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Wireless Weekly

and The Wireless Constructor.

Vol. 2. No. 2.

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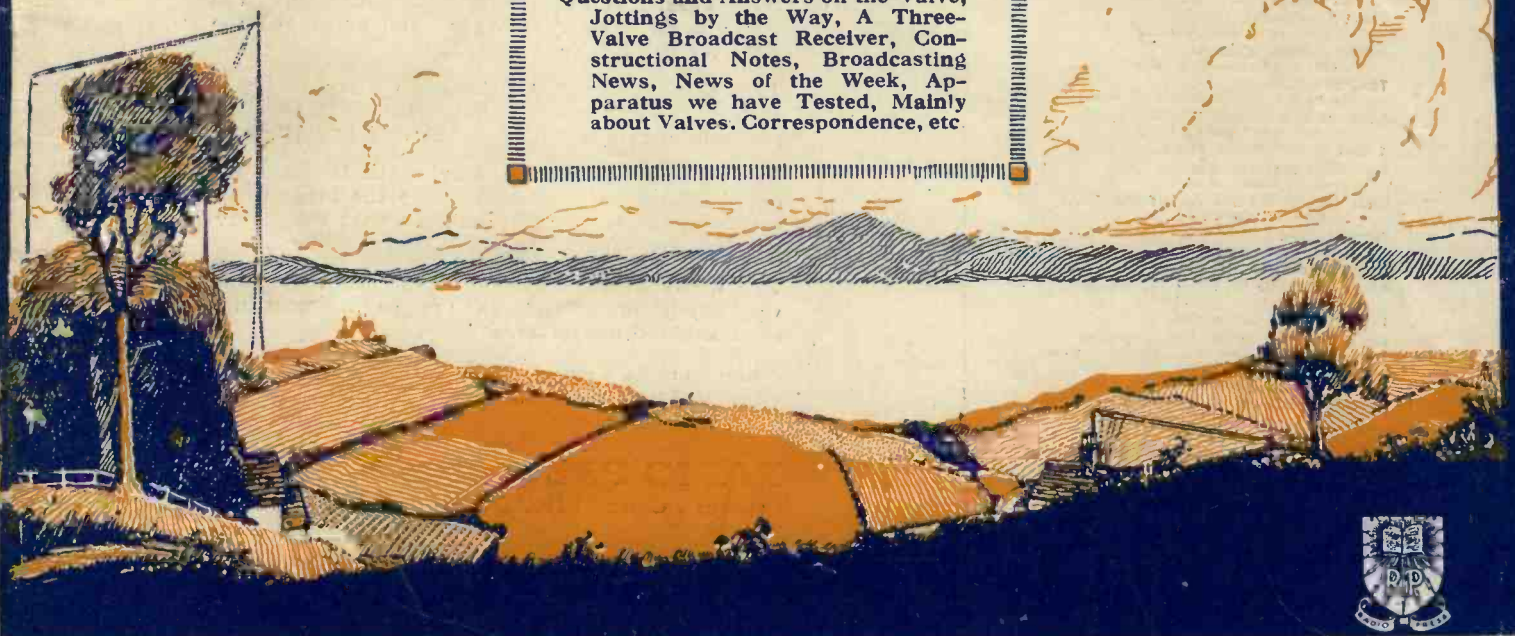
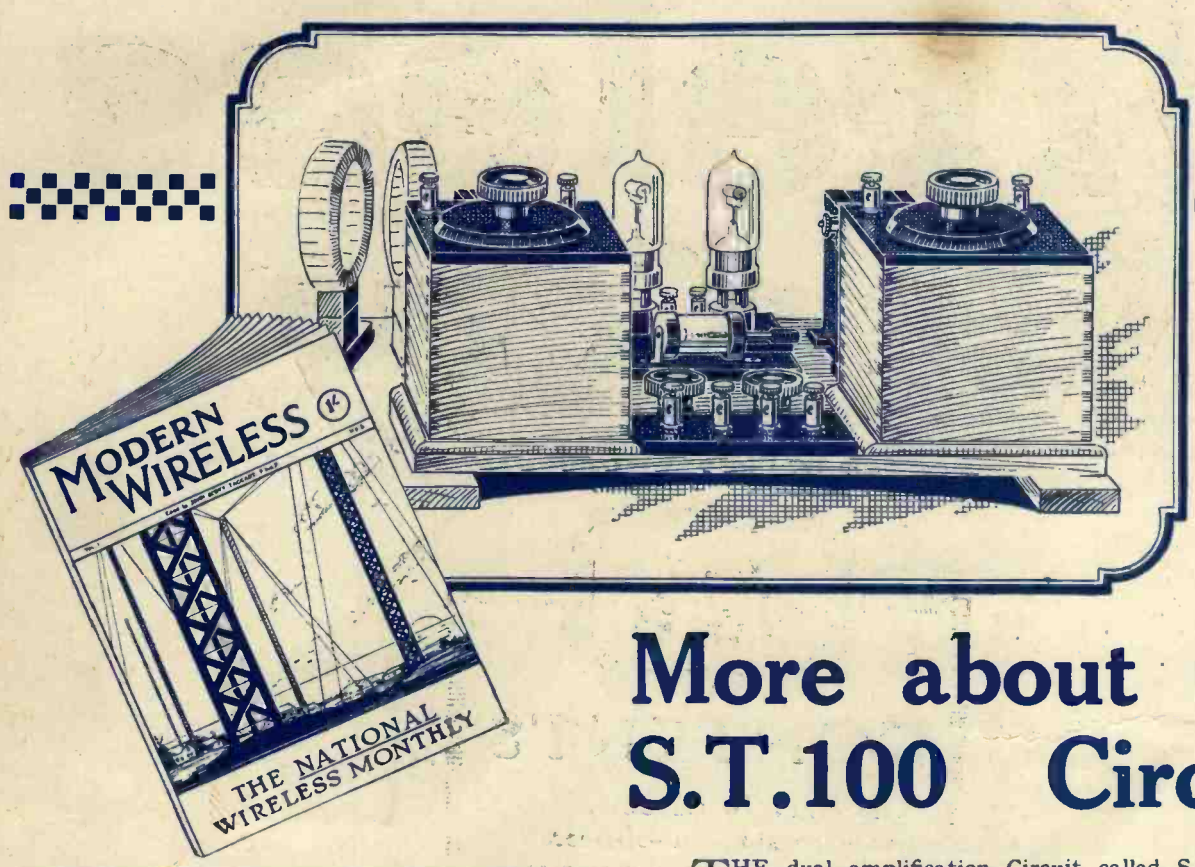


A New Flewelling Receiving Circuit (Exclusive)



More about the S.T.100 Circuit

THE dual amplification Circuit called S.T.100, particulars of which were first published in the June issue of *Modern Wireless*, still continues to create the greatest interest among Wireless experimenters.

In the July issue—now on sale everywhere—Mr. Percy Harris shows, by diagrams and photographs, exactly how to build up an S.T.100 Receiver using bought components.

This Constructional Article is so clear that the veriest novice can assemble the Set and get magnificent results from it at the very first attempt.

Get a copy of *Modern Wireless* to-day and try out S.T.100—you'll probably have the majority of the components lying around, so that the outlay will be very small.

The whole of the Articles in this issue are of a very high order and its 120 pages constitute remarkable value for money.

Make sure of your copy to-day while the supply is available.

JULY issue

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Two-Valve Circuits.
By John Scott-Taggart, F.Inst.P.
A Simple Crystal Receiver.
By E. H. Chapman, M.A., D.Sc
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Above and Below the Broadcast Wavelengths
By Lambda.
Types of Tuning Inductance.
The Measurement of Wireless Quantities.
By E. H. Chapman, M.A., D.Sc., F.R.Met.Soc.
A Simple Long Wave Set.
By Paul Woodward.
An Easily-made Wave Meter for 300 to 9,000 Metres.
By R. W. Hallows, M.A.
How to choose a Honeycomb Coil.
Etc. Etc. Etc.

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Wireless Weekly

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July 25, 1923

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Advertisement Managers: SCHEFF PUBLICITY ORGANIZATION LTD., 125, Pall Mall, London, S.W.1.
Tel.—Regent 2440.

Staff Editors:
J. H. T. ROBERTS D.Sc., F.Inst.P.
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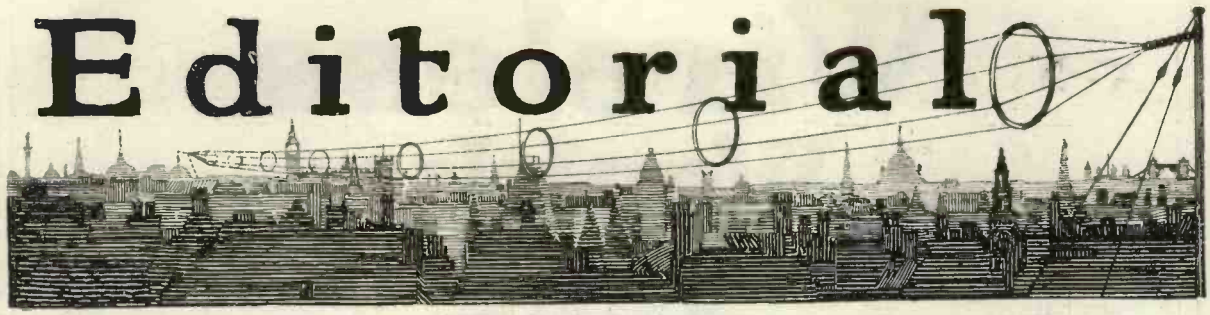
Editorial



AT long last we have a statement by the Broadcasting Committee, as published in full in our last issue, and before long —possibly even by the time these lines appear in print—we may have the anxiously awaited final report.

This report, it is confidently expected, will settle the important licensing question and other outstanding matters which affect the wireless industry, the public and the future of broadcasting generally.

There still remains, however, the unsatisfactory position between the British Broadcasting Company and the Concert Artistes' Association and Entertainment Managers. It is of the utmost importance that this matter should not be left in its present state of abeyance, as, if so, it is very likely to lead to further controversy at a time when the anticipated successful autumn and winter season should be in full swing.

Everyone who has the real interest of broadcasting at heart will agree that previous "stunt" publicity on the part of the daily Press did incalculable harm to a new industry, and there must be no possible opening afforded for another Press campaign in which scare headlines such as "Another Ban on Broadcasting" can be employed.

The British Broadcasting Company has already approached the entertainment providers with a view to arriving at a satisfactory working agreement, but so far its efforts have not been crowned with success. Nevertheless, their programmes are admittedly excellent and in fact are improving, the officials responsible both at the London and provincial stations sparing no efforts to provide entertainment to meet the tastes of all classes of listeners-in.

Perhaps the time has now arrived when the British Broadcasting Company can omit the various Associations from their reckoning altogether, and make their own arrangements for the necessary artistes, both concert and theatrical.

The Broadcasting Company will doubtless have all the necessary points down for consideration, and nothing is further from our intentions than to endeavour to teach the company how to run its own business. We have strong views, however, and consider it our duty to have strong views, with regard to the harmful effects upon the development of broadcasting and the prosperity of the wireless industry generally which might result from the present situation.

We feel that the controversy may suddenly break out afresh and interfere with the peaceful development of broadcasting in the autumn. We are all heartily sick of disputes and committees, and we hope that the B.B.C. will take every possible step to avoid an open dispute which will upset public confidence in broadcasting.

As the entertainment providers will not come to an arrangement, the B.B.C. will, we hope and believe, treat them with friendly expectation, but decline to invite further snubs, which are always given the fullest publicity. Their policy is to lie low.

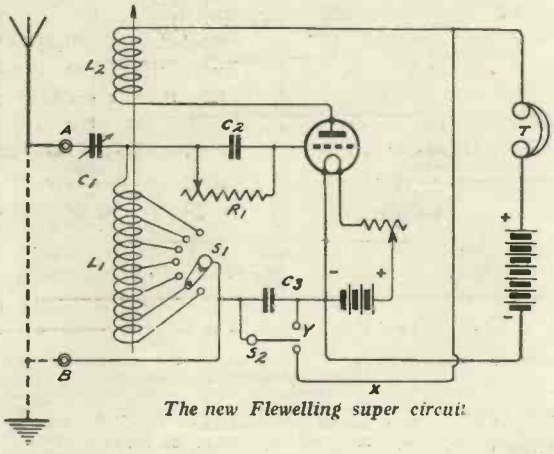
With the probability of an early report from the Broadcasting Committee, the prospect is certainly brighter than it has been for many months, and in a very short time broadcasting should attain the national popularity which it well deserves; but, we repeat, *all* outstanding hindrances to this development must be definitely and finally removed before September next. It will be a very serious error of judgment on somebody's part if public enthusiasm in the autumn is wrecked by unedifying and really unimportant disputes.

A NEW FLEWELLING SUPER CIRCUIT

The following article is based upon the contents of a letter sent exclusively to "Wireless Weekly" by the inventor of the circuit.

THE Editor has received an interesting letter from Mr. E. T. Flewelling, in which he encloses a circuit diagram of his latest super circuit.

This circuit is reproduced in the accompanying figure. It will be seen that the arrangement is very much simpler than it originally was. Any ordinary reaction circuit may be changed into a Flewelling circuit by the use of a 0.006 μF fixed condenser and an additional connecting wire. In the figure it will be seen that the variable condenser C_1 is included in series with the aerial, rough tuning being accomplished by the inductance L_1, which is tapped, the switch S_1 being connected to earth. In the grid circuit there is the usual grid condenser C_2, having a capacity of about 0.00025 μF. This condenser is shunted by a 0 to 5 megohms variable gridleak R_1; a Watmel variable gridleak, which has been submitted for test to this journal, will prove satisfactory for this purpose.



The new Flewelling super circuit

Between the earth and the negative terminal of the filament accumulator is a fixed condenser, C_3, having a capacity of 0.006 μF. A switch, S_2, is shown in the circuit. When the switch is on the top stud, Y, the whole circuit acts as an ordinary regenerative circuit, but if the switch is on the lower stud the circuit operates as a Flewelling receiver. The lower stud, it will be seen, is connected to the top side of the telephone receivers T, while between the telephones and the negative terminal of the accumulator is the high-tension battery.

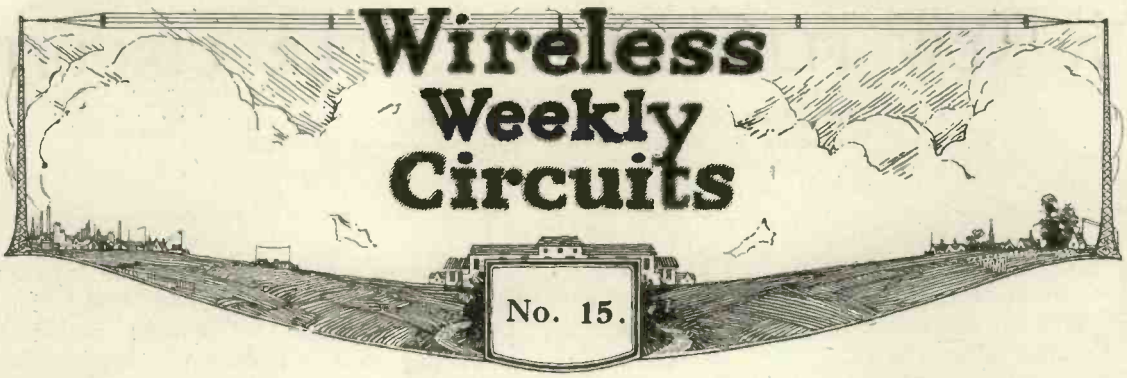
The reaction coil L_2 is tightly coupled to the inductance L_1, and when using the circuit as a Flewelling the only adjustments, apart from tuning, are the gridleak R_1 and the filament rheostat.

The dotted connection in the circuit, joining the aerial and earth terminals, is employed when no aerial is used; connection to the earth, however, remaining.

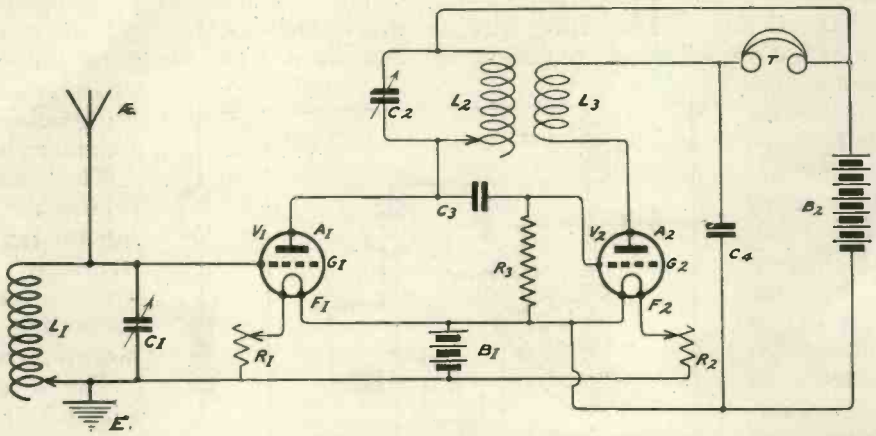
The circuit may be adapted to a frame aerial, excellent results being obtainable.

As is usual in the case of new circuits, we test them out before recommending them to our readers, and in the next issue of WIRELESS WEEKLY an article will appear by A. D. Cowper, M.Sc., a member of our editorial staff, and the winner of the recent Armstrong Super competition, organised by the Radio Society of Great Britain. Mr. Cowper introduced one or two slight modifications, but he finds that the circuit works exceedingly well and just as effectively as the original circuit described in WIRELESS WEEKLY.

