.

The instruments used should preferably be of the flush type. These barely project above the surface of the panel, and for that reason they are well protected from injury. When mounting them it is necessary to make holes 2 in. or more in diameter in the ebonite in order to take the cases. These can be cut out quite easily with a fretsaw or a jeweller's hacksaw, the edges afterwards being trimmed up with a fine half-round file. If, however, the constructor does not care about the task of making these large holes he can make use of instruments of the panel-mounting type which require holes to be made for their terminals only.

(*Concluded on page* 394.)

In connection with the advertisement of Messrs. Reys Ltd., appearing in our Jan. 23rd issue, we understand that the address of this firm is 173, Gt. Portland St., and not 174 as shown.

How to Mak
Panel R

Type

By HERBERT

A description of a compact t
excelle

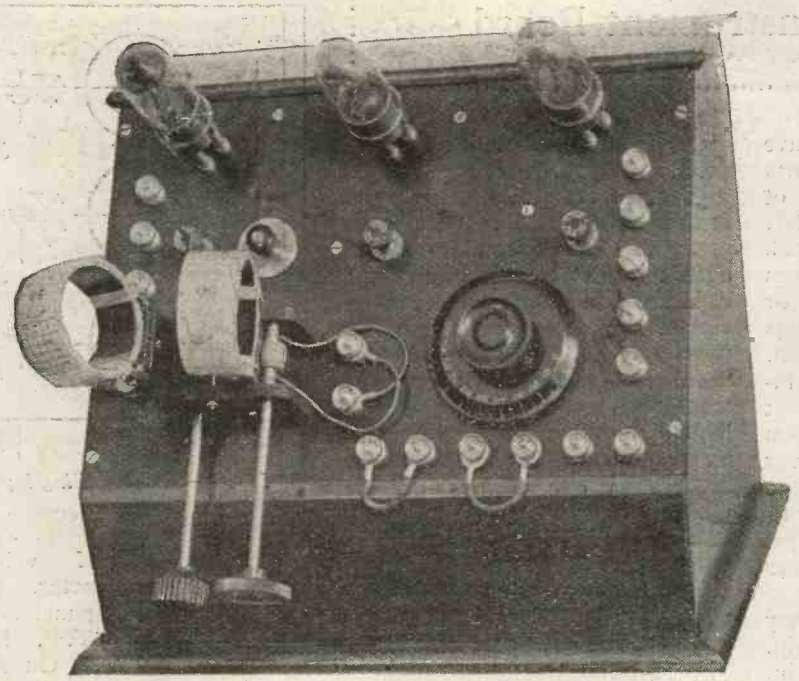


Fig. 1.—The complete instrument.

MANY amateurs favour a set in which valves may be switched in or out of circuit, thus enabling the number of valves in use to be regulated easily, according to the strength of the received signal. The present set is suitable for the reception of spark, continuous wave, or telephony signals, and one, two, or three valves may be used at a time, while reaction is possible in each case. The finished set is seen in the photograph Fig. 1, and may be used either as a single-valve set alone, or as a valve detector, with one or two stages of note magnification.

Again, the set may be used with a frame aerial, while the constant aerial tuning system may be applied, if desired, to an ordinary aerial. The terminals which facilitate this are seen on the left of the panel in Figs. 1 and 2.

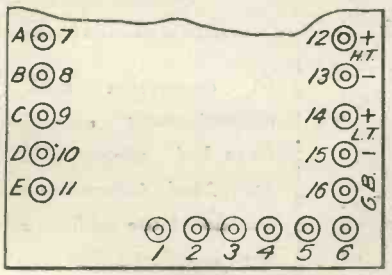


Fig. 3.—Terminal arrangements.

The bottom row of terminals are those permitting the number of valves in use to be regulated, while the row on the right of the panel are for high- and low-tension batteries, and grid bias battery, if one is used. If not, the terminal G.B.- must be joined to L.T.−. A diagram of the terminal arrangements is given in Fig. 3.

The circuit diagram is shown in Fig. 4 from which the connections for the various circuits may be followed. For constant aerial tuning, the aerial is connected to terminal A, leaving terminal B free, while C, D and E are joined together. If this method of aerial tuning is not required at any time, join the aerial to B, leaving A free, and join C, D and E as before. The aerial tuning condenser is now in parallel with the coil. If a series condenser is required, join the aerial to D, join C to E, and leave A and B free. If a frame aerial is to be used, all terminals should be disconnected, the frame joined across C and E, D and E being short circuited. If one valve only is required, the telephones are joined to terminals 1 and 2 in the bottom row, the rest being left free. For two valves, join 1 and 2, and connect the telephones to 3 and 4. Again, if all three valves are to be used, the 'phones go to terminals 5 and 6, 1 and 2 being short circuited as before, and 3 joined to 4.

A list of the components required is given, together with the cost, and it will be seen that the set is by no means expensive.

Article.	£	s.	d.
Cabinet	0	18	0
Panel	0	5	0
Coil Holder (Goswell Eng. Co. Ltd.)	0	7	6
1 .0005 Variable Condenser	0	6	0
12 Valve Pins	0	1	6
3 Lissenstats (Minor) ...	0	10	6
18 Terminals 4B.A.W.O. Type	0	3	0

IMPORTANT A

From this issue onwards "WIRELESS WEEKLY" of complete sets. These articles, t by a new member of my staff, w designed and constructed for " Each set of the series will be giv letter W (an abbreviation for " numeral.

Each and every set will b own home, 12 miles from 2L thoroughly satisfied will be allo carried out on a large outdoor small indoor aerial. This is in a every set thoroughly tested before

Readers of this journal ca any set in this series with the fu a double check on the effective

In the case of the present s Birmingham and Manchester on loudly on three valves on a l simply by connecting the earth

ke a 3-Valve Receiver

W 1.

K. SIMPSON.

ree-valve set, which has given t results.

1	Variable Grid Leak (Watmel)	0	2 6
1	Lissen Transformer T_2	1	5 0
1	Royal Transformer (R.A. Rothermel, Ltd.)	1	0 0
1	Dubilier Condenser .0001 μF	0	2 6
1	Dubilier condenser .0003 μF	0	2 6
1	Dubilier Condenser .002 μF	0	3 0
1	Dubilier Condenser .004 μF	0	3 0
Wire, leads, screws, etc. ...		0	2 0
		£5	12 6

Components of other makes than those mentioned may be used, but the constructor is advised to buy all his components from reliable firms.

NNOUNCEMENT.

a special feature is being made in constructional articles dealing with he first of which has been written ill give full details of sets specially WIRELESS WEEKLY" readers. en a type number consisting of the WIRELESS WEEKLY") and a

personally tested by myself at my and only sets with which I am ed to be described. The tests are nerial, a small outdoor and a very ccordance with our policy of having being described in our publications.

n proceed with the construction of illest confidence that there has been results obtained.

et, I have heard Aberdeen, Glasgow, only two valves, and 2LO very oud-speaker, with no aerial but ead to terminal A.

JOHN SCOTT-TAGGART, *Editor.*

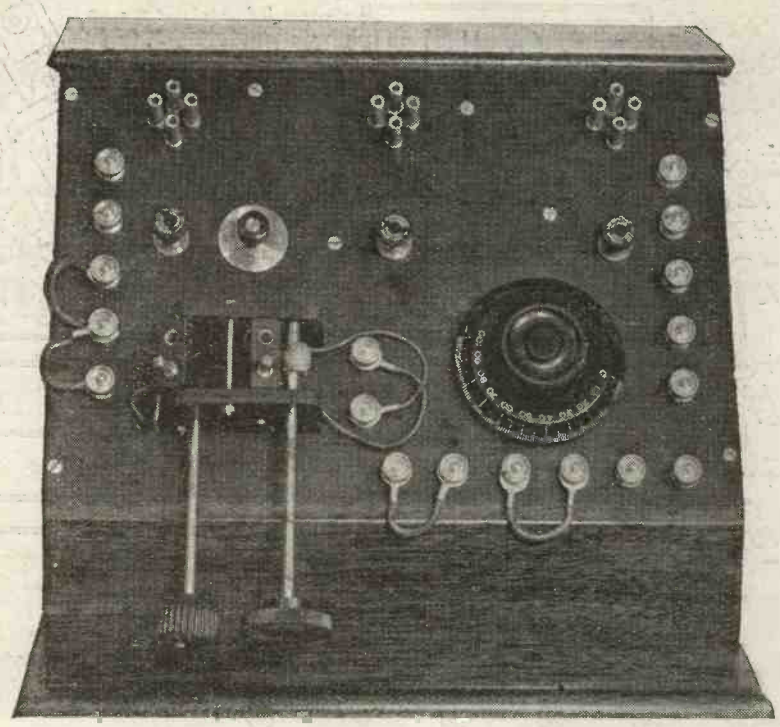


Fig. 2.—Front view of the panel.

The ebonite panel measures 12 in. × 8 in. × ¼ in., and a half-size scale diagram showing the layout of the components will be given in our next issue. The surface, or "skin," should be removed from the panel, by rubbing with fine emery cloth, as this improves the insulating properties, and reduces any surface leakage, thereby helping to keep down undesirable noises.

The positions of the various parts should then be marked, and the necessary holes drilled. Two holes will be required for the leads to the aerial tuning coil, those to the reaction coil being connected to the two terminals provided, enabling the coil to be easily reversed if necessary.

A photograph of the back of the panel is given in Fig. 6. The positions of the transformers are clearly seen, and it may be remarked that the

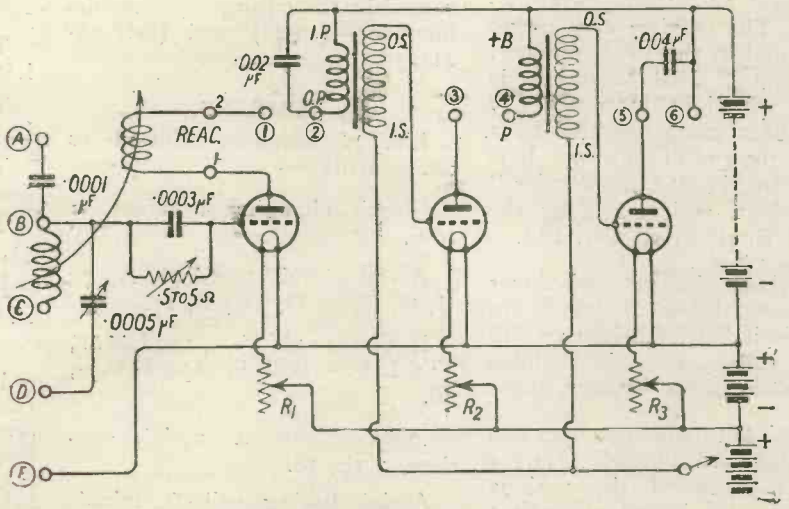


Fig. 4.—The circuit arrangement.

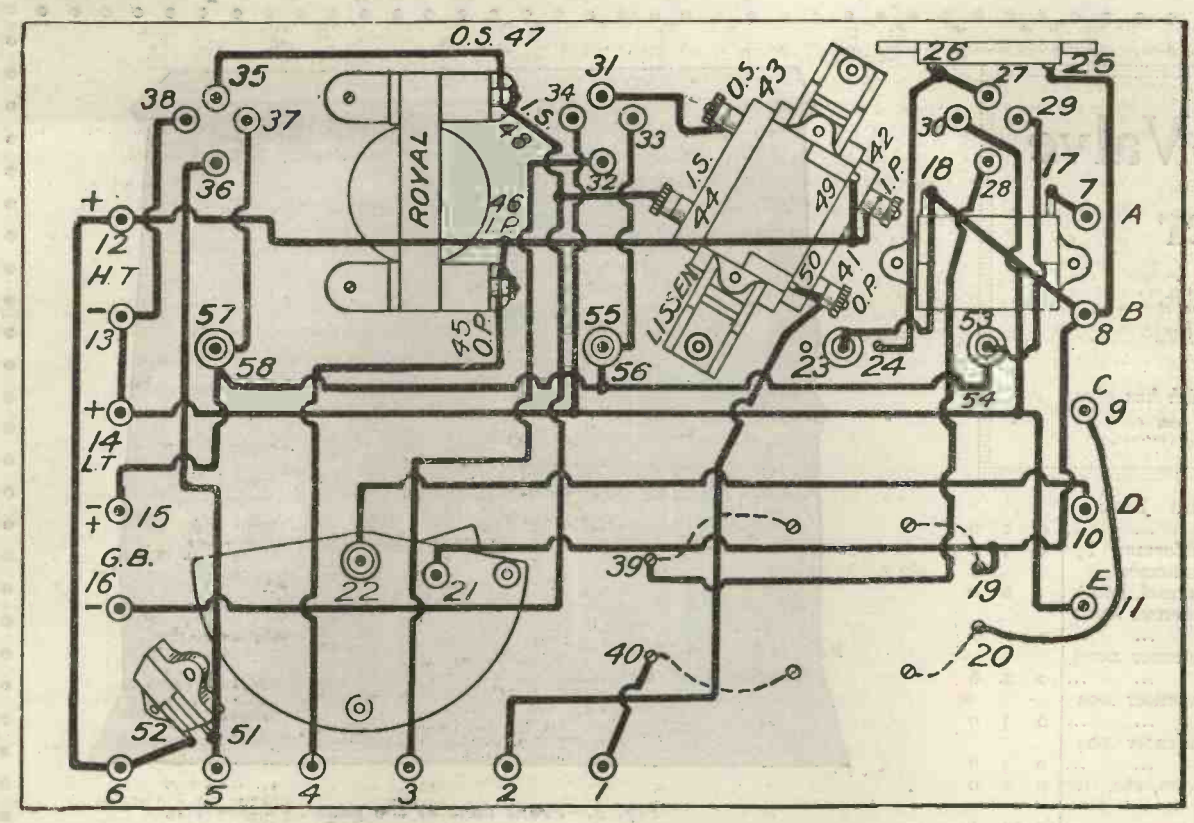


Fig. 5.—Wiring diagram of the receiver. All points to which connections have to be made are numbered, thereby making it easy to follow the circuits.

first transformer, between the detector and first note magnifier (marked T_1 in the circuit diagram) is a Lissen, of the type T_2, while the second, marked T_3, is a Royal, sold by Messrs. R. A. Rothermel, Ltd.