We are advised by the Griffin Wireless Supplies Co. that the ST100 circuit may be seen and heard working with a frame aerial at their showrooms, 80, Newington Causeway, S.E.1. The firm claims that results are extremely good when used with their "Hedgehog" type of transformers.



A Tuned-anode with Reaction Receiver



COMPONENTS REQUIRED.

L_1 and
L_2 : Two variable inductances.
C_1 and
C_2 : Variable condensers having a maximum capacity of 0.001 μF.
R_3 : A gridleak having a resistance of about 2 megohms.
R_1 and
R_2 : Standard rotary filament rheostats.
T : High-resistance telephone receivers.
B_2 : 60-volt high-tension battery.
B_1 : 6-volt accumulator.
C_3 : A fixed condenser of 0.002 μF capacity.

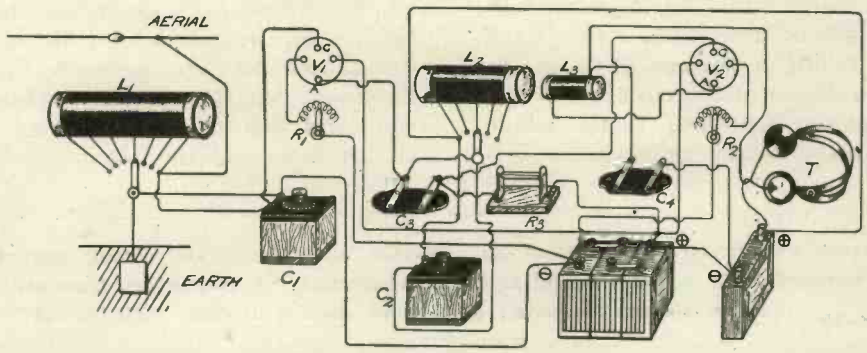
GENERAL NOTES.

This is the ST34 circuit in which tuned anode coupling is used, reaction being introduced from the anode circuit of the second valve.

The circuit may be used for the reception of British broadcasting.

VALUES OF COMPONENTS.

The inductance L_1 may be a cardboard tube 3in. diameter, wound with No. 26 double cotton covered wire, tappings being taken at the 10th, 15th, 20th, 30th and 40th turns. The tuned anode inductance is an inductance coil wound on a 3in. tube; 50 turns are provided, tappings being taken at the 20th, 25th, 30th, 35th, 40th, 45th and 50th turns. The reaction coil is wound with similar wire on a 3½in. tube, 60 turns being provided.



METHODS OF TELEPHONY CONTROL

By P. P. ECKERSLEY, Chief Engineer of the British Broadcasting Co.

In the following article this well-known wireless engineer deals with the practical problems of wireless telephony transmissions.

TELEPHONY control methods are legion. It is curious that one finds so few variations in amateur arrangements, and that experimenters do not try out more varied methods. It is the object of this article to suggest various types of telephony control and give diagrams showing the circuits.

In the first place, there are certain broad distinctions to make, and one may divide systems into:

(*a*) Trigger control.
(*b*) Power control.

By trigger control I mean methods which rely for their action upon the fact of the voice variations releasing energy in large quantities in some way or another, the action depending upon some instability in the circuit. In these types of control absence of distortion cannot be guaranteed. By power control is meant a method of control which actually and directly varies the input power to

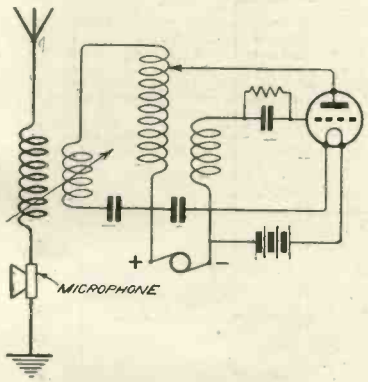


Fig. 1.—An early form of transmitter.

the oscillating valve. Let us first examine trigger control systems, as these are of interest to the amateur because of their economy.

Microphone in the Aerial

In Fig. 1 is illustrated one of the earliest known types of wireless telephone transmitters. The only important thing to notice is that a coupled circuit must be used. It may be asked at once why is this included as a "trigger control"? To my mind, the microphone in the aerial gives, to a certain extent, wavelength control as well as amplitude control. On talking into the microphone, the wavelength of the aerial system is, I think, minutely varied, and therefore it becomes different from that of the closed circuit, the net result being a bigger change of aerial amps. than would otherwise be the case. I must say I have no real experimental evidence to prove this one way or another; it is merely the result of quite casual investigation at one time and another.

The circuit of Fig. 1 is so simple that it may be asked why it is not more often used. The answer is also simple—it is just because about 0.2 to 0.3 ampere is the maximum aerial current that can be handled by a microphone of the ordinary type.

You know, of course, that methods of producing continuous waves were invented before the valve. Every wireless engineer started experimental wireless telephony, using the arc as the generator for the carrier wave. To get any distance they had to use several amps. in their aerial because no amplifying valve existed and crystal reception alone could be used at the receiving end. Thus inventors had a happy time inventing microphones that would deal with amps.

There were all sorts of ingenious arrangements actually made and used, young Niagaras that shivered into spray when one shouted, and other abominations. . . . I wonder if they were ever asked "to increase modulation, old man," and what they did, and whether their signals "were quite O.K.?" . . .

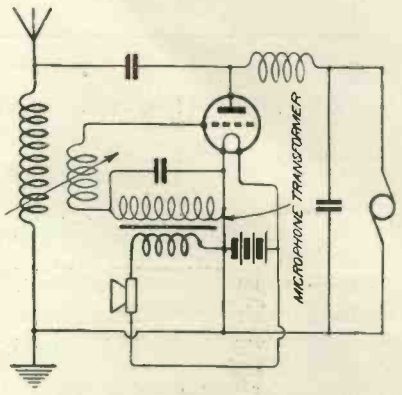


Fig. 2.—Illustrating grid control.

Truly, we owe a lot to the valve. Anyone, however, using 0.1 to 0.2 amps. (and 10 watts!) will find this method of control gives very good speech when correctly adjusted, but will find adjustment a little critical.

Grid Control

Fig. 2 gives a sketch of grid control—to my mind quite the nicest form of control for economy and efficiency. It involves only the one oscillating valve and a microphone transformer—in most cases nothing else.

Grid control is quite definitely a wavelength control as well as an amplitude control. It is efficient on waves below 800 metres; above this wavelength it is no good. This is rather an interesting fact, and the reason for it is not at all obvious.

With certain valves it is a good plan to connect a choke of the order of tens of henries in series with the supply, the reason again not being obvious.

I think, in the case of certain valves which are apt to be a little unstable, the choke has a stabilising effect and tends to stop "breaking," *i.e.*, too strong modulation causing the set to stop oscillating. The choke will be found useful if the user is experimenting with fine mesh valves working on high tensions of about 1,500 to 2,000 volts.

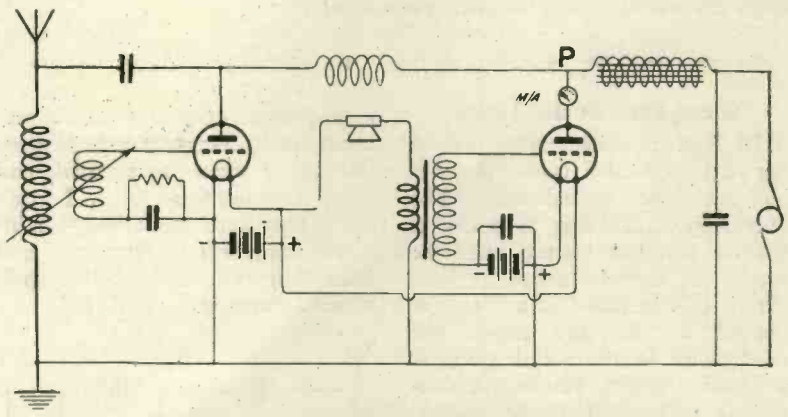


Fig. 3.—Showing arrangement of circuit for choke control.

The chief point to note with grid control is that the adjustment of the reaction coupling must be looked to, the best way being to set the reaction coupling so that it is just enough to maintain stable oscillation—no more.

Some seem to find virtue in connecting valves in the grid circuit, one way or another. Personally, I have designed and used sets up to ½ kw. (500 watts), using just the circuit of Fig. 2 without ever needing to complicate the apparatus by introducing valves. I have found no better speech or ease of handling by using this method, always provided plain reaction is in use.

Choke Control

Turning now to power control, the first and foremost of these is choke control. This is an American invention, but I think I am right in saying that it was used by Capt. Round and Major C. E. Prince in their experiments at Chelmsford in 1913. The circuits are very familiar, of course, but they are given again in Figs. 3 and 4.

The control is purely a power control, the choke working as an auto-transformer and varying the voltage of the applied E.M.F. to the oscillator in sympathy with the voice as applied through the microphone to the microphone transformer, and thence to the main control valve. Everything is beautifully straightforward and, if properly designed, there need be no distortion, no trigger action, and, with fullest control, the voltage of the point P may vary between O and +2E, where E is the applied E.M.F.* Thus the aerial power may be made to fall to zero or rise to double its steady value with the voice variations. Of course, this can never been seen on the aerial ammeter because the changes are so rapid and the ammeter so sluggish in action.

Many experimenters may think they will get greater ranges by forcing up their aerial current to the neglect of their control system, but it is obvious that 0.5 of an amp., which is varied between 0.1 to 0.9 with the voice, will give far louder telephony signals than a current of 0.9 which is varied between 0.8 and 1.1—in the latter case the voice vibrations are a mere ripple on top of a strong "carrier." In the first case a variation of 0.8 is obtained, and *variation* is what really counts.

In every case I have seen, the control has been neglected and the aerial amps. have been worshipped. What is the good of "radiating 1.1" (always, of course, with 10 watts) if you are not controlling it? *To get proper control the feed to the oscillator should equal the feed to the control valve.*

This means that the control valve will get very hot because it will have to stand the full loss, whereas the oscillating valve only has to stand the deficiency losses. Put 150 watts (100 milliamps., say, at 1,500 volts) into an oscillating valve, and if the efficiency of the system is 50%, 75 watts

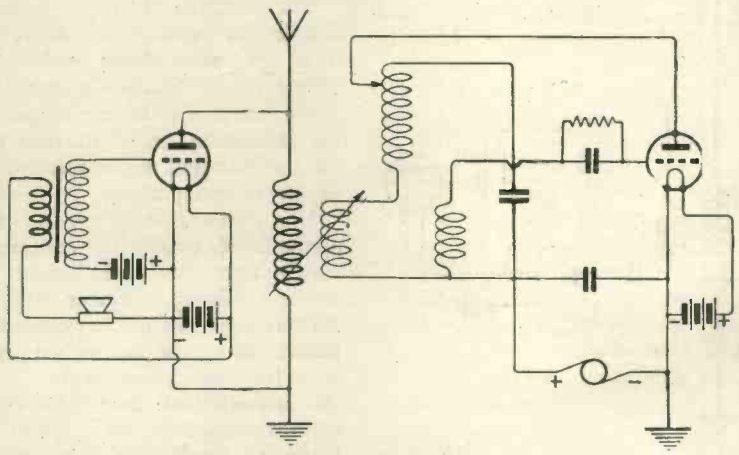


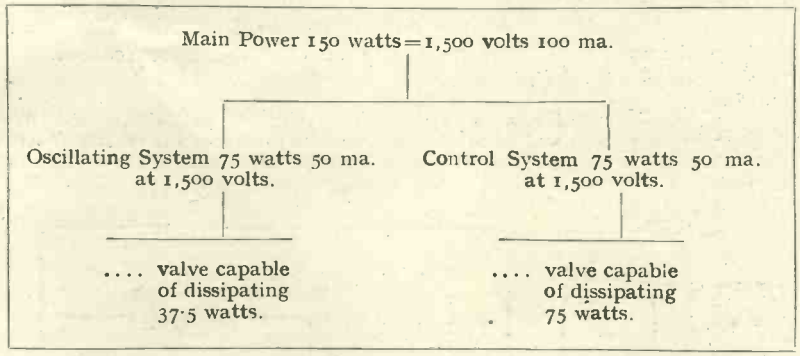
Fig. 4.—Another method of power control.

* This is a theoretically possible maximum.

will go into the oscillating circuit and set up oscillations therein; 75 watts will be dissipated in heat at the anode of the valve. (At 100% efficiency an R valve would keep quite cool with 1,000 kilowatt input and 1,000 amps. in the aerial. *Note:* It would be amusing to see what happened if the aerial ceased to oscillate! Finish 1 R valve!!)

But if 150 watts are put direct on to a control valve, the plate must stand 150 watts, twice as much as the oscillating valve, and therefore the control valve must be able to stand at least twice as much loss at its anode as the oscillator.

Thus, take our 150 watt set, and write down the genealogical table:—



Now the aerial current will be $\frac{1}{\sqrt{2}}$ of its value when all, or nearly all, the power went into the oscillating system, but no fear need be felt; the power is going to the right of our genealogical table, and is working to *control* the aerial current. You have no ocular proof of this, but ask your friends if they have not aural proof. If you are designing this 100 watt transmitter, meaning by the P.M.G.'s regulations that you may not put more than 100 watts into your oscillator, remember that for choke control you will require a 200 watt generator, 100 watts for your oscillator, and 100 watts for your control. Don't worship the amp.; it's the control of the amp. that counts.

Now there are further considerations in the control system, and the first and foremost, if freedom from distortion is required, is to realise that the control valve must have negative potential on the grid so that the transformer is not loaded on its positive voltage excursions. The way to test things is to get a milliammeter in series with the valve, see Fig. 4, and to note when you talk into the microphone whether this wobbles. Remember it must *not* wobble appreciably, otherwise the control valve must be rectifying and the speech must be becoming distorted. You will need to obtain a very open mesh grid valve and adjust the negative potential to suit conditions.

If you do this, and if you can get hold of a really good microphone, there is no reason why your speech and music should not be just as good as that from 2LO—your problems, as a matter of fact, will be less in some respects, inasmuch as you are dealing with far less power. Of course, I know a microphone that gives faithful reproduction is hard to come by.

Absorption Control

Leaving choke control at last, we now come to so-called absorption control—a type of control sometimes used with a good deal of success by radio engineers, and incidentally the type used by Capt. Round and Mr. Ditcham in their original broadcasts from Chelmsford in 1919, when a power of 15 kw. was used on a highish wavelength, using aerials 400ft. high. (Would that such powers and aerials were allowed to-day for broadcasting, but perhaps all my readers don't agree.)

The system is just the same as that used in Fig. 1; it is, in fact, a way of putting the microphone in the aerial, only a microphone which is able to stand the full current. Again, for the same reason, a coupled circuit must be used, because it is absolutely impossible to keep the system stable otherwise.

The above gives basically the main systems of telephony control that have been used commercially at one time and another. In my next article I propose to go further into the question of telephony control systems, and discuss the future development and the possibility of no carrier wave transmission, and so on. In fact, I shall leave the well-known behind, and talk about what development may lead to in the future.

Questions & Answers on the Valve

A COMPLETE COURSE ON THERMIONIC VALVES

By JOHN SCOTT-TAGGART, F.Inst.P., Member I.R.E., Author of "Thermionic Tubes in Radio Telegraphy and Telephony," "Elementary Text-book on Wireless Vacuum Tubes," "Wireless Valves Simply Explained," "Practical Wireless Valve Circuits," etc., etc.

PART XIII

(Continued from Vol. 1, No. 14, page 788.)

Draw a Circuit showing a Crystal Detector followed by two stages of Low-frequency Amplification.

Fig. 1 shows such a circuit. The theory of its action is very simple; the rectified pulses passing through the primary T_1 produce low-frequency current variations in the secondary T_2, and these are amplified by the first valve.

Draw a Three-valve Circuit in which the first Valve acts as a Detector and the other two Valves as Low-frequency Amplifiers.

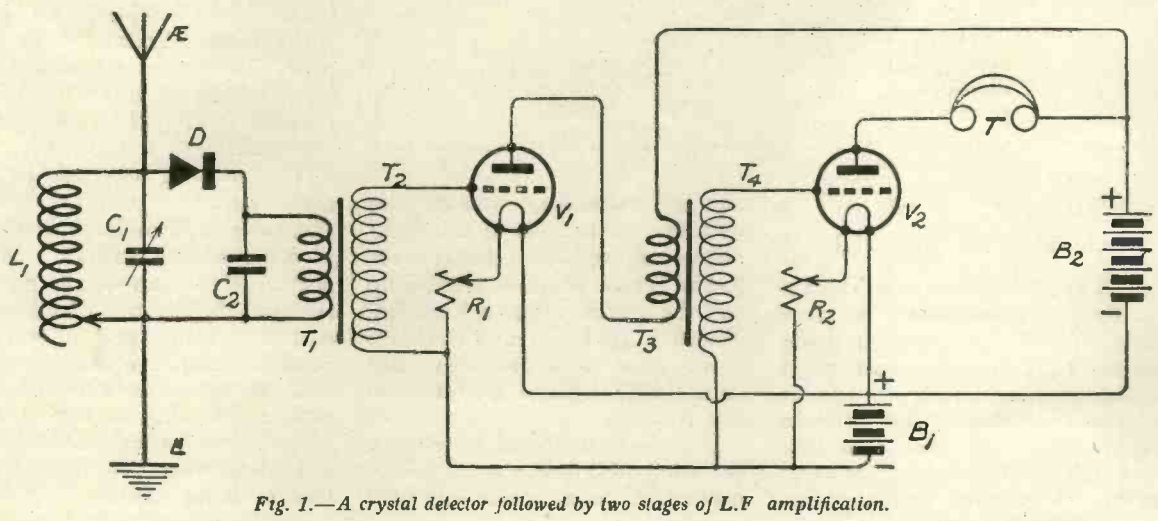


Fig. 1.—A crystal detector followed by two stages of L.F amplification.