The coil holder is of a very useful type, allowing for both "coarse" and "fine" adjustment. The moving coil socket is operated in the usual manner, while the "fixed" socket is capable of slight movement by means of a cam, operated by a knob at the end of an arm. It is known as the "Cam-Vernier" Coil Holder, and is sold by the Goswell Engineering Co., Ltd.

The three filament resistances are Lissenstat Minors, which are equally suitable for bright or dull emitter valves, and the variable grid leak is of the Watmel type.

All points to which contact has to be made are numbered, and a table is given of the various points to be joined, each set being enclosed in brackets. The wiring is given in Fig. 5.

An example will make this clear. The terminals of the variable condenser are marked 21 and 22, and from Fig. 4 it is seen that one set of plates go to terminal D, which is numbered 10, while the other set go to the grid leak, condenser, terminal B (No. 8), aerial tuning coil, and fixed condenser. This is represented in the wiring table in this manner:—(10-22) and (8-18-19-21-23-25).

NUMBERS.

List of numbers allotted to components:—

Circuit changing terminals 1 to 6.

Aerial circuit terminals A, 7; B, 8; C, 9; D, 10; E, 11.

H.T.+, 12; H.T.−, 13; L.T.+, 14; L.T.− G.B.+, 15; G.B.−, 16.

.0001 Constant aerial condenser, 17, 18.

Aerial tuning coil (terminals on coil holder), 19, 20.

Aerial tuning condenser, 21, 22.

Variable grid leak, 23, 24.

Grid condenser, 25, 26.

First valve: G, 27; P, 28. Filaments, 29, 30.

Second valve: G, 31; P, 32. Filaments, 33, 34.

Third valve: G, 35; P, 36. Filaments, 37, 38.

Reaction terminals on panel, 39, 40.

Transformer T_1: O.P. 41; I.P. 42; O.S. 43; I.S. 44.

Transformer T_2: O.P. 45; I.P. 46; O.S. 47; I.S. 48.

Transformer by-path condenser, 49, 50.

Telephone by-path condenser, 51, 52.

Filament resistances R_1, 53, 54; R_2, 55, 56; R_3, 57, 58.

CONNECTIONS.

List of points to be joined:—(1-40), (2-41-50), (3-32), (4-45), (5-36-51), (6-52-12-46-42-49), (7-17), (8-18-19-21-23-25), (9-20), (10-22), (11-30-34-38-13-14), (15-58-56-54), (16-44-48), (24-26-27), (28-39), (29-53), (31-43), (33-55), (35-47), (37-57).

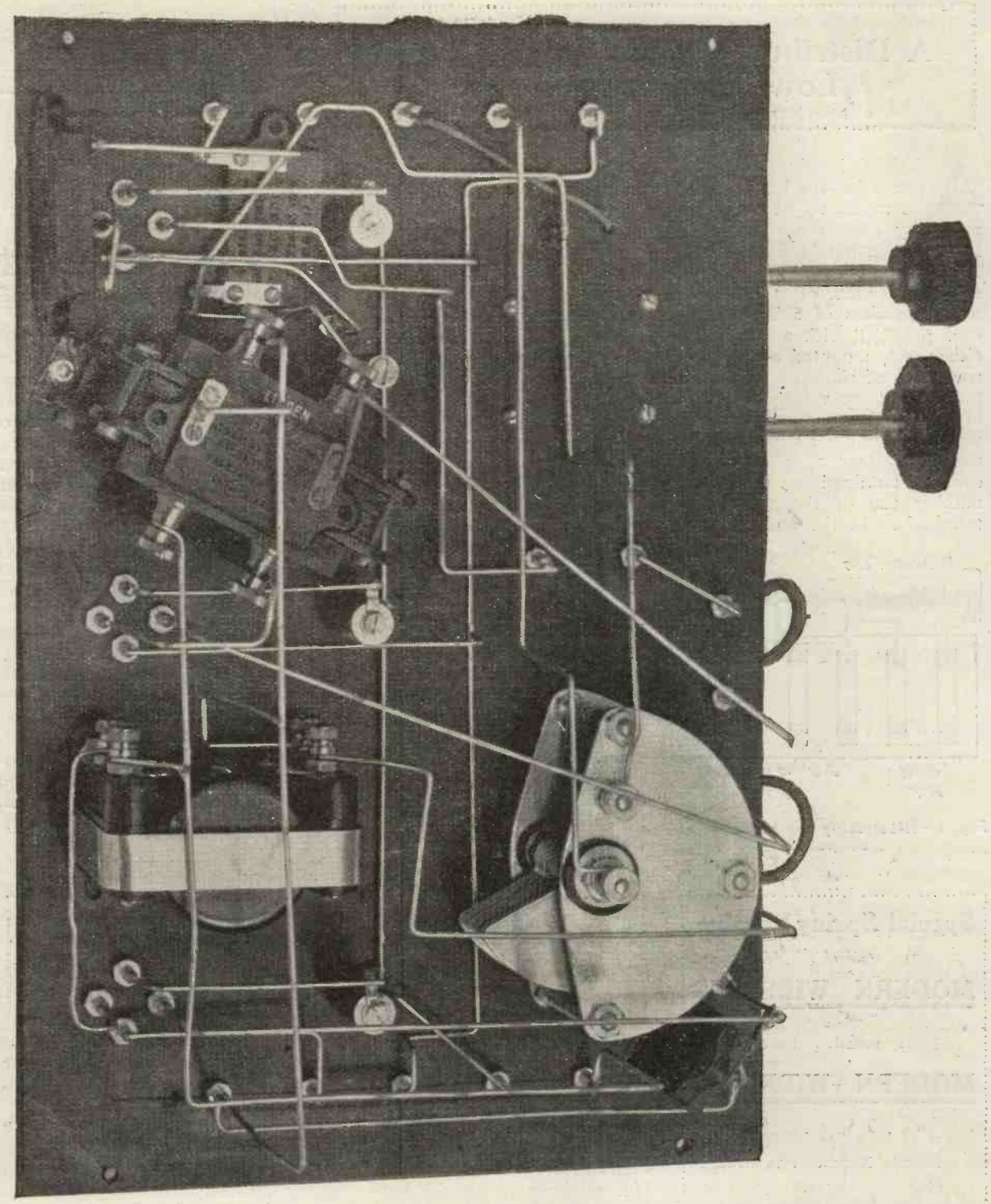


Fig. 6—A photograph of the back of panel wiring. The disposition of the components, together with the simplicity of the panel layout, may also be seen. The two knobs seen projecting beyond the panel on the right are for varying the coupling between the aerial and reaction coils.

Further constructional details, together with a half size drawing of the layout of the panel, for the building of this Three Valve Panel Receiver will be given in our next issue.

A Distributing Panel for High and Low Tension Batteries

A VERY handy distributing panel for the batteries can be made up at small expense by anyone who cares to have such a handy fitment upon his wireless bench. Fig. 1 gives a general idea of the device, which consists of 6 brass strips each provided with a terminal at either end, mounted upon a narrow strip of ebonite. The high-tension battery voltage is varied in the usual way by means of a wander plug. From the low-tension battery 2, 4 or 6 volts can be obtained as desired by making use of the appropriate terminals. In the case of accumulators such as those of the Exide make, in which the series connections between cell and cell are made with lead strips attached to terminals, it is a very simple matter to attach stout wire leads so that connections to the panel may very easily be made. Other accumulators with lead strips which are not detachable may be converted by drilling a 4B.A. clearance hole in the middle of the strip and fitting a terminal as shown in Fig. 3.

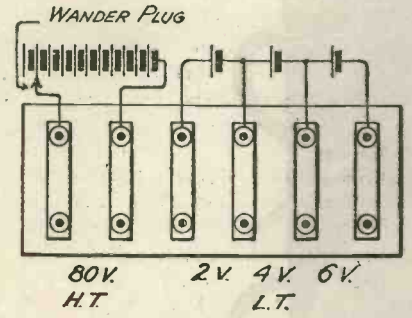


Fig. 1—Illustrating the principle of the panel.

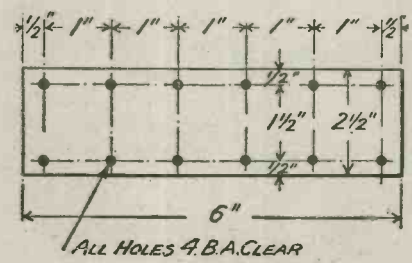


Fig. 2—Lay-out for panel drilling.

The panel itself is made of a strip of ¼-in. ebonite 2½ in. wide and 6 in. in length. In this are drilled holes for the terminals, as shown in Fig. 2, all being 4B.A. clearance. Six strips of brass 2 in. in length and ½ in. in width are now cut out, holes being drilled in them with their centres 1½ in. apart. These are fixed down to the panel by means of the terminals. The distributing panel may be mounted upon a shallow box, which can also contain the two microfarad condensers shunted across the high-tension battery; or it may simply be provided with a small batten at either end and fixed to the bench.

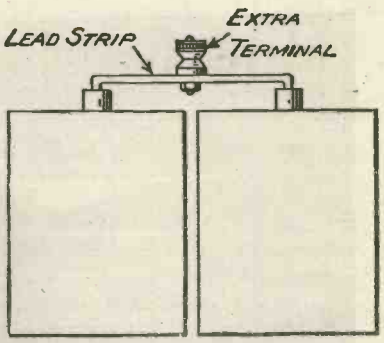


Fig. 3—Method of tapping accumulators fitted with soldered lugs.

Since it allows one, two or three cells of a 6-volt accumulator to be used at will, this panel is very useful to those who use both dull emitters and valves of the ordinary pattern. Further, the high- and low-tension batteries may be connected either negative to positive, as is usual, or negative to negative if desired.

R. W. H.

A Handy Instrument Board

(*Concluded from page* 389)

The voltmeter should read up to 10 volts, for most good 6-volt accumulators show a reading of about 6½ volts when they are fully charged. For the ammeter a maximum of 5 amperes will be sufficient for ordinary purposes. The milliameter should have a minimum of not less than 15 milliamperes, and it is not desirable that its greatest reading should exceed 30, otherwise the differences will be so small that anything like fine measuring will not be possible. Both ammeter and milliameter should be of the moving coil type, for this gives a scale which is very much better to read. The voltmeter should have a fairly high internal resistance in order that it may not practically short circuit the battery when thrown into action.

The voltmeter switch is very simply made in the way shown in Fig. 2. A ⅜-in. hole is drilled in the panel and two strips of sheet metal are fixed to it by means of screws. The upper one of these is attached to a short length of ¼-in. ebonite rod by means of a 4B.A. screw. The two parts of the switch should be well separated so that there is no possibility of the voltmeters coming into action until the button is pressed right down.

R. W. H.

How to Make the "Wireless Weekly" Omni Receiver

No. IV.

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

Another article dealing with this fascinating receiver.

THE next step in the construction of the Omni Receiver is to make the cabinet which holds the terminal board and the front panel.

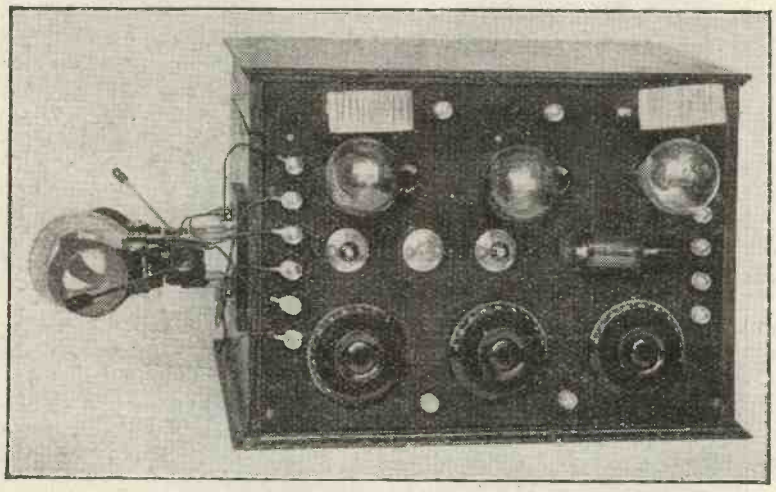


Fig. 13—Photograph of the receiver showing coil holder.

The cabinet has a sloping front and a lid which closes down over the terminal board. On the left hand side of the cabinet, as shown in Fig. 13, we have a three-way coil holder which enables a very large variety of circuits to be tried out. This coil holder is of Igranic manufacture, but there are various other types which may be used.

Dimensions of Cabinet

Fig. 14 shows the cabinet in detail. It will be seen from this illustration that the side pieces are not rectangular, but that the front edge slopes gently backwards, so that the top is narrower than the bottom. Inside the box ledges are arranged so as to hold the two panels in place, four screws being used to secure the front panel and four to fasten the terminal board to the ledges. The ledges themselves are shown as L_1 and L_2 in Fig. 14, and similar ledges are provided at both sides of the cabinet. An allowance of $\frac{1}{4}$ in. is made for the terminal and front panels, this dimension being the thickness of the panels; the ledges themselves are screwed to the sides of the cabinet.

The Lid

The lid is made of the same wood as the remainder of the cabinet, which is preferably mahogany nicely varnished or polished. The work of French polishing the cabinet is preferably left to a professional cabinet-maker. The front of the lid is left open, the space being occupied by the top portion of the front panel when the lid is closed. Those who propose to make up the companion cabinet, which will contain some extra components and batteries, should make about two dozen little semi-circular channels along the right-hand bottom edge of the lid. Fig. 15 is a side view showing these channels. Their purpose is to allow rubber covered leads to go from the main Omni receiver to the auxiliary cabinet which some may care to construct. This latter cabinet will be described in future issues of *Wireless Weekly*. It is more in the nature of a luxury than a necessity.