The amplified currents then have their voltage stepped-up by the inter-valve transformer T_3, T_4, and are then applied to the second valve, which amplifies them still further.

When is this sort of Circuit a desirable one to use?

This circuit may be recommended when the receiving station is within ten miles of a broadcasting station, and it is desired to work a loud-speaker. Good loud-speaker results could not be obtained, usually, above five miles on such a circuit, but loud signals in telephone receivers may be obtained up to considerable distances.

Fig. 2 shows the circuit. The first valve acts as a detector on the leaky grid condenser principle, while the second and third valves act as low-frequency amplifiers.

What are the advantages of a Circuit of the Fig. 2 type?

This circuit will give louder signals than a circuit in which the rectification is accomplished by a crystal detector. Moreover, it is

more reliable, as there is no crystal to get out of adjustment. The circuit cannot be regarded as the most effective way of using three valves, but it is certainly the simplest, as the only adjustment to be made is the tuning of the aerial circuit.

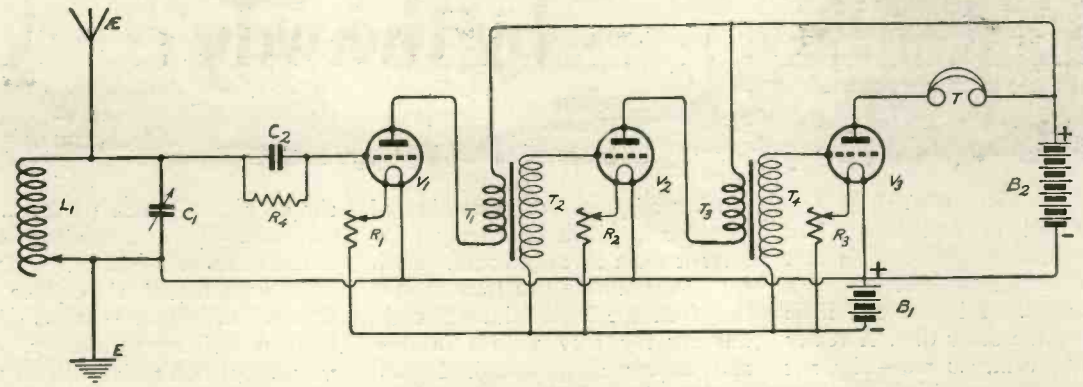


Fig 2.—A valve detector followed by two stages of L.F. amplification.

In a previously given circuit, a crystal detector and telephones were connected across the tuned anode oscillatory circuit of a high-frequency amplifying valve. Could the Crystal Detector be replaced by a Valve Detector?

Yes. Fig. 3 shows a theoretical arrangement of the circuit. It will be seen that the oscillations in the aerial circuit are impressed on the grid of the first valve V_1, the amplified oscillations flowing in the circuit L_2, C_2. Across this circuit L_2, C_2, are connected the grid and filament of the second valve V_2, which acts as a detector. In the grid circuit of this valve we have the grid condenser C_3 shunted by the resistance R_3. In the anode circuit of the second valve we have the telephones T. The amplified oscillations in the circuit L_2, C_2, are detected by the valve V_2 in the usual way, just as if the circuit L_2, C_2, were part of an aerial circuit. The fact that this circuit is in the anode circuit of the first valve makes little difference.

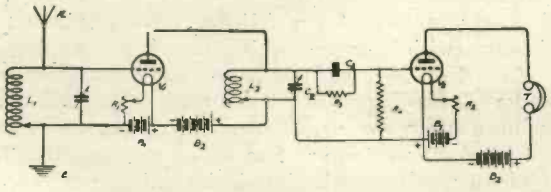


Fig. 3.—Showing how a crystal detector may be replaced by a valve when the crystal is preceded by a H.F. valve.

Redraw the Fig. 3 Circuit in practical form, using a Single Accumulator and a Single High-tension Battery.

Fig. 4 shows the practical circuit redrawn.

In Fig. 4 what is the value of the Grid Condenser C_3 and the Gridleak R_3?

The grid condenser C_3 has the usual value of about 0.0003 μF (microfarad), while R_3 has a value of 2 megohms; this latter resistance may be a variable gridleak, if desired.

Why is it that the Gridleak R_3 is connected directly across the Grid and positive side of the Accumulator B_1, instead of across the Grid Condenser C_3?

The gridleak is connected across grid and filament because, if it were connected across the condenser C_3, the grid would receive a positive potential from the high-tension battery B_2. This potential would be communicated to the grid through the gridleak; but, since the leak is connected in the position shown, the condenser C_3 effectively prevents the positive potential of the high-tension battery affecting the grid of the second valve.

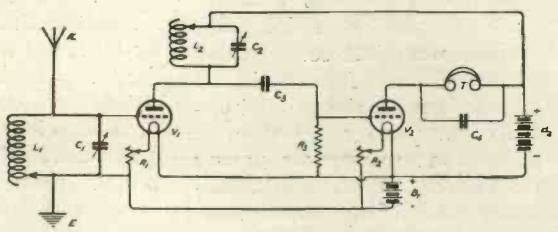
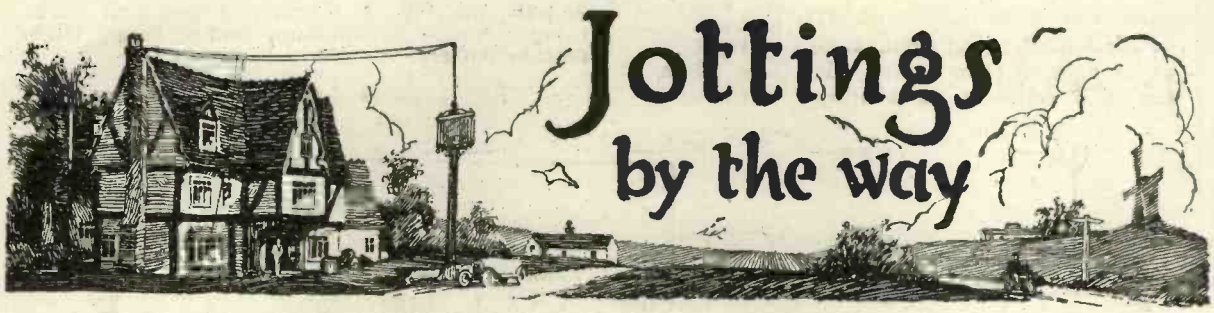


Fig. 4.—The circuit shown in Fig. 3, but using single L.T. and H.T. batteries.



A Sad Affair.

IT is sad to find how often one's fondest hopes, one's best ideas, somehow fail to work out properly. I had a sad little experience the other day. A really great idea came to me—why not use lines of aluminium paint for making connections beneath the surface of the panels? You see the possibilities! Gone would be the need for soldering joints or for tightening down inaccessible nuts. As the connecting links would present towards one another edges no more than a thousandth of an inch or so thick capacity between them would be of negligible dimensions. If you wanted to make a condenser, what could be easier? You would merely take a piece of mica and dab a patch of aluminium paint on either side of it; then you would connect up, and, whilst the set was working, you would continue to dab until the results were just so.

But when with feverish hands I had traced out a simple trial circuit upon a piece of ebonite, it refused, alas! to function in any way whatever. Tests with a milliammeter and a high-tension battery were instructive. Even when the E.M.F. was raised to 100 volts a thick line of the paint would not pass current enough to produce the slightest flicker of the instrument's pointer.

Instead of a new conductor I had in fact discovered a very excellent insulator! This is surprising at first, for the paint consists of tiny particles of aluminium suspended in solution. Apparently the medium is not very volatile, and when the paint dries, each particle of metal is left with a thin coating of grease or something of that kind, which effectively insulates it from its neighbours. Still, even though fate has thus smitten me upon the head with her club, burying my rosy visions in dust and ashes; and, though I shall not be able to write a wondrous article beneath the fine headline, "Really Wireless Wireless," yet I think that there is something in the idea. If some cunning maker of pigments can devise a metallic paint that will conduct well when dry, he should reap a fortune, and all of us will shower blessings upon his head.

Ten Years Too Late.

I suppose that every one of us has thought for a moment at some time or other that he was on the eve of giving birth to some epoch-making invention. An inspiration comes. The theory is undoubtedly all that it should be, and when a model is put together it works perfectly. Then we hasten with trembling steps to one of the Great Men of Wireless, to whom we display diffidently yet with a very proper pride the child of our brains and hands. "Quite a good idea," he says, after a brief examination. "Let me see, I first used it ten years ago. I think it was invented by ———." He names one of the pioneers of wireless, and, thanking him, we glide from his presence. This habit that people have of forestalling one's inventions is really most reprehensible.

Another Nasty One.

But quite another kind of experience even more soul-shaking may come your way as it once did mine. You make up some very simple device which performs excellently. There is nothing extraordinary about it—in fact, it seems so obvious that you feel sure that dozens of people must have thought of it for themselves. You use it, but don't give it a thought as a possible aid to fame and fortune. Then one day you see the thing announced in a vast advertisement as the most marvellous of discoveries for the wireless man's ease and comfort. Everyone rushes to buy it; no set is complete without it. The man who puts it on the market buys a Rolls-Royce, and you retire into your shell to brood upon the grossly unjust conduct of Fate. These little things will happen in this vale of tears. For a lady, Fate has a most muscular arm, and when she hands you one for yourself she usually does it pretty well.

The Case of Snorkings.

Some fellows, however, seem to go on asking for it for a pretty long time before she loses her temper and lands them a really saucy one. Take, for example, that fellow Snorkins, who spent his whole time in inventing every conceivable thing from excuses to tall stories, from complicated corkscrews to self-adjusting rheostats. Most of his brain-waves worked out pretty well. Mrs. Snorkins was trusting enough to swallow without demur the nine hundred and seventy-two ingenious and varied excuses which he gave in the space of five years for arriving home on the stroke of midnight. The tail stories won him a reputation in certain circles as a genius; in others they sufficed to place him upon a pedestal as the world's

most able liar. With his corkscrews and other gadgets he had a measure of success. His prosperity made him boastful, patronising, and a general nuisance. So far, Fate had withheld the spanking of which he was so badly in need. She let the man go on just to see what he would do.

Eventually he turned out his single-control, self-tuning, no-aerial wireless receiver, presenting the model proudly to Mrs. Snorkins. It was a beautiful thing. The ebonite panel contained nothing but two knobs standing side by side in its midst. There were no terminals, no visible wires. The first knob had a pointer which travelled round a scale marked Eiffel Tower, Radiola, Brussels, London, Birmingham, and so on. The second bore the words "louder" and "softer" with beautiful curly arrows pointing in opposite directions. To use the thing you set the pointer of the first knob against the station desired, then you moved the second so →, or so ←, until the sounds were suited to your ear.

The Bludgeon Falls.

Mrs. Snorkins became a wireless enthusiast on the spot. As she is more than a little deaf, the second knob remained permanently at its maximum setting, which caused the loud-speaker hidden within the cabinet to emit a blare of noise that could be heard from cellar to attic. The first knob's pointer was seldom on the zero mark. Mrs. Snorkins would wake up at three in the morning and switch on WJZ. Throughout the day she had Königswusterhausem, Rome, Paris, and Lyons pouring forth melody for her delectation to fill in the gaps between the broadcasting hours of our home stations.

Snorkins, like Frankenstein, had created a monster that was beyond him. For him life became one long horror of mingled Jazz, Wagner, weather reports, and talks on feeding babies, from which there was no escape at home. For a time he wandered sadly about the streets growing daily more wan-looking. Eventually he was run in for assaulting a perfectly harmless man engaged in giving an open-air wireless demonstration. His conduct at the police station was so remarkable that he was kept under observation. Finally, he was removed to Colney Hatch, where, I learn, he is now engaged in perfecting an apparatus for delivering parcels by wireless.

Bumble Takes a Hand.

It is proposed, I see, that in future the erection of aerials shall be controlled in some measure by local authorities. This seems very right and proper. You cannot nowadays erect a garage or even a toolshed in some places without submitting the most detailed plans to the Panjandrums of your town or village and obtaining their august consent. But as things are you may splice together with old bits of rope a clothes-prop, a broom handle and an old umbrella and erect with their aid an aerial that, besides being an eyesore, is also a menace to the lives and property of your neighbours. If you do not wish to make the thing secure, no power on earth can compel you to do so, though, should it crash through the next-door greenhouse during a gale, or fall upon your fellow-man's devoted head, he can sue you for pretty heavy damages.

In theory, the idea of control of some kind is beautiful, we are agreed; but how would it work out in practice? I foresee breakers ahead. You may have a council, or whatever the body is that does these things, which, knowing nothing of wireless, will make the most absurd regulations. At Little Puddleton, where we are all for solidity, I think that telegraph-poles stayed with stout wire will become *de rigueur* for aerial masts, anything slighter being looked upon as too flimsy to be safe.

A friend who lives in a near-by townlet tells me that there they expect that the artistic touch would rule. Poles would have to be tall, slim, and of graceful proportions, whilst the truck would be replaced by a finial of some emblematic design. Each place will evolve its own particular aerial. Probably in half a century collectors will go in hordes to Christie's to bid madly against one another for a typical Wigglesby Magna mast, or for a pair of the quaint insulators that decked the back gardens of Great Gubblesthorpe, 1923.

A Good Idea.

Seriously, though, I think that the suggestion that aerials should be inspected and passed fit is thoroughly sound. To judge from those that one sees, many people have derived most of their knowledge of spars and cordage from the pictures of Mr. Heath Robinson. Aerials of the most precarious type have sprung up during the summer on every side. Many of them, though suspended from quite thin poles, have no sort of staying, and the slightest breath of wind sets the crazy masts swaying. What will happen when the autumn gales burst upon us and do their worst goodness only knows. I venture to prophesy that there will be some pretty pieces of recrimination between landlord and tenant over damaged roofs and chimneys, and between neighbours over gardens laid waste, party walls razed and chicken runs decimated by falling aerials. It would be to everyone's advantage to have definite rules and regulations for the erection of aerials and a proper system of inspection.

WIRELESS WAYFARER.

A THREE-VALVE BROADCAST RECEIVER

By E. REDPATH, Assistant Editor.

The following article deals with the completion and assembly of this self-contained receiving set.

(Concluded from Vol. 2, No. 1, page 10.)

The Intervalve Coupling Coils

DETAILS of the intervalve coupling coils are given in Fig. 7. The primary coil, which is ultimately to be connected in series with the first anode variometer, consists of a wooden

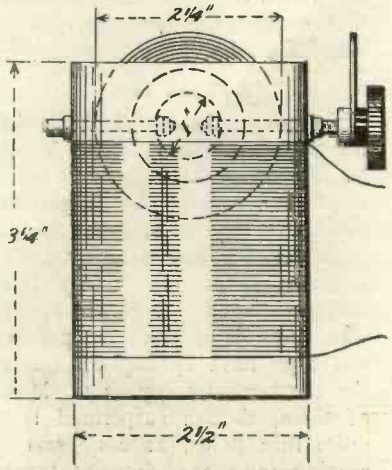


Fig. 7.—Details of the coupling coil.

ball mounted upon brass spindles in a similar manner to a variometer rotor, and fitted inside a cardboard tube (preferably impregnated with paraffin wax) carrying the secondary windings

The primary coils consist of 26 turns of No. 22 s.w.g. d.c.c. and the secondary coil of 100 turns of No. 36 s.w.g. d.c.c. copper wire, no "tappings" being provided. When ultimately connected up in the set, the effect of reversing the connections of this secondary coil should be tried.

The Secondary Condenser

This condenser may either be purchased complete, in which case a capacity of 0.0003 μF should be specified, or may be built up from standard parts as mentioned in the specification of materials required. For a preliminary trial the condenser may be omitted and the secondary coil (L_2 in Fig. 4) used as an aperiodic coil, in which case the effect produced by the later addition of the condenser can be observed.

The Small Fixed Condensers

Details of one of these condensers are given in Fig. 8. Three are required, each consisting of four copper foils separated by thin mica (about 1-500in. thick), the area of overlap of the plates or foils being $\frac{3}{4}$in. square. These condensers will form C_1, C_3 and C_4 of Fig. 4. For the condenser C_5 twice as many foils should be employed, whilst for the condenser C_6, if it is decided to fit one, 8 foils with an overlap of $1\frac{1}{4}$in. by $\frac{3}{4}$in. will be found satisfactory.

The Crystal Detector

So many designs for crystal detectors have appeared in these pages that none will be given in this present article. As already mentioned, the type of detector which gives a fairly firm contact, such as zincite-bornite, is to be preferred, provided that really good crystals are used, the only reason for the use of the "cat-whisker" type of detector in the writer's set being that no really good crystals of zincite or bornite were available. When actually fitted to the set, or rather in the preliminary assembly to be described presently, the effect of reversing the connections to the detector should be tried.

The L.F. Transformers

On account of the close proximity of the various components in a set of this description, it is desirable that the low-frequency transformers used should be screened, and it is found that the ironclad type, as fitted to the writer's set, are very satisfactory.

Those experimenters who make a special point of constructing as much of their own apparatus as possible will find full particulars of a serviceable L.F. transformer in *Modern Wireless*, No. 3, or in the author's handbook "How to Make a Unit Wireless Receiver."