Fitting the Panels into the Cabinet

Fig. 16 shows very clearly how the panels are fitted into the cabinet. The panels are entirely self-contained, except for the coil holders and the second intervalve

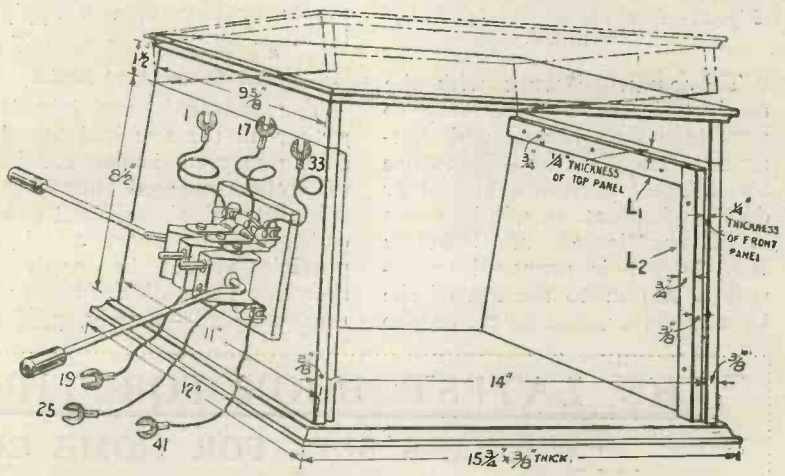


Fig. 14—Details of the cabinet.

transformer; this latter is mounted in the bottom of the cabinet, and four flexible rubber covered leads go from the four terminals to the four appropriate terminals on the terminal panel. The four terminals which go to

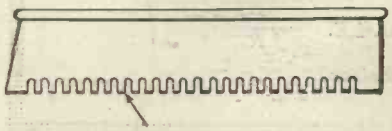


Fig. 15—Side view of lid showing 24 serrations.

the second intervalve transformer are 15, 7, 55 and 56, illustrated in Fig. 5. The flexible leads are joined to these four terminals at one end, and to the corresponding terminals of the intervalve transformer at the other. It is to be noticed in connection with Fig. 5 that the words "input" and "output" have been used in error by the draughtsman for "inside" and "outside."

Having screwed the panel into place and fitted the intervalve transformer, all that remains is to join the leads from the three-way coil holder to the six terminals down the left of the panel. These six terminals are marked 1, 9, 17, 33 and 41 in Fig. 5 and Fig. 6. These are the numbers reading from top to bottom in Fig. 13. In Fig. 14 the leads from the coil holder have been marked to correspond with the terminals to which they are connected.

Fig. 17—How the connecting links are made.

To commence work with the receiver it is only necessary to provide coils, valves and batteries. The sizes of coils to use for different purposes, and other details of operation, will be given in future issues of *Wireless Weekly*. It is proposed to devote a section to the use of the Omni receiver, so that those who have made it will be able to carry out the experiments described from time to time.

In the near future it is proposed to describe another type of Omni receiver which is of alternative design. It will not be an improvement on the present pattern, but merely an alternative arrangement. The numbering of the terminals will remain the same, so that any description of experiments or circuits will apply to both.

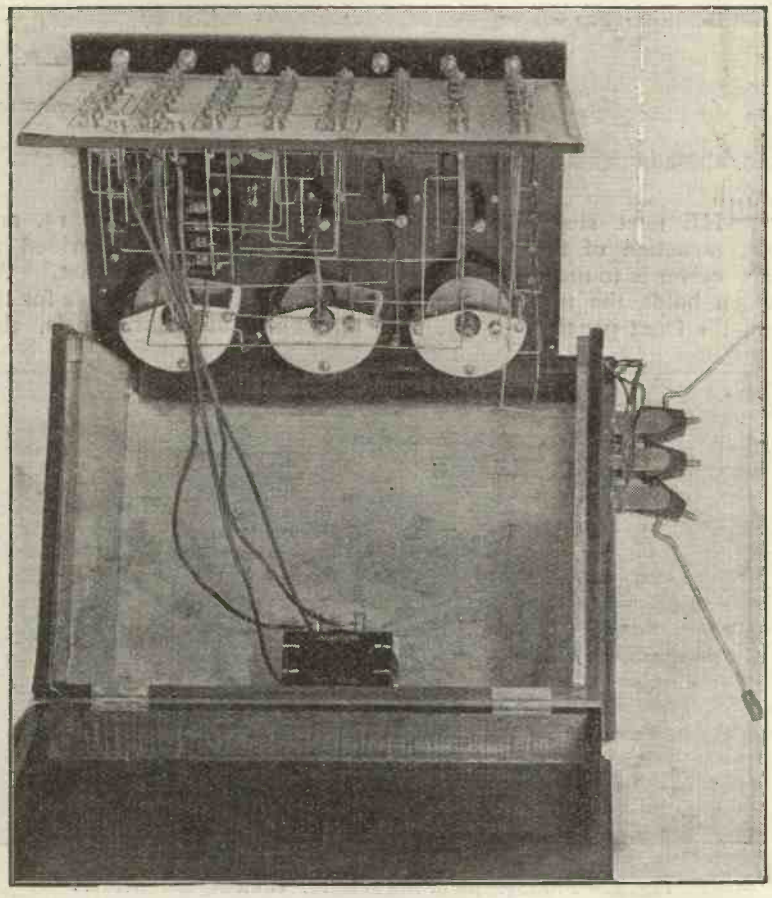


Fig. 16—How the panel is placed within the cabinet.

The Connecting Links

The terminals are joined together on the terminal board by rubber-covered leads, consisting of rubber-covered flex having fishtail terminals soldered to each end. The shortest length possible should be used, and therefore three different sizes are recommended—namely, 3, 6 and 12 inches. Fig. 17 illustrates how these connecting links are made. The wire should be multi-strand copper, covered with rubber insulation; no outside covering of cotton is desirable.

Blue Prints, etc.

Exact size sheets for the terminal panel with component symbols printed on them are obtainable from Radio Press, Ltd., at 1s. 6d. for two, one of which will serve as drilling template.

A blue print, exact size, showing drilling holes for the front panel, is also obtainable at 1s. 6d. each.

The above are produced by the publishers of *Wireless Weekly* for the convenience of readers who want more than it is possible to give in a periodical.

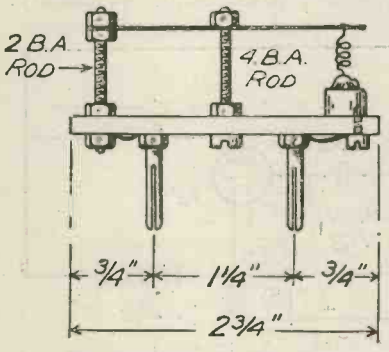
NEXT WEEK.—The first article dealing with the use of the finished instrument.

A Handy Plug-in Detector

ANYONE who is using either plain crystal sets or those which employ a combination of crystal and valve will find it most convenient to make up a number of small plug-in detectors each provided with a different crystal. If this is done changes can be made without any trouble at all and the effect upon the set noted most easily.

When one is making up half a dozen or more detectors one naturally wants to find a type that is simple to construct and which does not call for any expensive materials. That about to be described will be found to fill these requirements.

The drawing shows the appearance of the finished instrument. This made up on a strip of ebonite ½ in. wide and 2¾ in. in length, ¼ in. ebonite will be all that is needed. At one end is a pillar made from a short length of 2B.A. studding and kept in place by nuts above and below the ebonite. At the other is fixed a crystal cup secured by a 4B.A. screw, the hole for which is drilled eccentrically into the brass so that the cup may be moved considerably in order to allow searching to be done. To the top of the pillar is fixed by means of a couple of nuts an arm of springy brass 2 in. in length and ⅜ in. wide, in the middle of which is drilled a 3/16-in. hole. Through this hole passes the shank of a 4B.A. screw inserted upwards below the ebonite and fixed in place by means of a nut screwed hard down. A second nut above the arm allows the point of the catwhisker to be adjusted. The contacts take the form of a pair of valve pins 1¼ in. apart, which fit into valve legs upon the panel. A friend who saw the design suggested that it might be better to provide the detector with one pin and one leg, but a moment's thought will show that it is not the case. The fact that both of the contacts are of the same kind enables one to reverse the detector in a moment, which is a very great advantage.