The Preliminary Assembly

Fig. 9 shows pictorially the method which is strongly recommended in the case of any receiving set which is at all complex. Although three standard valve panels, with the usual four terminals and filament rheostat, are shown, it is to be understood, of course, that if these are not

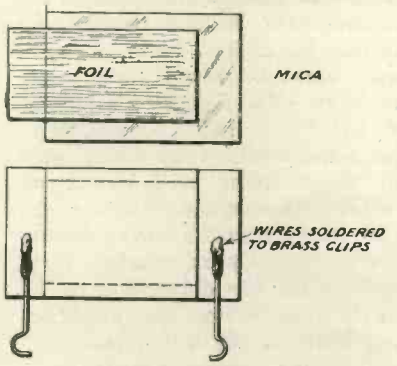


Fig. 8.—One of the small fixed condensers.

available the three valve holders already specified for this set may be secured to the wooden board and wired up to the terminals and a single filament rheostat.

This preliminary assembly not only enables various small adjustments, such as the capacities of the fixed condensers and changes in the direction of coil connections, to be effected very readily, but, in addition, it affords to the inexperienced constructor a clearer insight into the details of the arrangement and the functions of the various component parts. It is also a comparatively easy matter to test the individual circuits and components separately by suitably altering the connections. If any difficulty is experienced with the variometers, it is also a simple matter to connect a crystal and a pair of phones across each variometer and connect up to the aerial and earth, in which case the arrangement forms a simple "variometer-tuned" crystal receiver, and will enable a good estimate to be formed of the wavelength range of the variometer.

The capacity values of the two condensers C_1 and C_3 (Fig. 4) should then be adjusted experimentally until each is approximately equal to that of the aerial.

When all the components have been completed and carefully tested in the preliminary assembly, it remains to assemble them finally upon the back of the ebonite panel and fit all complete into the containing box.

The photograph, Fig. 10, is a front view of the completed panel, and shows the disposition of the various controls, valve-holders, crystal detector and terminals. As the overall dimensions of some of the components to be used by readers will vary, it is not considered necessary to give a "drilling plan" of the ebonite panel itself.

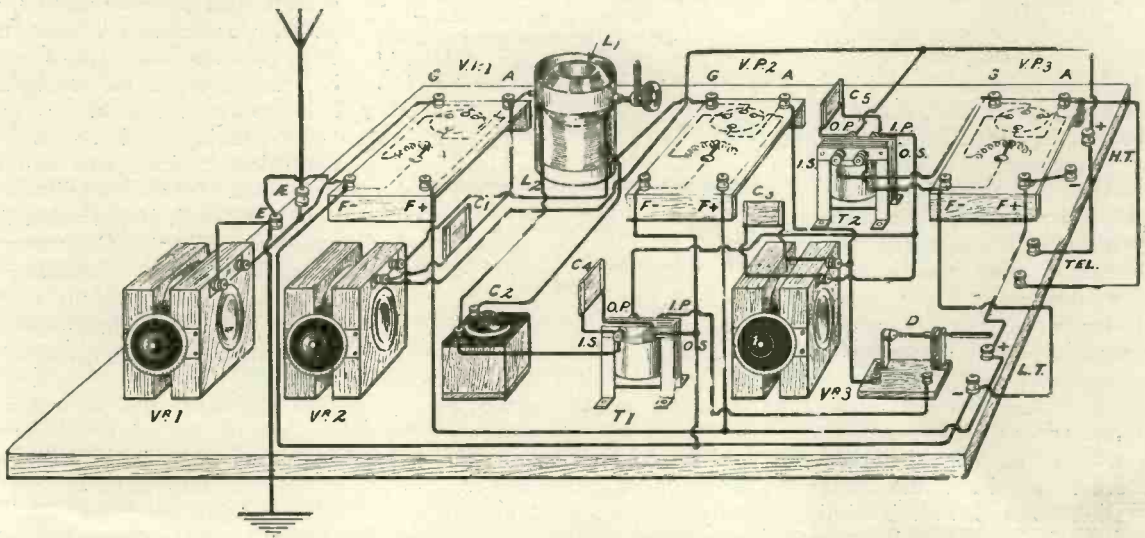


Fig. 9.—The arrangement and connections for the preliminary assembly.

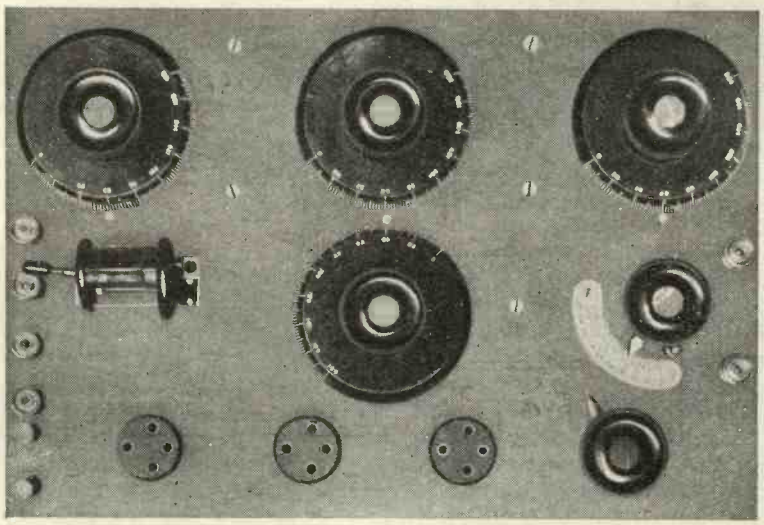


Fig. 10.—Front view of the completed panel.

The Containing Box

Full details of the containing box are given in Fig. 11, reference to which will show that provision has been made for including the 60-volt high-tension battery and either a small accumulator for use with the ordinary type of valves or dry cells for lighting the filaments of dull-emitter valves.

The overall dimensions of the box are such that a standard Vio-lina loud-speaker can be fitted as shown in a previous photograph (Fig. 1); but if this is not desired, and if the batteries are to be external to the set, the contain-

ing box need only measure 13in. by 9in. inside, by about 4in. deep. In any case the details of jointing and the choice of material are left to the skill and taste of the individual reader.

Wiring Up

It is in the final assembly and connecting up of a set that a great many readers experience difficulty and frequently go wrong. In the present set there are three different types of circuit; firstly, the filament lighting circuits; secondly, all the grid circuits; and, thirdly, all the anode circuits.

Reference to Fig. 12, which is a complete back-of-panel wiring diagram, will show that these respective circuits are indicated by different types of lines, and if the various circuits are wired up in the order named and the connecting wires covered with insulating sleeving of different and distinctive colours, the probability of any error will be considerably reduced, whilst the completed arrangement is very easily checked over.

Black sleeving is recommended for the filament lighting circuit, represented by heavy black lines in the wiring diagram, Fig. 12; green for the grid circuit; and red for the anode circuit. Any readers who experience difficulty in wiring up their set from the necessarily small diagrams appearing in these pages may, in this instance, obtain a full-size blue print wiring diagram by forwarding a postal order for 1s. 6d. to the Editor of this journal.

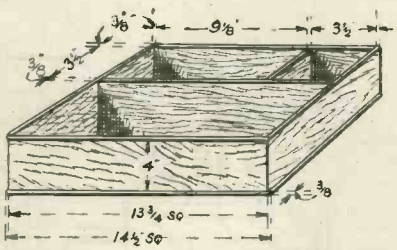


Fig. 11.—Details of the containing box.

Operating the Set

When trying to receive actual signals with the components temporarily assembled, as shown in Fig. 9, some little difficulty may be found owing to the arrangement being so very selective.

The tuning will be rendered much less critical, and therefore easier, until the correct adjustments are ascertained, if the small fixed condensers (C_1 and C_3) across the second and third variometers, are omitted; whilst for all preliminary testing the coupling between the two coils L_1 and L_2 should be tight.

In the absence of a wavemeter or tuning-tester of some description, by means of which the various circuits may be calibrated, no hard and fast rules can be given. The aerial tuning variometer, when used in conjunction with an average experimental aerial, will tune

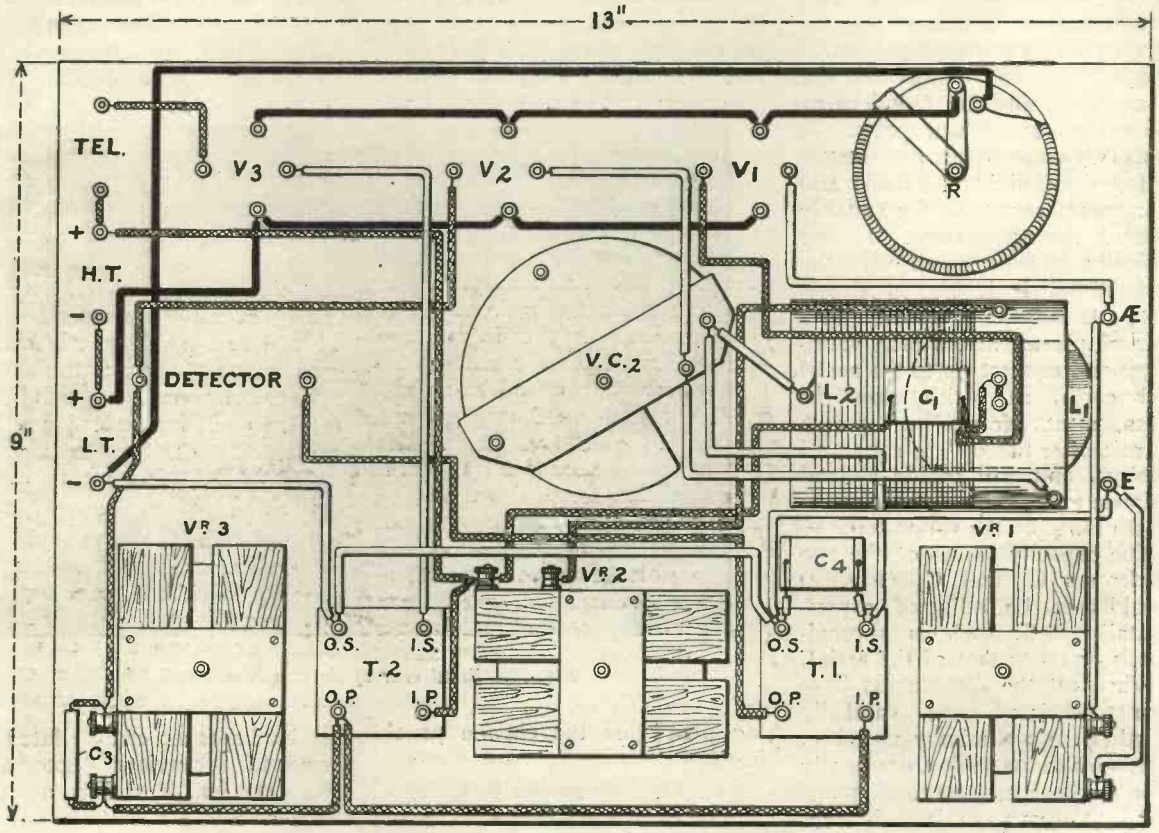


Fig. 12.—A complete back-of-panel wiring diagram.

in waves from about 300 to about 450 metres.

An Alternative Circuit

For those readers who care to experiment with a view to simplifying the arrangement, and incidentally noting which gives the best results, an alternative circuit arrangement is shown in Fig. 13. In this arrangement it will be noted that the coupling coils between the first and second valve are dispensed with, and electrostatic coupling employed. The variable condenser already on hand may be used for this purpose, and is to be connected as shown at C_4 in Fig. 13.

It will be observed that the grid of the second valve V_2 is connected to the negative side of the filament battery *via* the secondary of the "reflex" transformer T_1, this winding being shunted by a small fixed condenser C_3, as before. The effect of omitting this condenser, also of introducing into the grid circuit at the point marked X a high-frequency choke coil consisting of about 100 turns of No. 36 s.w.g. d.c.c. copper wire wound upon a cardboard tube 2½in. in diameter, should be tried. The secondary coupling coil may, of course, be used for this purpose instead of winding a new coil.

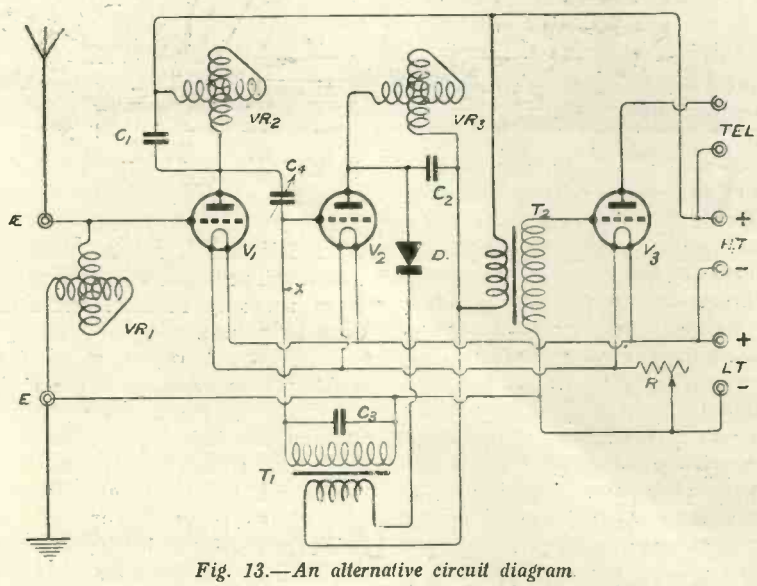
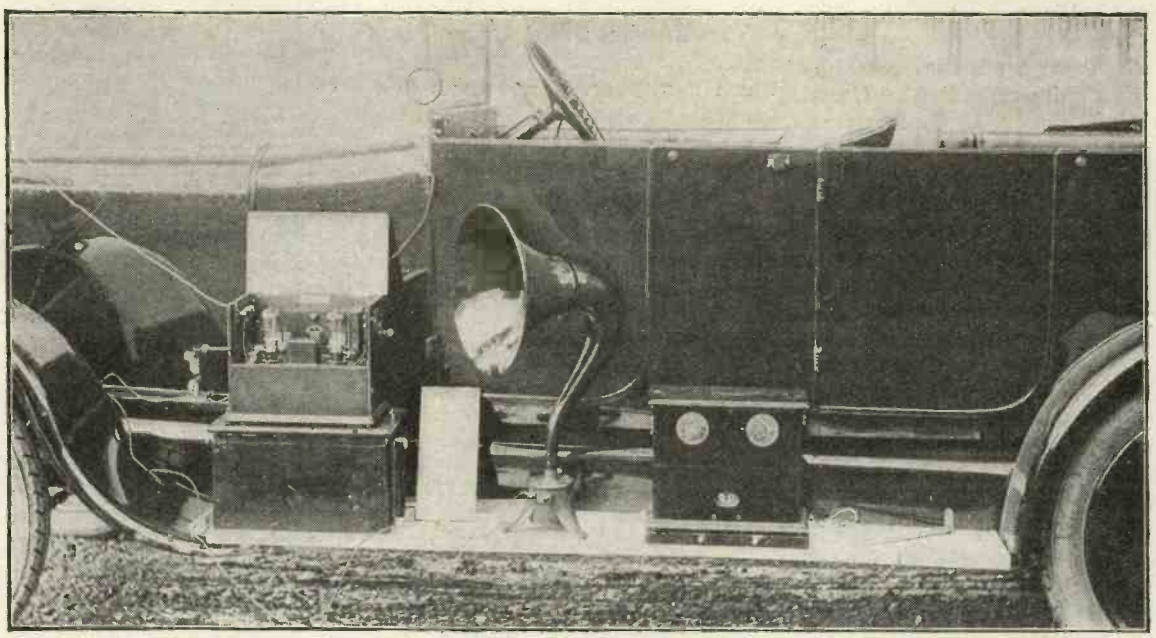


Fig. 13.—An alternative circuit diagram.

WIRELESS RECEPTION ON SMALL CARS



The popular interest in broadcasting has become so great that large numbers of people are taking apparatus with them in the open-air. Our photograph shows a B.S.A. car equipped with a Marconiphone V2 and power amplifier.

News of the Week

WE learn with interest that a School Radio Society has been started under the auspices of The Radio Society of Great Britain. An inaugural meeting was held on Saturday, July 14th. Mr. Hibberd, of the Grayswood School, Haslemere, who has for a long time been interested in the introduction of wireless in the school is to be the Honorary Secretary.

Mr. Hibberd, it will be remembered, contributed an article entitled "Wireless in Schools" in our issue dated July 11th. All schools having their own society should communicate with a view to joining, and it is suggested that a complete syllabus of work and lectures should be sent to all schools. We understand that at the time of going to press some 50 schools have already promised to join. Members of the Committee will be Mr. L. F. Fogarty, Mr. R. Carpenter, Mr. Pocock, Mr. Hannaford Brown, Mr. Galvin, Dr. Ritchie, and Mr. L. McMichael. It is further suggested that the subscription fee for Public Schools should be 3 guineas per annum and for Secondary Schools 1 guinea.

It is announced that a provisional wireless receiving station has been opened at Tulear, Madagascar, which will receive messages from passing ships within a radius of 250 miles between 9 and 11 a.m. and within a radius of 600 miles between 7.30 and 9.30 p.m. local Madagascar time. The call-sign of this station is FTL.

The Board of Trade has learned from the British Vice-Consul at Punta Arenas that direct wireless telegraphic communication between Punta Arenas and Stanley, Falkland Islands, has been re-established. The hours of working are from 10.30 to 11 a.m. and from 6.30 to 7 p.m.

At present messages are only received at Punta Arenas for Stanley, but it is hoped eventually to handle traffic for all parts of the world.

We are informed that there is no truth in the rumour that the venue of the new South Coast broadcasting station is to be altered. It has been definitely decided to erect the station at Bournemouth.

The Empire Press Union recently held an annual meeting, at which a number of references to wireless matters were made by Lord Burnham and other speakers. Lord Burnham remarked that the question of telegraphic communication was a crucial one for the Empire. He was a member of the Business Council of the Post Office, and had been present at many of the discussions upon the subject which had occurred at the meetings of that body. It seemed that one of the greatest difficulties in the way of a satisfactory settlement of the difficulties of wireless communication was the fact that the Postmaster-General changed once a fortnight. The fourteenth annual report of the Council made a reference to wireless telegraphy in which it was hoped that the decision of the Government to admit private enterprise to Empire wireless would lead to speedy utilisation of this means of communication upon a commercial basis. Wireless telegraphy had during the past year been employed but little for press purposes in the United Kingdom, owing to lack of high-power stations, whereas it had been employed largely by American newspapers for transmission of news from Paris and Hanover to New York, Philadelphia and Chicago.

At a luncheon given by the B.B.C. in London on July 20th prizes were distributed to the winners of the Wireless Man Hunt Competition. The names of the successful gentlemen are: Mr. A. Trill, of Croydon; Mr. C. Fleming Williams, of Letchworth; and Mr. C. Outler, of Forest Gate.

We are given to understand that the anticipated report of the Broadcasting Committee must not be regarded as being in any way final, in that the report will be made to the P.M.G., who will then negotiate with the parties concerned. To say the least this is very disappointing.

A case of some interest to listeners-in was heard at Southend County Court recently. An electrician had been sold a wireless set for broadcast reception, which he later discovered was not stamped and had been made by an amateur. He found that he could not obtain an experimental licence and accordingly brought an action for the value of the set, in which he was successful.

At the conference of the Urban District Councils' Association of England and Wales at Llandudno,

it was unanimously decided that the executive council should be instructed to consider the question of the control by local authorities of the erection of wireless aerials. It was stated that the matter had become of vital importance owing to the enthusiasm of wireless experimenters, who were not as competent as telegraph linesmen to fix overhead wires and apparatus with that regard to safety which was imperative, especially in the case of wires erected over public thoroughfares. Among the risks were damage by fire, insecurity, masts in dangerous proximity to public roads, and chimneys becoming dangerous through attachment of aerial apparatus.

The Austrian Marconi Co., Ltd., has recently been formed, with a capital of £133,000. Marconi's Wireless Telegraph Co., London, subscribed £93,000, and the Austrian Government the remaining £40,000. The company has the exclusive right to conduct wireless traffic between Austria and all other countries for a minimum period of 30 years. We understand that several new stations will be erected, and it is anticipated that traffic will be opened before the end of the year.

We notice that provision is being made for tuition in wireless at the London University, Gower Street. A syllabus of lectures and demonstrations for July 7th included subjects dealing with wireless, and an exhibition of wireless telephony apparatus by Prof. J. A. Fleming, F.R.S., took place in the Electrical Lecture Room.

During the last voyage of the *Saxon Prince* from Newport News to Rio de Janeiro, one of the seamen was taken seriously ill, and instructions were given by the captain to the wireless operator to ascertain if there was a ship in the vicinity carrying a doctor.

A reply to the wireless call was received from a Spanish steamship *Manuel Arnus*, bound from Teneriffe to San Juan (Porto Rico), and the vessels altered their course in order to meet. As they were approaching each other instructions as to treatment were wirelessed from the Spanish ship.

In view of the fact that the *Manuel Arnus* is equipped with wireless direction finding apparatus the result of bearings taken caused the vessels to meet with minimum delay. The Spanish surgeon boarded the *Saxon Prince*, and on examining the patient found that the case was serious enough to warrant his removing the seaman to his own vessel. The transfer was accomplished without delay and the vessels renewed their interrupted voyages.

The Black Bros. Orchestra which has frequently contributed to the B.B.C. programmes.

AMMETERS AND VOLTMETERS FOR WIRELESS USE

By Dr. J. H. T. ROBERTS, Staff Editor.

The following article deals with the principles underlying the construction of these well-known instruments, together with their use in testing.

IN almost every branch of electrical science the ammeter and the voltmeter may be said to be fundamental measuring instruments, the former for measuring the strength of electric current, the latter for measuring the voltage, or electrical pressure, which determines the flow. There is a considerable variety both of ammeters and voltmeters, and as the wireless experimenter frequently requires to know the suitability of an instrument for his particular purpose, it will be useful to give a short account of the general principles underlying the construction and use of these instruments.

The Ammeter

It was explained in the series on "Electricity and Magnetism"

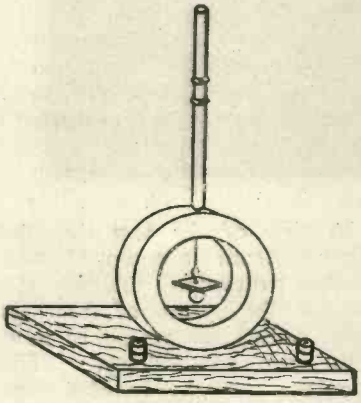


Fig. 1.—Illustrating principle of electromagnetic ammeters and voltmeters.

that an electric current produces several characteristic effects, which include the thermal, electro-magnetic, and the electro-chemical effects. Any of these may be employed as the basic principle in an electrical measuring instrument, but the one which is most useful for general purposes, and which is commonly used, is the electro-magnetic effect.

If a magnetic needle be suspended at the centre of a vertical

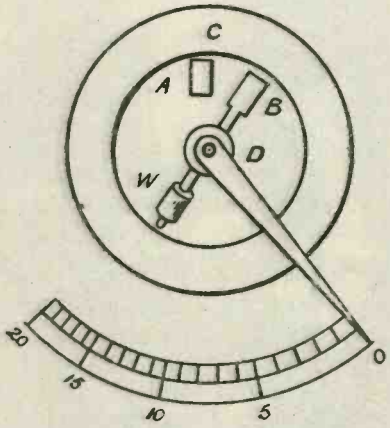


Fig. 2.—Principle of "moving-iron" instrument, "gravity control."

coil of wire, the electro-magnetic field set up in the region of the coil when an electric current passes through the wire causes a deflection of the needle, and the amount of this deflection is an indication of the strength of the current which is flowing in the coil. This is the action which is made use of in the construction of the most common form of ammeter. In practice, however, since an ammeter usually requires to be portable, it is necessary to introduce various modifications from the simple arrangement which has just been mentioned.

Before dealing with the various types of instrument, it will be well to fix our ideas by considering an actual specimen in the shape of a

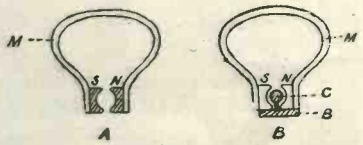


Fig. 3.—(a) Permanent magnet of moving-coil direct current Weston ammeter. (b) Showing fixed soft-iron cylinder for producing uniform magnetic field.

"moving-iron" instrument with what is called "gravity control." Such an instrument is indicated in Fig. 2. C is a cylindrical coil of wire through which the current flows. A is the end view of a short bar of soft iron placed with its length parallel to the axis of the coil. B is a similar bar of soft iron which is mounted on a pivot and balanced by a weight W of non-magnetic material. A pointer is attached to the movable system BW, and, by means of a scale, the angular displacement of the pivoted system may be read off. When a current passes through the coil, the two soft iron bars A and B are magnetised, both with the same polarity, and they repel one another to an extent which depends upon the strength of the current.

Classification of Instruments

Ammeters and voltmeters may be classified in various ways.

(1) According to whether they are intended to be used with
(*a*) Direct current.
(*b*) Alternating current.
In some cases instruments designed for use with alternating current may be employed for direct current, but direct current instruments are not available for use with alternating current.

(2) According to the principle upon which they are based,
(*a*) Hot-wire.
(*b*) Moving iron.
(*c*) Moving coil.
(*d*) Induction.

(3) According to the controlling force which acts against the force created by the current,
(*a*) Gravity control.
(*b*) Spring control.
(*c*) Magnetic control.

Further classification may also be made according to whether the instrument is intended to be portable or for switchboard use, and also as to whether the dial is to be in the form of a flat disc, like the face of a clock, or in the form of a horizontal or vertical scale.

The instrument which has been briefly described above is *not* of the portable type, since it requires accurate adjustment in order that the pointer shall be on the zero of the scale when no current is flowing through the instrument.

Weston Moving Coil Instrument

The construction of the Weston moving-coil instrument may be taken as typical of that of the moving-coil class of ammeters. In Fig. 3 (A) is shown a permanent horse-shoe magnet with pole-pieces S, N, attached so as to leave a cylindrical space in which a small rectangular coil of wire may rotate about an axis co-axial with the cylindrical tunnel. The intensity of the magnetic field in S, N in Fig. 3 (A) will be greatest at the parts where the pole pieces come close together and will be less at the intermediate parts. In order to provide a uniform field in which the coil may rotate, a soft-iron cylinder C is introduced, as shown in Fig. 3 (B). This has the effect of making a practically uniform air gap across which the magnetic flux must travel, with the result that in the central parts the lines of magnetic force due to the permanent magnet are very uniformly spaced. A small rectangular coil of very fine wire is wound upon an aluminium frame and is pivoted, in watch-jewels, so as to be capable of rotation about an axis coincident with that of the soft-iron cylinder. To this coil is attached a very light aluminium arm, which moves across the scale and indicates the angle of deflection of the coil when a current flows through it.

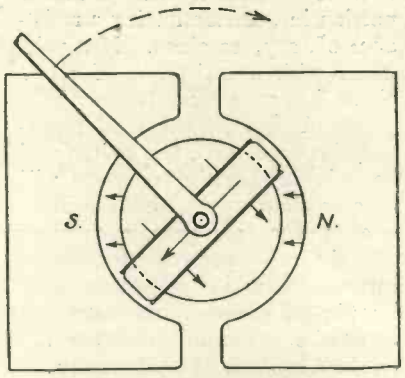


Fig. 4.—Showing the moving coil.

In Fig. 4 the magnet is supposed to be lying in a horizontal plane, the axis of rotation of the coil being vertical. Above and below the coil is a hair-spring, similar to that used in a watch, the upper and lower hair-springs being opposed and being slightly unequal in strength. The controlling or restoring force, tending to bring the coil and the needle back to zero position, is thus equal to the difference between the forces exerted by the upper and lower springs. These springs also act as leads, the current passing into the coil through one spring and out through the other. When a current passes through the coil, the latter behaves as a magnet, and rotates in the magnetic field between the poles S, N, taking up a final position in which the deflecting forces due to the electro-magnetism are balanced by the restoring forces due to the hair-springs. After the scale of the instrument has been calibrated by means of currents of known strengths, it may be used for determining strengths of other currents.

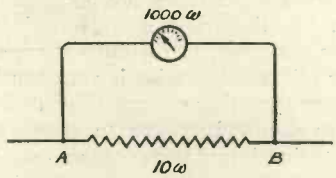


Fig. 5.—The voltmeter circuit must not take sufficient current to upset the circuit conditions.

Employment of Ammeter

One of the primary requirements in any measuring instrument, whether electrical or otherwise, is that its employment shall not upset the conditions which it is designed to record. Thus an ammeter which is designed for measuring current in a circuit must not, by its introduction, materially alter the current in the circuit. This means that the internal resistance of the ammeter must be very small.

It will be evident from the description which has just been given that the resistance of the small coil of fine wire may be considerable, but this difficulty is readily overcome by connecting across the terminals of the ammeter a low resistance, known as a "shunt." If the relation between the resistance of the shunt and the internal resistance of the ammeter is known, the proportion of the current which will take the path through the ammeter is known, and the scale may be calibrated accordingly.

For example, suppose the resistance of the ammeter coil is 9 ohms and the resistance of the shunt is 1 ohm, then one-tenth of the current will flow through the ammeter, and if the position of the needle when 1 ampere is flowing through the coil be marked "10 amperes" and so on, the scale will indicate the total current flowing through the ammeter and the shunt combined.

In some instruments the shunt is incorporated in the instrument itself, and is called a self-contained shunt. Sometimes, however, par-

ticularly where it is desired to use an ammeter for a large range of current-strengths, a set of shunts is supplied with the instrument, each shunt giving to the scale reading of the instrument a different set of values. For example, if in the case mentioned above the 1-ohm shunt were removed and a shunt of $\frac{1}{10}$ of an ohm were substituted (the relation between the internal resistance and the shunt

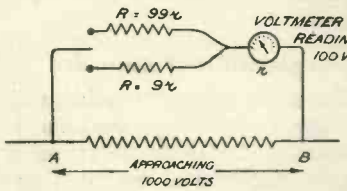


Fig. 6.—Increasing the range of voltmeter by means of series resistances.

resistance being now 99 to 1) a total current of 100 amperes would only result in 1 ampere passing through the ammeter, and hence the readings would need to be multiplied by ten, or, in other words, the range of values indicated within the scale would now be increased ten times.

An ammeter must always be included *in series* in a circuit in which it is desired to measure the current, and, as we have said, its net resistance must always be very low so that its introduction into the circuit does not materially increase the resistance of the circuit, as otherwise the current indicated by the ammeter would be less than the current which was flowing before the ammeter was introduced.

The hot-wire ammeter and induction instruments will be dealt with on another occasion.

The Voltmeter

Voltmeters which are employed in ordinary practice are almost invariably of the electro-magnetic type and usually are neither more nor less than *ammeters* of high resistance. It may be said, in other words, that the principle of the common voltmeter is identical with that of the ammeter. Just as the ammeter must have a *low* resistance, so as not to upset the *current* conditions of the circuit, so the voltmeter must have a *high* resistance so as not to upset the *voltage* conditions of the circuit.

In Fig. 5 is represented a portion of a circuit, the particular portion in question having a resistance of, say, 10 ohms. If a voltmeter with a resistance of 1,000 ohms be connected between the points A and B, the total resistance between these two points will be reduced, but the reduction will be extremely small, and for practical purposes we may consider that the small current which flows through the side circuit represented by the voltmeter circuit does not upset the potential difference between A and B. Consequently, if the voltmeter has previously been suitably calibrated, it will indicate the required voltage between the two points A, B.

Testing H.T. Batteries

A voltmeter is frequently employed for testing the condition of high-tension batteries. It is well known that the current-capacity of small dry cells, such as are commonly employed in the construction of H.T. batteries, is very small. If, therefore, the internal resistance of the voltmeter is too low, the current which flows through the instrument may be sufficiently great to cause partial polarisation of the batteries, with the result that the voltage drops and the indication of the voltmeter is incorrect. If a voltmeter of this type be employed for testing secondary batteries (" accumulators "), the difficulty referred to does not arise, as the current capacity of such batteries is very much larger than that of small dry cells. Care should be taken to ascertain that the internal resistance of a voltmeter intended for the testing of H.T. batteries (or in any other case where the current capacity of the system is limited) is sufficiently high, otherwise perfectly good cells may fall under suspicion or be actually condemned. If there is any reason to doubt the indications of the voltmeter, and the internal resistance is not known, it is a good plan to test the cells on a second voltmeter, and note whether there is any considerable discrepancy between the indications of the two instruments.

Another way in which the unsuitability of a voltmeter may sometimes be noticed is the gradual dropping of the indicated voltage as the cells are left connected to the instrument. When

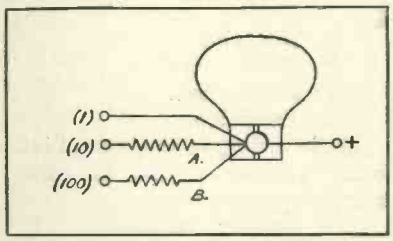


Fig. 7.—The principle of Fig. 6 incorporated in voltmeter instrument.

the voltmeter is connected to the battery the reading should remain absolutely steady; if it gradually falls, this probably indicates that the internal resistance of the instrument is too low, and that polarisation of the cells is taking place, but, of course, it may also indicate the presence of faulty cells in the battery.

The range of a voltmeter may be increased in a manner somewhat similar to that described above for an ammeter. Instead, however, of placing a *shunt* across the terminals of the instrument, *resistance* is included *in series* with it. The reason for this can best be understood by reference to Fig. 6. Suppose the voltage between the points A and B is to be determined and the range of the instrument is between 0 and 100 volts, whilst the potential difference between A and B is approaching 1,000 volts. If a resistance R be included in series with the instrument, R having a value nine times as great as that of the internal resistance of the voltmeter, then the combined resistance in the voltmeter circuit is ten times what it was originally, and the potential difference between the terminals of the instrument will be one-tenth of the potential difference between the

(*Continued on p.* 70.)

RANDOM TECHNICALITIES

By PERCY W. HARRIS, Staff Editor.

In these notes are discussed many points of interest to the radio experimenter and listener-in.

IN America practically the only form of commercial radio-frequency coupling utilises transformers, which are sold in a form similar to that of audio-frequency transformers. Many of them have iron cores, the laminations being extremely fine so as to cut down to a minimum the losses due to eddy currents. Practically all such transformers have an optimum magnification on 360 metres (the standard broadcasting wavelength in America). The fact that nearly all broadcasting is done on one wavelength makes it a simple proposition to design a transformer which is efficient on such receptions. In this country, where we have different wavelengths for different stations, the problem is not so easy of solution.

American radio-frequency transformers appear to be very inefficient compared with our own methods of coupling, and for this reason have not achieved such a wide popularity. The tuned anode method seems practically unknown in America, and in fact one rarely finds any reference to a tuned high-frequency stage, whether tuned anode or tuned transformer.

American audio-frequency transformers follow the general lines of those here, but are generally wound with finer wire, and will not stand such high plate voltages. There is a simple reason for this, as it is rarely that a higher voltage than sixty is used on the plates of any of the American valves, save where they are used with power amplifiers. These American transformers do not always act efficiently with our own valves, as their impedances are often too low.