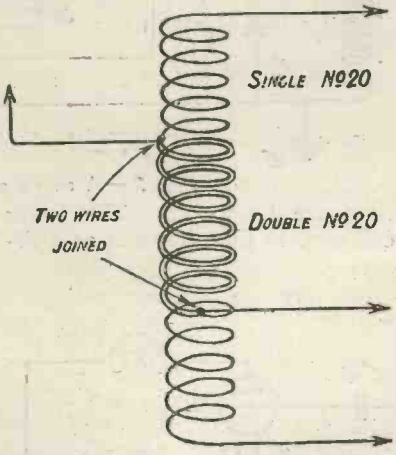
Constructional details of the Detector.

A number of detectors of this design may be made up each fitted with a crystal of the kind that requires a catwhisker contact. Perikon detectors can also be made on the same lines by increasing the length of the pillar and the adjusting screw and fitting a second cup, also eccentrically mounted, to the end of the arm.

R. W. H.

Extreme Selectivity

MANY readers have expressed the desire to have the method of winding incorporated in the set described in our issue for February 20, illustrated a little more fully than was possible in the reduced circuit diagram. The attached figure shows how the winding is made, and it will be noticed that by using a double winding of No. 20 wire, two windings being in parallel and joined at each end, the effect of a much thicker wire is obtainable. This method, which very successfully solves the problem of obtaining low resistance winding without recourse to the thicker wires, which are usually obtainable with some difficulty, can equally successfully be applied to other circuits. For example, in the set described in the issue for February 13 under the title of "A Loud-Speaker Reflex Circuit," the particular form of aerial coupling there shown can be substituted by a method similar to that shown in the present illustration, the aerial being tapped on to the point where the two wires are joined and the earth and filament to the other point of contact between the two wires.



Method of using double wire to obtain low resistance. See Figs. 1 and 2, pages 348 and 349 of last week's issue.

The Radio Society of Great Britain.

Transmitters and Relay Section.

The calibration waves recently sent out from 6XX were sent as arranged every night except one. The signals of diminishing strength which it was proposed to transmit were, however, not transmitted. It was found difficult to alter the strength of the signals in the manner desired with the apparatus at present installed at 6XX.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

THOSE who have had ample experience of the tuned anode method of coupling one valve to another will, no doubt, desire to extend their experience to other forms of high-frequency coupling, and one which will commend itself to those who are interested in dual amplification circuits is given in Fig. 1.

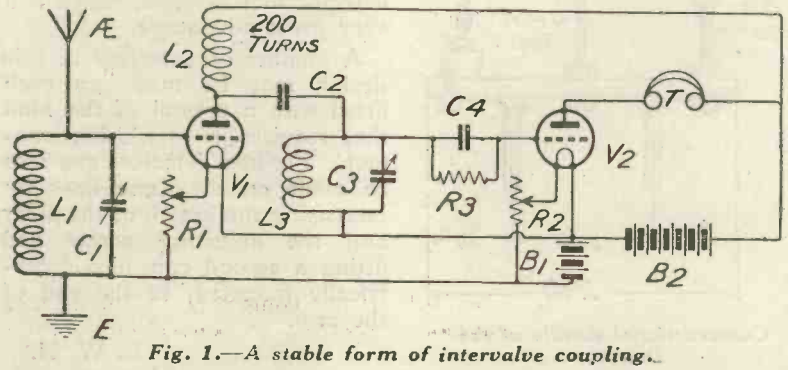


Fig. 1.—A stable form of intervalve coupling.

An air-core choke coil L2 is connected in the anode circuit of the first valve, and instead of having a tuned anode in series, it is connected in parallel with the coil L2, and a coupling condenser C2 of 0.0001 μF to 0.0003 μF.

The circuit L3 C3 is tuned in the ordinary way to the incoming wavelength, and if the second valve is to act as a detector, the usual grid condenser C4 and grid-leak R3 is provided.

This type of coupling is of advantage in dual amplification circuits where it is desired to prevent any possibility of instability.

Interesting experiments may be carried out by coupling the inductance L1 to L2. The latter coil can, in fact, be used as a reaction coil to introduce reaction on to the grid circuit of the first valve.

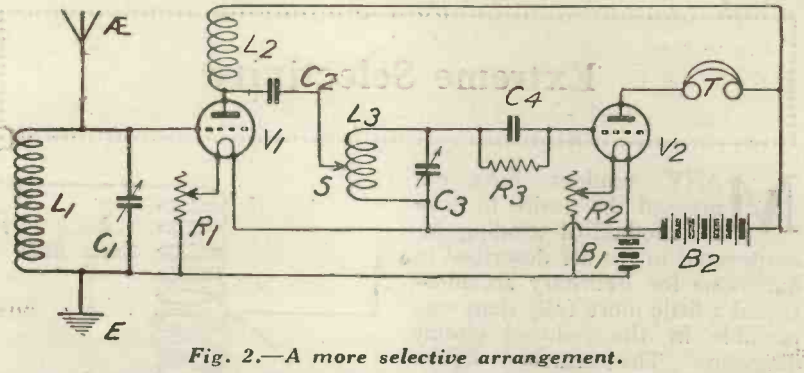


Fig. 2.—A more selective arrangement.

The coil L2 is preferably a plug-in coil of 200 turns, or 250 turns, and the experimenter will find plenty of other uses for it in future circuits, and also for longer wave telephony reception.

Fig. 2 is similar to Fig. 1, except that instead of coupling the whole of the inductance L3 to the anode circuit of the first valve only a portion of it is used, and preferably a variable tapping is taken. The advantage of a variable tapping S is that the damping of the oscillatory circuit L3 C3 is reduced, and also the coupling is looser between the anode circuit of the first valve and the oscillatory circuit L3 C3. The signal strength does not seem to be as great as with a tuned anode circuit, but the selectivity is improved.

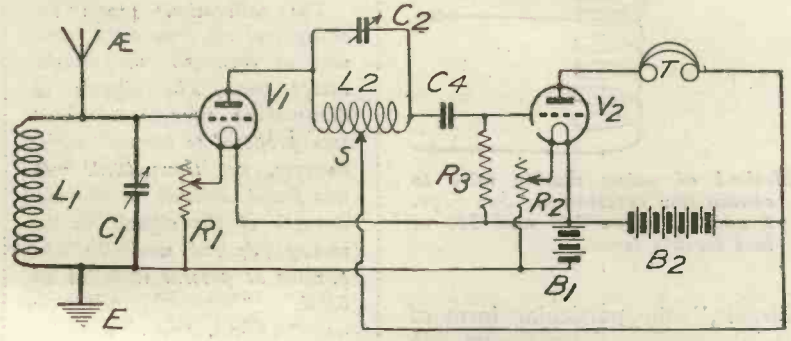


Fig. 3.—A simple method of obtaining stability.