* * * *

Most British amateurs are acquainted with the fact that if the I.S. side of the low-frequency transformer is connected to the battery side of the filament resistance in the negative lead, a negative potential will be impressed upon the grid, depending upon the voltage drop across the resistance. Thus, if we have a 6-volt accumulator and the resistance is such that the voltage across the filament terminals of the valve is adjusted to exactly four, there will be a drop of two volts across the resistance, and the grid will be two volts negative compared with the filament. While the advantage of this form of connection is fully realised by the American manufacturers, many of them cannot so wire up their instruments, as this method is covered by a patent held by one of the larger corporations. Of course it is quite possible to use one or two dry cells in the grid circuit to give the necessary grid potential. The filament battery in America is called the "A" battery, and the plate battery is called the "B" battery, thus the grid cells are quite logically called the "C" battery.

* * * *

While on the subject of grid potentials it is well to point out that the advantage of placing this negative potential on the grid is only obtainable when the voltage of the filament battery is higher than the voltage drop across the filament. Thus, if we have a four-volt valve and light it with a four-volt battery, the resistance must all be cut out, and there will therefore be no voltage drop. This point should be borne in mind by those who are about to buy accumulators, and who are under the impression that they will get all they need by buying a four-volt accumulator.

* * * *

Some very interesting experiments have recently been conducted by one of the big American broadcasting stations in an attempt to overcome the difficulty due to "dead-spots." The City of Cleveland is well known

to be such a dead-spot, and an attempt to obtain satisfactory reception of broadcasting on 360 metres proved thoroughly unsatisfactory. An attempt was then made to broadcast on wavelengths not only of 360 metres but also of 100 metres, the 100-metre reception being picked up in Cleveland on a frame aerial. It was found that the 100-metre transmission was satisfactorily received, and by means of re-transmissions the distant programme was made available to all those people in the City of Cleveland who wished to hear it. Several interesting points came out during the test, one being that daylight absorption of the 100-metre transmission was far less than that of the 360, and, in fact, that the 100-metre transmission (although on much lower power) came in decidedly better. American amateurs with transmitting licences have long since demonstrated that transmissions on wavelengths of 200 metres and below are remarkably efficient. Possibly in this country it may be found that broadcasting on 100 metres, or perhaps on still shorter wavelengths, together with re-transmissions on the standard broadcast band, may effectively solve the problem of our own dead-spots.

* * * *

Reaction on to the aerial ("criminal reaction," as I heard it termed recently) is under no ban in the United States. In fact, the larger wireless corporations, in their endeavour to popularise radio, have manufactured and sold very large numbers of sets in which reaction on to the aerial is the rule. Such sets can be fairly efficient when properly and skilfully handled, but of course are the reverse of selective, and are capable of causing just the same interference in America as we experience here. Discriminating amateurs use what are known as "three-circuit tuners," a secondary circuit being very loosely coupled to the aerial, and the plate circuit tuned and coupled back to the grid circuit, either electro-magnetically or electrostatically. Such tuners when handled with a reasonable amount of care cause no trouble whatever from radiation, and give a signal strength in excess of that available with the best single circuit tuners, while their selectivity is extremely high. In skilled hands it is quite possible to separate stations the wavelengths of which are within a few metres of one another.

Perhaps the most popular of American circuits is that in which the aerial is tuned by means of tappings on the stator of a vario-coupler, the turns being tapped in units and eights or units and tens, so that by combinations of two single-pole switches running over studs, it is possible to use any number of turns up to the maximum. The secondary, which rotates within the primary, is so arranged that with a variable condenser across it, it will tune well over the broadcast band. The plate circuit of the valve is tuned, and if the wavelengths are fairly short the inter-electrode capacity in the valve is quite sufficient to hand back energy from the plate circuit to the grid, thus giving all the reaction needed.

AMMETERS AND VOLTMETERS FOR WIRELESS USE

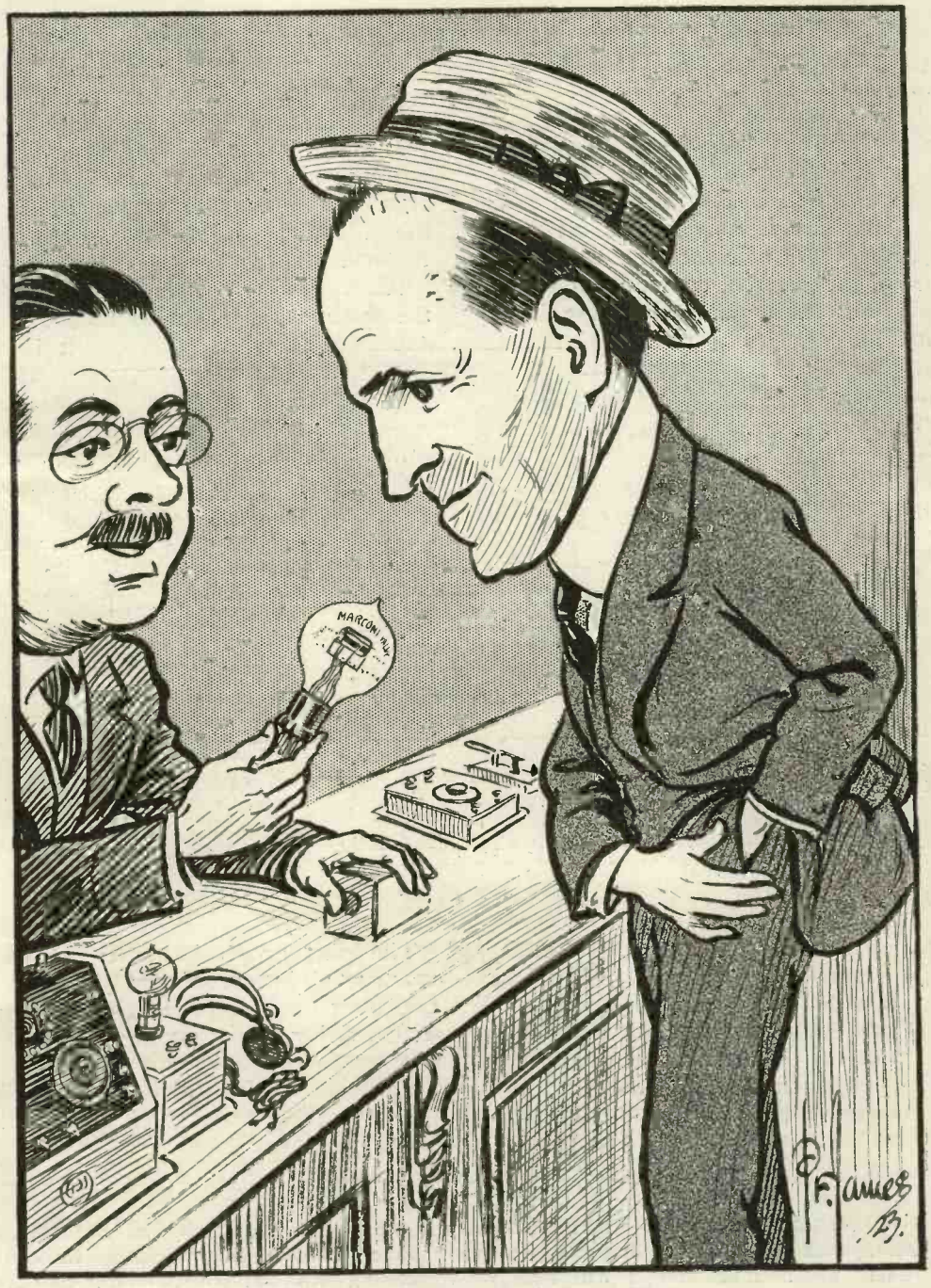
(Continued from page 68.)

points A and B. Correct readings will be obtained by multiplying the actual readings of the instrument by ten.

In practice, coils of different resistance are frequently incorporated in the instrument itself, and switching arrangements are provided so that the different ranges of the instrument may be readily obtained. This is indicated in Fig. 7, where two such coils A and B are shown. One positive terminal is provided and three negative terminals. Suppose the scale is divided for 1 volt, that is to say, the application of a potential difference of 1 volt between the terminals + and (1) will make the needle move right across the scale. Now if the resistance of the coil A is nine times the resistance of the moving coil, it will require 10 volts, applied between the terminals + and (10) to make the needle move right across the scale. The terminal (10) is so marked because when that terminal is used the whole range of the scale is 10 volts. Similarly, if the coil B has a resistance equal to ninety-nine times that of the moving coil, it will require 100 volts applied to the terminals + and (100) to produce the full-scale deflection. Suppose the whole scale is divided into one thousand divisions. When using the terminals + and (1), each division reads 1/1,000 of a volt; when using terminals + and (10), each division reads 1/100 volt, and when using terminals + and (100), each division reads 1/10 volt, which arrangement is very convenient for experimental work.

EVENTS WE NEVER EXPECT TO WITNESS

No. 3.



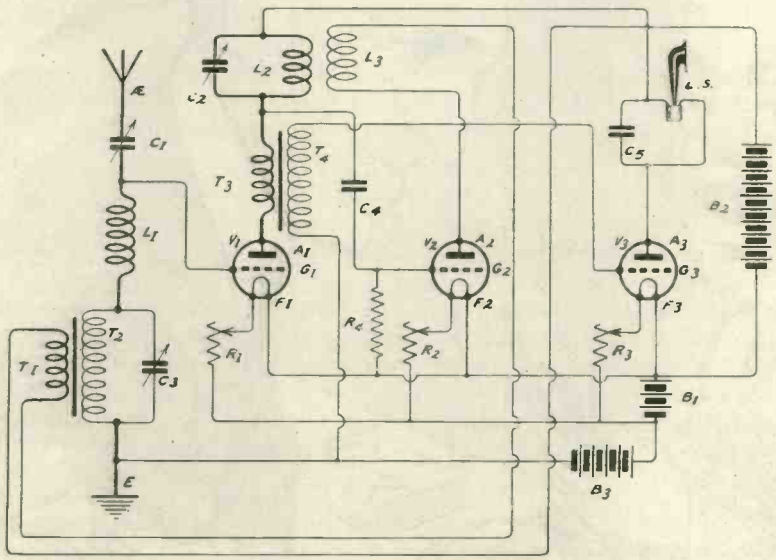
Mr. Mullard buys a Marconi valve for his broadcast receiver.

A THREE-VALVE ST76 CIRCUIT

By JOHN SCOTT-TAGGART, F.Inst.P., Member I.R.E.

This article is a continuation of the one appearing in the preceding issue of this journal.

IN the last issue of *Wireless Weekly* the writer gave details of a new two-valve reflex circuit, and it is proposed here to show how this circuit may be extended to make an exceedingly efficient three-valve set. The values of the different components are as before, but an additional valve has been added, and an extra intervalve transformer is necessary. In the accompanying figure the primary of a step-up intervalve transformer T_3 T_4 is included in the anode circuit of the first valve. The secondary winding T_4 is connected to the grid G_3 of the third valve V_3 and to the negative terminal of the battery B_3, which provides the grids of the amplifying valves with a negative potential of about −9 volts when the high-tension battery B_2 has a value of about 100 volts.



Circuit diagram of the ST76 arrangement.

The operation of this circuit is the same as that of the ST75 circuit described in the preceding issue. Care should be taken to see that the transformer T_3 T_4 is well insulated and not close to any wires going to earth. It should not, for example, be placed near the filament accumulator or high-tension battery.

As the different coils and condensers have the same values as those used in the ST75, it is only proposed to point out that a fixed condenser C_5 of not less than 0.002 μF capacity is connected across the loud-speaker. This, of course, is not essential, but will usually improve the tone.

By the use of plugs and jacks it is possible to use two or three valves in this circuit.

The photograph last week showed a set constructed in accordance with this circuit. The plug enables the loud-speaker to be inserted, either in the anode circuit of the first valve or the anode circuit of the third.

Full constructional details of the ST75 will appear in the next issue of *Modern Wireless*.

THE SHEFFIELD RELAY STATION

An account of the progress made and the difficulties encountered in connection with the above station.

THE difficulties which have hindered the progress of Sheffield's relay station were fully explained to the wireless public of Sheffield by Capt. P. P. Eckersley, chief engineer of the B.B.C., on Monday evening, July 9th. Those who had organised the meeting were gratified to find the large and stately Firth hall of the University crowded to the doors some time before the meeting was opened, and it was a fine testimony to the lively interest in wireless existing in Sheffield.

In his racy and captivating style, Captain Eckersley assumed the rôle of apologist for the B.B.C. towards the impatient amateur who wished to listen in on a crystal set, but did so, as he said, without his hand on his heart, for the difficulties were such as had to be surmounted by research or experiment. He impressed the company with the assurance, however, that the B.B.C. were anxious to do everything possible to push on the relay station so that wireless should be within the reach of everyone, and not a section only.

He explained what led them to the idea of a relay station. One of the great troubles was jamming, or interference generally. They decided that they must either receive wireless waves in Sheffield and re-transmit them, or have them sent up by telephone for retransmission at a greater power, sufficient to shout down the jamming. It was the first time in England that they had tried to do this experiment. It was a new thing. He did not believe they had done it even in America. With regard to the position of those wishing to receive distant stations direct, the solution of the difficulty was to get different wavelengths. But they were difficult to get hold of. If they put a relay station on between 350 and 425 metres there was no doubt it was going to jam the rest of the services to some extent. That problem was to be got over and the first thing the Company were asking for was a wavelength over or below the present broadcasting length. They were experimenting at present on how to do that.

They felt that the best thing to do was to set apart a wire from the parent station on the ordinary trunk routes to the transmitter, and transmit on a certain maximum length at which they could receive. But, of course, they were waiting for some money. (Laughter.) They only got five shillings per person—sometimes. If they go to the Postmaster-General and say they want a wire from London to Sheffield he would reply, "Yes, that will be £15 a night."

Captain Eckersley referred to the technical problem they were up against in the land wire method, namely distortion. Briefly their problems were: What is the wavelength going to be so as to allow of not jamming with direct reception of broadcast matter, and to enable them to receive by wireless and pass on by relay? What is the cut-off, or distortion of high and low notes going to be on the land line? And another problem was: If they are going to establish a relay station in Sheffield, what would Sheffield hear? If reception in Sheffield by relay was as he had heard it direct, they would be reminded of the "insurrection in hell" phrase recently used.

Sheffield had at that moment a station. It was not a relay station because they had not a land line or a wireless receiving station. They would send out on the station now erected regular transmissions, and hoped to do so twice a week, though if it was necessary to close down for a week at any time they must not be disappointed. The wavelength would be somewhere about the 400's.

After the speechmaking the new transmitting station was put into action, and by means of an ordinary crystal set with loudspeaker very clear speech and music was received from the Applied Science Department where the relay station is first to be fixed. The power used was 100 watts, and Sheffield generally within a radius of four miles was able to listen-in to the first broadcasting performance of the new station.

The Junior Magnavox loud-speaker.

NOW that summer has come in earnest many of our readers will be turning their thoughts to ways and means whereby broadcasting can be enjoyed in the open air with the same ideals of comfort applicable to the home.

Picnics hold a greater charm when the joys of the party are enlivened with music, and the possibility of dancing to follow also holds some attraction. Further, tennis and cricket pavilions may enjoy this new amusement, as may also garden parties, river trippers and motorists.

Those experimenters who contemplate open air reception should bear in mind the fact that loud-speakers have a considerably bigger accomplishment to perform in the open air than is the case when the instrument is used in a room.

In *Wireless Weekly*, Volume 2, No. 1, many suggestions for outdoor aerials were given, and, by means of these, experimenters will find that for reception up to 5 miles from a Broadcasting Station quite suitable apparatus is a crystal receiver coupled to a two-valve low-frequency amplifier and loud-speaker. For distances greater than this and up to approximately 18 miles, a three-valve receiver is recommended.

Should the purpose of the reception be to conduct an open-air dance, then, in order to give the required amount of volume throughout the area over which the dancers will perform, a system of sound distribution should be introduced. Loud-speakers should be installed at equal distances round the area in which the dancing is being conducted; these should be turned towards the dancers and connected in parallel with the receiver. By this means the amount of volume produced is evenly distributed among the performers without any individual loud-speaker being unduly loud. The effect will then be that, though everyone will see the instruments and hear them, no one will be able to say positively which one they are listening to.

When the programme to be received is dance music, or even opera, this method of distribution is particularly effective, for the music is "brought" right amongst the audience rather than being concentrated about the horn of any one particular loud-speaker. Again, this method reduces the number of valves required, for nothing like the same volume of sound is needed.

For conducting an open-air dance within a radius of, say, 15 miles of a Broadcasting Station, it is suggested that the best apparatus would be a single-valve receiver coupled to a two- or three-valve power-amplifier and six loud-speakers. The method of connecting these is as follows:—

From the output terminals of the

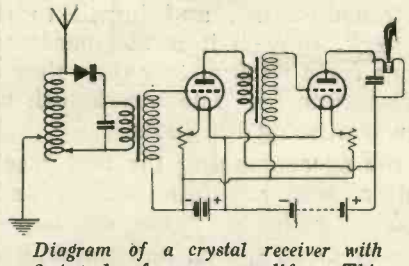


Diagram of a crystal receiver with 2-stage low-frequency amplifier. This circuit is suitable for receiving in the open up to distances of five miles, using a loud-speaker.

LOUD-SPEAKI DOO

By STANLEY G. RA

The following article contain on how broadcasting can be

The above photograph by Mr. A. Haskett wireless concert

...G OUT OF ...RS

...EE, Staff Editor.

...a few brief suggestions ...joyed in the open air.

...hows an audience listening to an open-air ...at Newcastle.

...receiver connection is made to the pri...mary of an intervalve transformer; ...he secondary is connected to the in...put of the power-amplifier, to the ...utput terminals of which are con...nected the six loud-speakers in paral...lel. The most suitable valves for the power-amplifier are L.S.2 valves with 200-300 volts applied to the plates. The loud-speakers should be of a large size, whilst all battery leads should be as short as possible and of a fairly large gauge wire.

On the river, at all times attractive while the warm summer lasts, wireless offers considerable amusement, and, further, makes the evenings more enjoyable with the pleasantness of music.

Whereas in the past the gramophone has supplied this want, times have changed, and with a little ingenuity on the part of the experimenter wireless can be made to give this amusement with even better results.

In the case of small boats not possessing masts, the aerial may be either a frame or else a cage type aerial swung between a short staff fitted at either the stern or the bow of the boat.

The earth connection is made by means of a bare copper wire, to the end of which is attached a weight, thrown over the side of the boat.

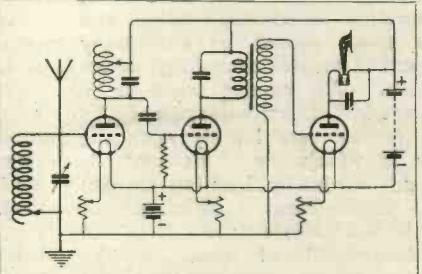
With this arrangement it may be taken that any three- or four-valve receiver will give perfectly good results, using a loud-speaker, and will produce a volume sufficiently loud to enable those on the banks of the river to hear with distinction.

Using a four-valve set with a loud-speaker, distances up to approximately 30 miles from a Broadcasting Station should be obtained.

Those readers who are anticipating a holiday on the river could do no better than take a wireless receiver with them, for on wet evenings when the river offers no attraction, nothing is more consoling than the fact that, though confined under canvas, one may yet listen to the music and news emanating from the nearest Station of the B.B.C.

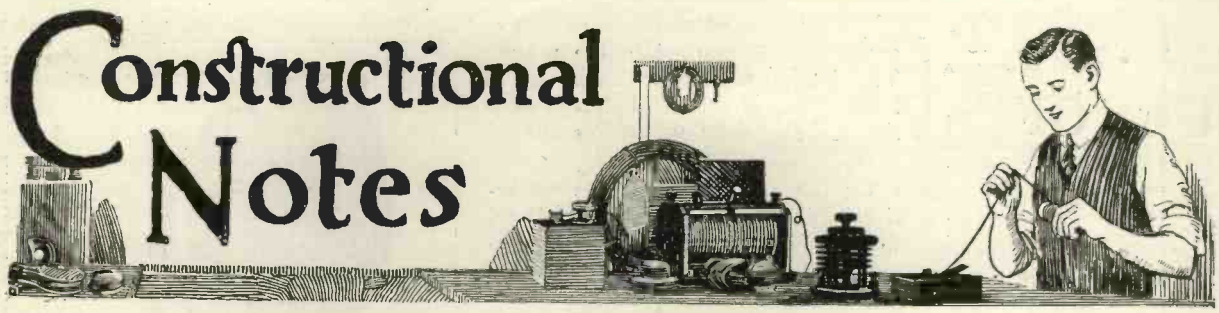
In conclusion, it is as well to carry at least one spare valve, and, should you not be using a loud-speaker, see that there are sufficient telephones for each member of the party. Another word of advice is that, since wireless apparatus is so sensitive to the effects of damp, it is as well to insulate it from the ground or deck by means of a box or mackintosh. If the set is to be used to any extent for outdoor work, it is well worth the trouble of assembling the apparatus to be used in a leather suit case, not only for purposes of portability, but also as a means of protection.

The True-music loud-speaker.



A three-valve circuit, comprising one H.F. valve, detector, and one L.F. valve, suitable for operating a loud-speaker in the open up to distances of 18 miles.

Constructional Notes



THE making of a low-frequency transformer is not a task that every amateur wireless constructor would care to tackle, involving as it does the winding of very large quantities of wire so fine that the slightest jerk will cause a break. There are, however, people who take pride in making every possible part of their set themselves, and they will find useful the constructional details given below.

There are two points of great importance in the design of a low-frequency intervalve transformer. The first is that its primary should have a large impedance; the second,

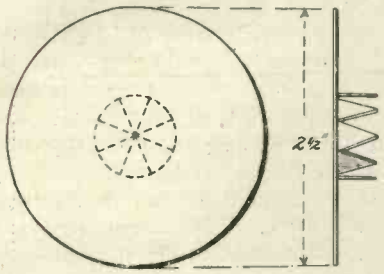


Fig. 1.—The end flanges of the transformer.

that the core should be built up of laminations or of small wires, and that these should be sufficiently numerous to provide a large cross-section. We cannot work to a definite impedance value, since this will depend very largely upon the way in which the transformer is wound and assembled; but we can aim at providing a direct-current ohmic resistance somewhere in the neighbourhood of that of the 'phones which would replace the transformer in the plate circuit of the detector valve if a note-magnifier were not in use.

As it is essential to silent working that the insulation between windings and core shall be as good as possible, we will make the bobbin of a piece of ebonite tube 3in.

MAKING A L.F. TRANSFORMER

long, with an internal diameter of ½in. The end flanges, made of stout cardboard, are 2½in. in diameter. In the middle of each is drawn a ¾in. circle, as seen in Fig. 1, which is marked out as shown. The flaps are then cut with a sharp-pointed knife and bent up as depicted in Fig. 1. After a thorough dressing with shellac the flanges are slipped on to the tube with the flaps pointing inwards. These are shellacked again and then bound tightly with silk whilst still wet.

The windings of the primary will consist of 2oz. of No. 42 single silk-covered wire. The end is soldered carefully to a piece of stout insulated wire which is anchored in the usual way to one of the flanges quite close to the ebonite tube. The end of the stout wire is allowed to project outwards from the flange, and the letters I.P. are marked on the cardboard beside it. We are now ready to begin winding.

To do this by hand is an almost impossible feat, since there will be about 10,000 turns in the primary alone, and the secondary will contain nearly two and a half times as many. If a lathe is available matters are very much simplified, for we can mount the bobbin on a mandrel. If not, some kind of winding machine must be improvised; Meccano parts can be made to serve quite well.

The fine wire is now wound on as tightly and as evenly as possible; the reel should be mounted on a spindle, the right hand feeding the wire on. When this winding is complete, solder the end to another length of stout insulated wire and anchor as before, marking the wire O.P. Cover the primary winding with a double layer of insulating tape wound like a puttee so that the edges overlap.

The secondary is put on in the same way, its ends being marked I.S. and O.S. respectively. Should a break occur during the putting on of either winding, the ends must be bared and neatly soldered together. The joint should then be wrapped carefully with silk and given a good coat of shellac. About 4oz. of wire will be required for the secondary.

The core consists of a bundle of 7in. lengths of the best soft iron

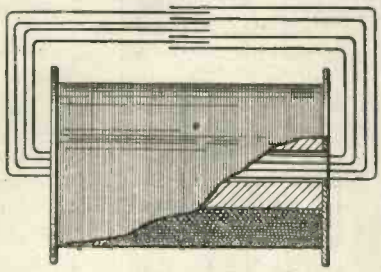


Fig. 2.—Showing the core and bobbin of the transformer.

wire of small gauge. Each length should be shellacked. The wires are made into a bundle that will just pass tightly into the ebonite tube, being firmly bound for the middle 3in. with stout thread. If the bundle is a loose fit, it should be wedged in with little wooden pegs.

The wires are now bent upwards and turned back over the bobbin to meet and overlap in the middle (Fig. 2). To reduce the reluctance of the magnetic path it is best to scrape the shellac off the ends and to bind each pair together with a few turns of very fine wire.

The whole transformer is next wound with tape and fine string to serve as a protection. The best way of mounting the finished in-

strument is to place it in a small box, packing it tightly in place with oily cotton waste, which will not collect moisture. Or if an old H.T. battery is lying about the workshop, its wax may be melted down and run into the box to make all secure. The four leads from the transformer are taken to terminals mounted on an ebonite lid made from the box.

The cost of making this transformer will be about 12s., but it will perform better and stand harder work than almost any ready-made type sold at nearly double its cost, since it contains far more wire and is vastly better insulated.

R. W. H.

AN EFFICIENT LEAD-IN TUBE

THE importance of having a good lead-in tube is not always realised; yet it may make all the difference to the quality and strength of one's receptions. If the lead-in is not well insulated on its way to the set a considerable part of the impulses brought in by the aerial may escape to earth before they reach the tuning inductance, and so do no useful work.

The tube to be described is simplicity itself, yet it is reasonably efficient. It costs very little to make, and it looks neat when mounted in the window frame, for nothing is visible either inside or outside the window but a wing nut or terminal screw and an ebonite washer beneath it.

The first requirement is a piece of stout ebonite tube with an internal diameter of ¼in. Its length must be exactly the same as the thickness of the window frame. A hole through which the tube will just pass is drilled with brace and bit in the window frame and the tube is inserted. A piece of 2B.A. screwed rod 2in. longer than the tube is now passed through it and an ebonite washer ¾in. or 1in. in diameter is placed over each end, the rod being clamped in position by nuts screwed tightly down both outside and inside the window.

The lead-in and the aerial wire of the set are fixed to the rod either by milled terminal screws or by wing nuts. The latter will be found the more convenient, since they are easy to tighten down and

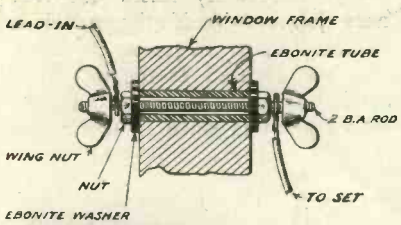


Fig. 3.—Sectional view of the leading-in tube.

unscrew. One can thus be sure of obtaining tight connections, and when the set is to be disconnected there is no need to use the pliers, no matter how hard the nuts may have been turned down.

R. W. H.

MOUNTING TUBULAR VALVES

THE V24 or "test tube" type of valve, though excellent on account of its low capacity, since the leads from filament, grid, and plate have not all to pass through one narrow pinch, has yet one great drawback.

It fits into clips which may be mounted either upon an adaptor for a four-pin holder, or may be fixed direct to the ebonite panel of the set. In either case the clips for grid and plate caps are apt to make rather a bad contact when the holder has been in use for some time.

The importance of having good connections in the grid circuit in particular is well known. In the anode circuit a poor or varying contact will lead to noises being produced in the receivers by the slightest jarring of the set, and it may even be the cause of a mysterious silence on the part of the set even when it is tuned to a wavelength upon which strong signals are known to be in existence.

There are two tips that are well worth attention. In the first place the little caps of these valves are apt to become covered in time with a layer of dirt, grease, or oxide, or a combination of the three. Their contact surfaces should be given an occasional polish with an old piece of the finest emery cloth. If your valves have been in use for some time, and if the caps are dull-looking, you will probably find that this treatment results in a marked increase in signal strength.

The second tip concerns the provision of a steadying device for the valve when it is mounted in the clips. Take a fairly stout rubber band and place it round the glass of the valve. Loop it over two or three times until it is quite a tight fit. Now run it down almost to the plate and grid caps.

Place the valve in its clips, then pull out a loop from the band and slip it over the one which makes contact with the grid cap. Take a second loop and place it over the plate clip. The valve is now held very tightly, the clips being forced against the contacts by the added tension of the rubber. No matter how the set is jarred within reason, it will not move in its setting. If each valve is fitted with a rubber band of its own, it is a matter of only a second or two to remove one from the holder and to replace it by another.

R. W. H.

SLOPING-FRONT CABINETS

THERE can be no doubt that the sloping-front cabinet is one of the best mountings for the ebonite panels of the receiving set. Besides looking very neat, these cabinets take up little space, since their extreme depth

need not exceed six inches. They are most convenient, too, for one can operate the set whilst sitting at the wireless table without having to stoop over it. Lastly, they are things that anyone who has a little skill in using ordinary woodworking tools can make quite easily for himself.

Any hard wood will do for them, though oak, which is easier to work than mahogany or teak, is perhaps the most satisfactory. The wood used should be well seasoned and half an inch in thickness.

The size of the cabinets will depend, of course, upon that of the panels used. If a standard height for the panels of, say, nine inches is adopted, all pieces of apparatus can be mounted in cabinets of uniform height, the width being varied to suit the requirements of individual units. Nine inches is a convenient height, since a panel measuring 9in. by 6in. will take a complete single-valve receiver and the reaction tuning condenser, or a high-frequency amplifying valve with its inductance and condenser. A 9in. by 9in. panel will do for two H.F. or L.F. valves, and one measuring 9in. by 12in. will serve to mount a complete three-valve set with valves, rheostats, transformers, and three variable condensers for aerial circuit, secondary and reaction.

Fig. 4 (top right) shows a finished cabinet of the largest size mentioned. The dimensions of end pieces that will suit all sizes are given in Fig. 4. These should be cut out carefully and trimmed up with the plane until all are of exactly the same size and shape. The bottom of the cabinet is 6in. wide, the front 3in., the back 11½in., and the top 3in. The length in each case will depend naturally on the size of the cabinet under construction.

The corners of cabinets made by professionals are usually dovetailed together. This, however, is a process to be undertaken only by those who are pretty good carpenters. The halved joint shown in Fig. 4 is much easier to make, and, as it looks just as well if neatly done, is strongly to be recommended. In order to provide a bed for the panel a beading of half-inch deal is fixed right round the opening of the cabinet. It should be so arranged that the panel, whatever its thickness, lies exactly flush. A very neat job results if the panel is mounted upon hinges at its lower end and secured at the top by a catch or a single screw. It can then be swung open in a moment

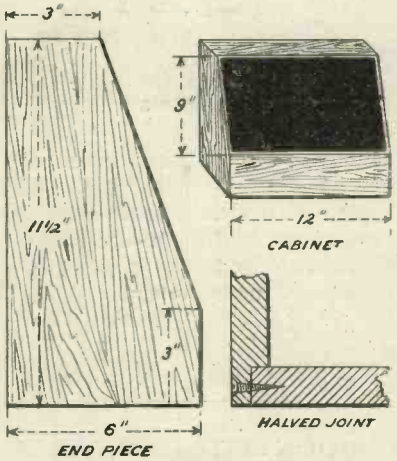


Fig. 4.—Illustrating the different sections of the cabinet.

if the need arises to inspect its underside or to make changes in the wiring.

To obtain a good finish on the wood is not at all a difficult matter. First rub it down as smooth as you can get it with the finest glass cloth, then dress well with linseed oil. When the oil has sunk in and become dry, it will be found that the grain has risen a little. Smooth down again with sand-paper and oil once more. When the second dressing is dry, the cabinet should be polished with beeswax and turpentine. The panel may be mounted when the first dressing has been given, the remaining processes being carried out on subsequent days.

Several of these cabinets can be used to form an experimental or "unit" set and when placed side by side have an excellent appearance. R. W. H.

A FINELY ADJUSTABLE DETECTOR

WHETHER it is intended to be used by itself or to act as the rectifier on a multi-valve set, a finely adjustable crystal detector is one of the most useful pieces of apparatus that can find a place on the experimenter's bench. Most of those that one buys have defects in their design that make them unsatisfactory for delicate work. Sometimes the adjusting screw is too coarse, sometimes the supports are so flimsy that the slightest jar upsets the contact after laborious adjustments, sometimes again no movement is provided for the cups themselves, so that one cannot properly search the crystals held by them for their most sensitive spots.

The design now to be described, besides being both easy and cheap to make, has none of these drawbacks. Whilst adjustments are being made it is perfectly flexible, but once it has been set it can be counted upon to withstand any reasonable treatment, in the way of slight jars that must occur when one is working at the wireless table.

The base is a piece of ¼in. ebonite 3½in. long by 1½in. wide. Only four holes are drilled in it; these, which are 4B.A. clearance, take the shanks of the terminals and the bolts (Fig. 5) which secure the supports in their places.

The supporting arms are made of stout angle brass, which is obtainable from most ironmongers. That which supports the fixed crystal is 2in. in height; the other is ½in. less. A 4B.A. clearance hole is drilled ¼in. from the top of the longer one, and a slot is filed down to meet it (Fig. 6). The purpose of this is to enable cups provided with various crystals to be removed or inserted with the minimum of trouble. The arm for the movable crystal is of the same dimensions and shape; it is made of sheet brass.

The adjusting screw should have a very fine thread. If possible, one such as those used for the fine adjustment gear of microscopes

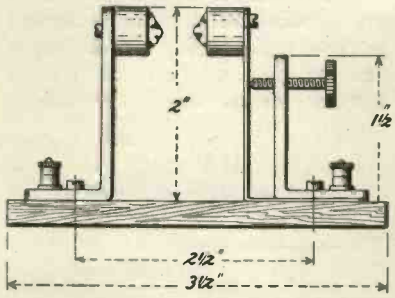


Fig. 5.—The detector assembled for use.

should be obtained, but if one of these is not available an 8B.A. screw 1in. in length may be used. It should be passed through a disc of ⅛in. ebonite ½in. in diameter and held in place by a nut at either side.

Tap a hole for it ¼in. from the top of the shorter support and make a hacksaw cut (Fig. 6) down to it. Drill a 6B.A. clearance hole through the support from edge to edge, and insert a bolt as shown in the drawing. This bolt serves to take up any backlash or wobble in the adjusting screw due to wear.

The parts may now be assembled on the base as shown in the first drawing. The base itself should be mounted on a piece of hard wood, recesses being made with a ⅜in. bit for the nuts of the terminals and screws.