Another interesting arrangement is that illustrated in Fig. 3. In this case the whole inductance L2 is not included in the anode circuit, but only the portion between the left-hand side of L2 and the tapping S, which is preferably adjustable. In this circuit there is less tendency for the first valve to oscillate of its own accord, and a high degree of selectivity is obtainable.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor

A Fine-Adjustment Two-Coil Holder

A two-coil holder, for mounting on the side or top of a cabinet or panel (by means of four small screws), and provided with a coarse and also a fine adjustment of the mutual coupling, is that submitted by Messrs. Goswell Engineering Co., Ltd. In this, the coarse adjustment is made in the usual way by swinging up a pivoted holder, controlled by a knob on a long spindle to minimise hand-capacity effects. For the fine adjustment, the other coil-holder (usually fixed in position) has in this instrument a small swinging motion, produced by a cam. This is affixed to another long spindle and bears up against the holder, advancing it against a fairly stiff spring, giving a very smooth and steady motion, without back-lash, of some $\frac{3}{4}$ in. at the centre of the coil. The cam is of insulating material, and the second spindle is wholly insulated from the other parts.

On actual trial, the holders were found to take the standard type of plug-in coils readily, and the mechanism worked as it should. Fine control over reaction-coupling was found in reception, facilitating the search for distant stations; whilst the closest possible coupling was obtained for super work. The insulation, on test, proved excellent, whilst the general workmanship and finish were of a high order. We found the small terminal-screws fitted on the coil sockets themselves decidedly inconvenient in use, for temporary experimental "hook-ups," and they are placed in such a manner that short-circuits might easily occur in such work: this does not apply when the instrument is permanently installed in a finished receiver.

The Multiphone

A sample of the Barnes Multiphone has been submitted for trial by Messrs. L. B. Tickle & Co. This comprises a small loud-speaker of conventional design,

and four head-sets. The latter, however, work on the principle of the doctor's stethoscope, consisting merely of ear-pads supported by the usual head-bands, each carrying a pair of flexible metallic tubes which are plugged into holes in the loud-speaker base. Thus one electrical telephone mechanism suffices for the four listeners. On actual test no diminution of volume of sound could be noticed on adding additional head-sets to the instrument after tuning-in on the one set—a very distinct advantage with crystal-sets or low-power valve-reception. The resistance of the windings is 4,000 ohms. The loud-speaker can be removed when head-sets alone are used, a plug being provided to close the aperture, and small plugs for the other unused outlets. The horn adapter automatically cuts off most of the outlet to the head-sets, when in use, but one can be left on for tuning-in.

On extended trial, the loud-speaker feature was found to be quite effective, though not powerful, and there was little distortion. With the head-sets, the sensitiveness in crystal reception fell short of a good pair of ordinary head-'phones; but was not diminished, as mentioned already, by the addition of further head-sets, as is the case with ordinary head-'phones. Evidently, the limit had not been even approached with four head-sets. In loud-valve reception, four could share with considerable appreciation. It was noticed that the connecting tubes were uncomfortably short and, being metallic, tended to make grating noises when slightly disturbed. These are matters which are readily remedied, and if rectified, would add materially to the value of the device. The head-sets also could be considerably improved as to comfort and non-liability to catch in the hair.

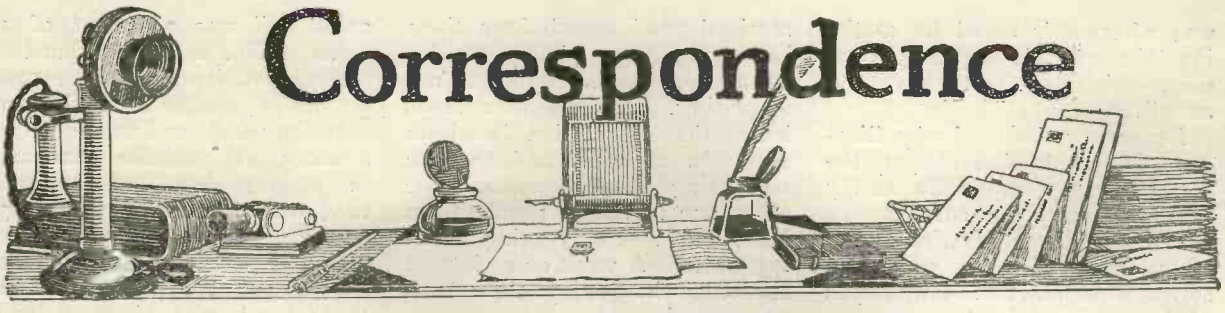
The Barnes Multiphone seems to be a practical as well as an ingenious device, and should, when developed fully, go a long way towards curing the low-powered set of its present selfish character.

"Celcouse" Crystal

A galena-type of crystal that is sold in a sealed envelope with a printed guarantee of replacement in case of insensitiveness is the "Celcouse," a sample of which has been submitted by Messrs. Cousell Bros. This is a brightly granular material which on practical test proved to have a large proportion of sensitive spots, and to equal in every way the best of the sensitised galenas. All sides of the piece submitted seemed to be equally excellent, and a freshly fractured surface also gave easy setting for good signals.

The "Royal" L.F. Transformer

From Messrs. R. A. Rothemel, Ltd., comes an attractive type of L.F. intervalve transformer, of particularly fine workmanship and finish. It is of a compact type, measuring only $2\frac{3}{4}$ in. by $2\frac{1}{2}$ in. Small terminals are provided on the front, making rapid changes of connections in experimental work an easy task. On trial in actual reception, excellent amplification was obtained without noticeable distortion. Tested with the "Meg" by 500 volts D.C. between windings, and from each winding to the metallic casing, the insulation proved unexceptionable.



Correspondence

ACCUMULATOR RATING

From Earl Russel.

SIR,—In your issue of the 6th inst., I note that you say it is unfortunate that accumulators are still sold with the ignition capacity marked on them.

There is no such thing as an Ignition Ampere Hour, and the sale of accumulators under that designation is fraudulent and has been denounced by responsible authorities. An ampere hour is as much a definite measure as a pint or a quart, and a man is no more entitled to sell an accumulator as having 30 ignition ampere hours when he means 15 ampere hours, than he would be to sell milk as two London quarts when it was in fact one quart. Until some prosecution of an offender is undertaken for a false trade description, the only remedy is to avoid dealing with any firm that uses this misleading form of description.

If, however, a customer has ordered a 30 ampere hour accumulator and receives a 15 ampere hour accumulator, he is entitled to repudiate the bargain and ask for his money back. — Yours faithfully, RUSSELL.

RESULTS.

SIR,—Having at first doubted the statements of several readers *re* the ST100 in your most excellent and instructive papers "M.W." and "W.W.," I now have great pleasure in backing them up, for I have found it a top-rate success.

I used the following components in building:—Fallons' condensers 0.0005 μF, Igranic transformers. Fellows' H.R. 'phones, Ediswan and Mullard A.R. valves, 100,000 ohm leak, hertzite and silver cat-whisker, 4v. L.T. and 66v. H.T.

Glasgow, Bournemouth, and Newcastle were then received on a 60 ft. single-wire aerial, about 12 ft. high, slung under the roof of an army hut.

London could only be described as "roaring," but Cardiff, Manchester, and Birmingham were not loud enough to be heard nicely above the A.C. hum (this

was afterwards cured by earthing the electric lighting conduit, which is 18 in. above the aerial).

I cannot understand why Glasgow is so loud and yet the farthest away, especially as my aerial is nearly due east.

With 16 turns of wire on an 18-in. frame with No. 30 coil in series and reaction fully open 2LO came in as loud as ever.

Thanking you for your most excellent circuit.—I am, yours truly,

G. LAVERS.

Blackdown,
Nr. Farnborough.

100 METRE TRANSMISSION

SIR,—In view of your note on page 288, Vol. 3, No. 9, my experience may interest you.

Some months ago I learnt that two local amateurs were working on very short wavelengths and using 1H.F. and detector, I tried to find them. At first the set would not oscillate, but this was cured by shunting the reaction coil with a 0.0001 variable condenser. As soon as this was done I experienced no great difficulty in finding them, and received good speech from them both. One was plainly audible on an open aerial, which is not surprising, as I afterwards learnt that his station is within 200 yds. of mine, and that he was using about 8 watts. The other one is about 1 mile from here, and was only using about .75 watts. A week or so later I succeeded in getting them both on one valve only.

On January 30, 1924, I again decided to try the short waves; a detector valve only being used. As soon as the set was oscillating I tuned in some CW, which proved to be UIXAM. Last night UIXAR was heard calling CQ, and on ceasing he was immediately answered by G2SH, and communication was established. As signals from UIXAR were somewhat too weak for comfort, I switched in 1L.F. valve, and heard both stations comfortably until G2SH apparently broke down. UIXAR then got in touch with G5KO. I was unable to follow this interchange owing to local interference from an untuned spark station.

The set I used was a 3-valve set 1H.F., detector, 1L.F. The aerial coil was a basket of 15 turns of No. 24 d.c.c. wound on a cardboard former, 1½ in. centre, 9 slots (no shellac or similar preparation used), and was tuned by a 0.005 μF variable condenser in series; American stations, etc., were received with only 30 to 40 degrees of the condenser in. The reaction coil was similar to the aerial coil, but had 25 turns, and was shunted by a 0.001 μF variable condenser. The aerial coil was directly coupled to the first valve. The valves were Marconi R for detector and French R for L.F., with about 75 volts on the plates. My aerial is a 60 ft. twin spaced 4 ft., with the free ends connected, 23 ft. at the house end, rising to 35 ft. at the free end. The earth is a metal plate about 4 ft. 6 in. × 2 ft., buried about 2 ft. 6 in. deep at the end of a 12 ft. earth lead.

Up to the present I have received the following stations on 140 metres or below:—2PW, 5XS, 2XR, 2ON, 5TR, 2SH, 5KO, 2KW, UIXAM, UIXAR, UICMP.—Yours faithfully,

W. F. FARRING.

Forest Gate, E.7.

Information Department

B. L. (DURHAM) says that his aerial and earth system does not appear to be very efficient, and mentions among other features that the lead-in runs for some 15 feet very close to and parallel with an iron rain water pipe.

We think the proximity of the iron pipe is sufficient to account for the results noticed, since if the down-lead is allowed to run fairly close to it, the capacity of the aerial will be considerably increased, since the pipe, being more or less earth connected, forms with the down-lead a condenser of a most undesirable sort. Further, there will be considerable loss of energy from the aerial circuit by eddy currents.

W. C. F. (BRISTOL) asks which method we consider to be the best for mounting crystals in their cups.

Undoubtedly the best method is that which makes use of what is known as Wood's metal. This is an alloy of lead, tin, bismuth and cadmium (usually) having a very low melting point. A small piece of the metal should be placed in the crystal cup and heated very carefully until it is just fluid, and then the crystal should be dropped into this and the metal allowed to cool. It contracts slightly in setting, and grips the crystal firmly. A somewhat less satisfactory alternative, but one which is nevertheless quite practicable, is to grip the crystal between three screws in the cup and then pack it round firmly with tinfoil. This latter precaution commonly improves results noticeably.

I. R. (TULSE HILL) states that he has been informed that it is not possible to hear the radiation from an oscillating valve set with a crystal receiver.

This, unfortunately, is not so. If both receivers are tuned to the same broadcasting station, a howl will be heard in the crystal set when the valve receiver oscillates.

W. E. W. (EPPING).

Please send us your address; we wish to communicate with you.

N. A. (COWES, ISLE OF WIGHT) reports that he finds considerable difficulty in obtaining an efficient earth connection, having no water pipe system in his house, and asks our advice.

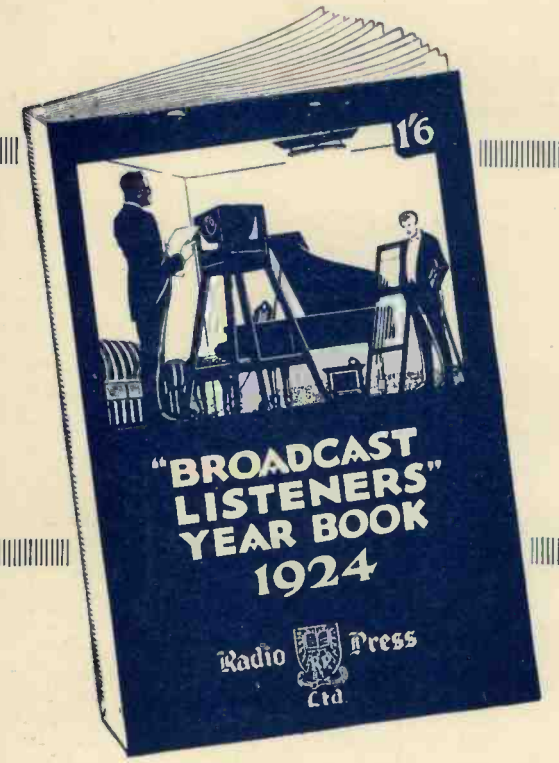
Probably the best solution of the difficulty is to bury an old galvanised iron bath or bucket, which has been freely perforated with small holes, about 3 feet below the surface of the ground underneath the aerial and as close to the leading-in point as possible. Stout copper wire should be soldered to the upper edge of the bucket, which should be almost filled with cinders or preferably broken coke. Three or four buckets full of water should then be poured in and the earth shovelled back.

J. S. W. (BRADFORD) states that every time a tramcar passes his house he hears a prolonged crackling and roaring which completely drowns signals, and asks for the remedy. His aerial runs parallel to the overhead wires and about twenty yards from them.

Interference of this nature is exceedingly difficult to eliminate at the best of times, and our correspondent is unfortunately suffering from a particularly severe form. At such a short distance from the wires of the power system only the most drastic remedies are of any use, and the first step is to consider a possible re-arrangement of the aerial. Try to get it further away from and at right angles to the source of trouble, instal a "counterpoise" earth, adopt a loose-coupled tuner, and dispense with all low-frequency valves.

M. L. (LONDON). What is the best kind of wire to use for winding tuning coils: cotton covered, silk covered or enamelled?

A great deal depends upon the type of coil which is to be constructed, and the method for varying the number of turns in circuit. Enamel-covered wire is most suitable for coils to which a slider is to be fitted. Double cotton-covered or double silk-covered wire are about equally suitable for winding tapped inductances, the cotton-covered wire having perhaps a slight preference because the thicker covering ensures a greater spacing between the actual wires of adjacent turns. Incidentally the cotton-covered wire is much cheaper. For honeycomb, basket, or duolateral coils double cotton-covered wire is most suitable. The silk covering frequently becomes damaged during the winding, especially upon the removal of the steel rods of the former or "spider." Single silk-covered wire is not recommended for use on any type of wireless receiving coils.



"Broadcast Listeners" Year Book 1924

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