The cups are made from short pieces of ½in. round brass rod in which are deep hollows made with a ¼in. or $\frac{5}{16}$in. drill. The holes for the 4B.A. retaining screws are made not in the centre but at a little distance from it (Fig. 6). The cups are thus capable of an eccentric movement which allows the surfaces of the crystals to be properly searched. If a number of different crystals are mounted in cups, one can test out any

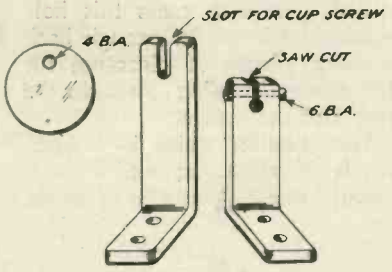


Fig. 6.—The parts of the detector ready for mounting.

couple very easily, for it is a matter of seconds to change the cups in the supporting arms.

R. W. H.

IMPROVING CHEAP TELEPHONES

TELEPHONES may be cheap for several reasons, but it is likely that little time has been spent over final adjustments. The closer the magnets are to the diaphragm the louder will be the signals, and this is what we require, especially in crystal receivers.

Unscrew the ebonite cap and slide the diaphragm off sideways; do not pull it upwards. A small piece of iron might be laid across the pole pieces if left for any time, as the magnetism is preserved thereby. Do not drag this off either, as magnets should not be jerked. Now lay a steel rule across the case and see if the pole pieces have been finished off square both ways and that there is no more space under the rule than four thicknesses of the *Wireless Weekly* paper (0.012in.). If more than this, unscrew the terminal nuts and lift the whole circular magnet out of the case and pack it up with fibre or paper washers, so that when replaced and bolted up, the lowest point on the pole faces comes about right. The windings will be found wound upon bobbins which are a friction fit on the poles. Push these gently down out of the way of the file, which might cut the wire running from one bobbin to the next. File up the pole faces square and leave the above-named space or a little less. The filings will be attached all round the pole pieces and can be wiped off, making sure that none is left sticking up.

As the space has now been made so very small, the diaphragm will be pulled down on the pole faces and will not come free *when the cap is screwed on tight.* To prevent this happening, cut a disc of very thin, smooth tissue paper the same size as the diaphragm and place between it and the magnets. Lay the paper disc over the magnets and lower the diaphragm centrally into position. Screw on the cap, and, when tight, the pressure should pull the diaphragm free. This can be tested by letting a match fall endways on to the diaphragm and listening to the sound, which will be hollow. If touching, the sound will be dead. Do not press the diaphragm with the finger; this may only damage it. If it is not free, cut some paper washers with a central hole to clear the magnets, and put in sufficient between the case and the paper disc until the diaphragm just comes free when screwed up. This equivalent amount can be further filed off the pole pieces, or the washers left in place.

When this adjustment is finally satisfactory the bobbins are gently raised again nearly to the top, and the washers, paper disc, diaphragm, and cap replaced and screwed up. One earpiece can be done first, and it can then be compared with the other to see how much change has been made. In the pair I adjusted, a cheap pre-war American make, the change was very marked, and they were then as good as Sullivan 'phones.

It is said that thin diaphragms are the best, but such difference as I found was in favour of a medium thickness The thickness of the diaphragm will affect its stiffness, however, and consequently the clearance space to be allowed above the magnets.

H. E. A.

THE coil-holder to be described is a handy little affair, very easy to make, and costing no more than about 3s. 6d. in all. It is most useful for taking the A.T.I. and the secondary, or for a tuned anode

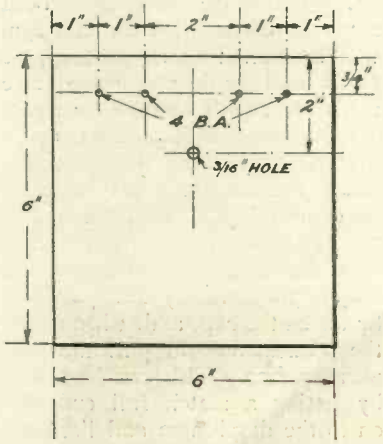


Fig. 7.—The layout of the panel.

inductance and the reaction coil coupled to it. It may also be used with great advantage as a high-frequency transformer, the variable coupling between the coils conferring great selectivity.

The apparatus is designed to take two coils, the lower fixed, the upper moving; but if it is desired to make it up as a three-coil stand, the design is very easily adapted to the purpose. In this case the fixed holder becomes the middle one, and a second moving holder, mounted in exactly the same way as the upper one, is added below it, a longer spindle being used.

Fig. 7 shows the layout of the panel, which is a piece of ebonite 6in. by 6in. by $\frac{1}{4}$in., and is not a very complicated business.

A SIMPLE STAND FOR HONEYCOMB COILS

The coil-holders can be made at home from $\frac{1}{2}$in. ebonite. But, as they can be bought complete from advertisers in this journal for 10d. apiece, it is hardly worth while to do so. Fig. 8 shows how that intended for the moving coil is treated. A $\frac{3}{16}$in. hole is bored for the spindle, and two 4B.A. holes are drilled and tapped for the screws which fix the extension handle in position. In the fixed holder only the $\frac{3}{16}$in. hole is drilled. In both cases this hole should be placed far enough back to allow plenty of clearance for the screws running through the plug and the socket.

The spindle, which is a $4\frac{3}{4}$in. length of 2B.A. screwed rod, is mounted in the $\frac{3}{16}$in. hole by means

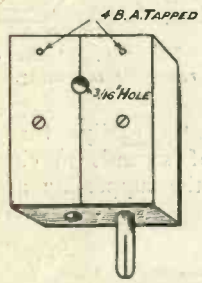


Fig. 8.—The moving coil-holder.

of two nuts placed one above and one below the panel (Fig. 9). A second nut is added below to lock everything securely in position. Above the nut on the upper side of the panel comes a $\frac{1}{2}$in. length of brass tube $\frac{3}{16}$in. in diameter. This is followed by another nut. Then comes the fixed coil-holder, which is locked in place by having another nut turned hard down upon it.

A flat washer is next placed on the spindle followed by a second piece of brass tubing 1in. in length and another washer. A nut is screwed down until the holder

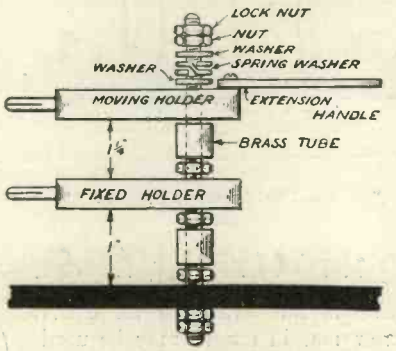


Fig. 9.—The arrangement of spindle.

moves easily but without wobbling. Then a lock-nut is put on to prevent the adjustment from altering when the stand is in use. The extension handle is simply a piece of ebonite $\frac{1}{8}$in. thick and 3in. long by $\frac{3}{4}$in. wide. It is fixed by means of two round-headed 4B.A. screws driven into the holes made for them in the holder.

Into the four 4B.A. holes at the top of the panel are inserted small terminals, one pair being connected to the plug and socket of the fixed holder, whilst the others are wired to the moving holder by means of flex leads long enough to allow of sufficient swing in either direction. The panel may be mounted on a piece of hard wood $\frac{3}{4}$in. thick, recesses being made with brace and bit for the lower end of the spindle and for the shanks of the terminals with their nuts.

R. W. H.

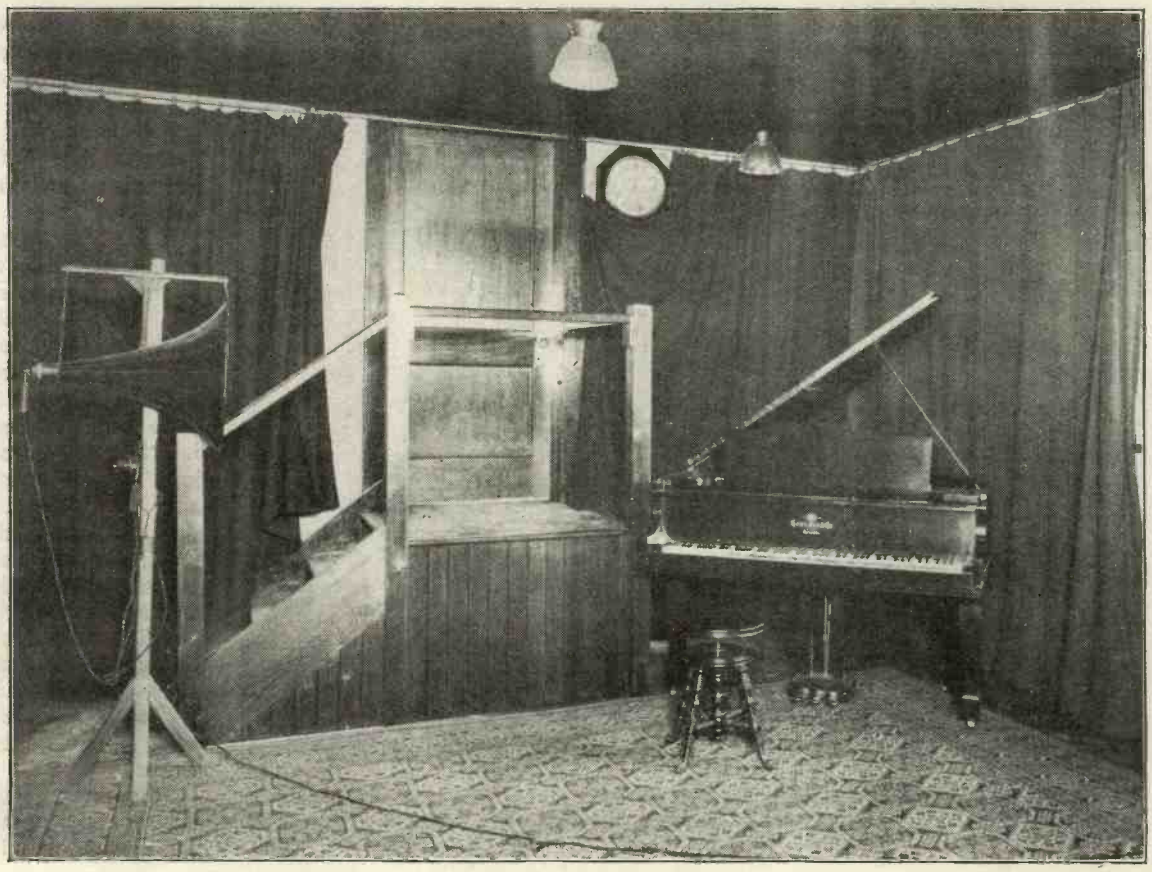
A DOMINION BROADCASTING STATION

The following article gives a brief description of one of the stations in the first of our Dominions to adopt broadcasting.

SHORTLY after the commencement of broadcasting in the United States of America and before this country seriously thought of adopting such a scheme, Canada commenced operations, and can therefore claim to be the first British Dominion to introduce broadcasting as a regular procedure.

When thinking of broadcasting on the other side of the Atlantic, one is apt to regard the United States as holding the monopoly of such a service; on the contrary, however, Canada has done much to make broadcasting popular and useful. Those of our readers who know the country will appreciate the advantages offered to dwellers in the wheat and forestry districts by its means.

Many families denied the everyday social intercourse that we in England are used to—by virtue of their calling taking them far from the cities and towns—are afforded the pleasures of a news service which otherwise would not be possible, and, further, the monotonous hours of darkness are relieved by musical programmes.

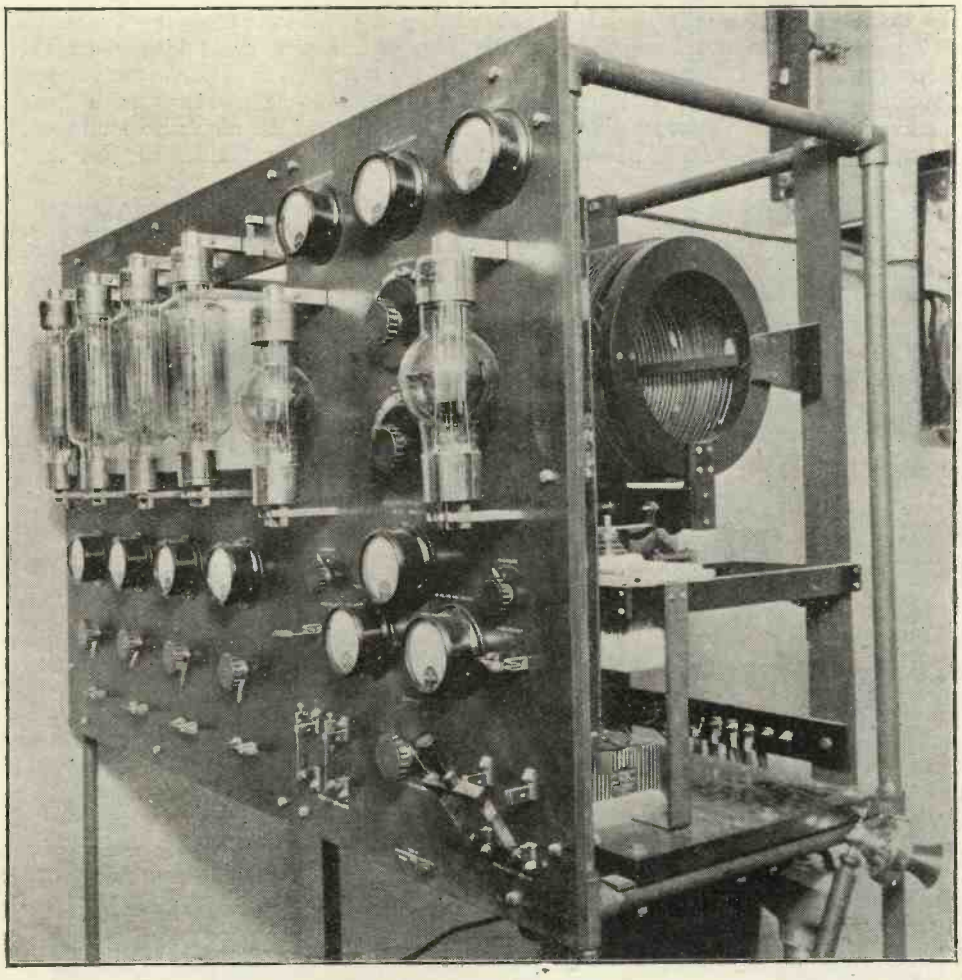


The studio at the "Calgary Herald" broadcasting station.

The method by which broadcasting is carried on in Canada is much the same as that obtaining in the United States, and a fair general

understanding of the stations used may be gathered from the following description of that belonging to the *Calgary Herald*, call-sign CFAC.

Situated on the top of the *Herald* building at Calgary, this station has been in regular operation since its installation on May 1st, 1922.



The two kw. broadcasting set. The four 500 watt oscillators may be seen on the left and the two 250 watt modulators on the right.

Apart from being the first of its kind in Western Canada, it has the credit of holding the second place in the whole of the Dominion for broadcasting a full programme from a theatre, and third place for a full church service.

The efficiency of the apparatus and its ability to cover a wide range is indicated by reports of its having been heard consistently through the West, Southern States, the Atlantic seaboard, Canada, Mexico, and Alaska.

In addition to the usual transmissions of concerts, news, weather reports, etc., lectures by prominent speakers are delivered every Wednesday and Saturday afternoons on various subjects. On Thursday evenings, before regular concert time, interesting addresses are given on abstract subjects. Every Saturday evening, commencing at 7.15, this station broadcasts, for the benefit of the youthful listeners-in, Old World Stories, the series now running being King Arthur and his Knights of the Round Table.

The Calgary Station employs one of the largest sets used in Canada, and has been heard as far away as Panama, a distance of 3,500 miles.

The set, neatly put together in panel fashion, is rated as a 2,000-watt machine; it consists of four 500-watt oscillators and two 250-watt modulators, and works on 430 metres wavelength. The plate current is supplied at 2,000 volts pressure, and the filaments are lighted by a 20-volt generator. The motor generator set is composed of a 2,000-watt 2,000-volt D.C. generator on the one end of a 5 h.p. motor and a 1,000-watt D.C. generator on the other end.

The manufacturers of this 2-kilowatt broadcasting set are the Canadian Independent Telephone Company of Toronto.

In order to keep interference from local noises as low as circumstances will allow, the motor generator set is situated in a different part of the building to that occupied by the general apparatus, and is controlled from the instrument room.

In addition to the transmitting plant the station is also furnished with a multi-valve receiving set coupled to a power-amplifier and large Magnavox loud-speaker.

The aerial is slung between two steel masts 75ft. in height, erected on the top of the *Herald* building, which is itself some 175ft. high.

Situated directly between the masts on the top of the building

Continued on p. 92.

THE CONSTRUCTION OF A 5-VALVE AMPLIFIER

By ALAN L. M. DOUGLAS, Staff Editor.

(Concluded from Vol. 2, No. 1, page 30.)

DETAILS for the assembly of suitable condensers have appeared from time to time in *Modern Wireless* and *Wireless Weekly*, and the reader's attention is particularly drawn to the article in *Modern Wireless*, No. 4, dealing with the assembly of variable condensers from bought parts. The essential points are rigidity

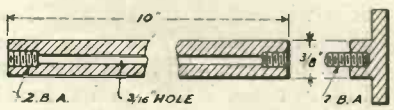


Fig. 9.—Details of the extension handles.

and evenness of spacing. For this purpose the vanes should be carefully examined in order that no irregularities may be present at the edges. This is a fruitful source of trouble in amateur-assembled condensers.

The method by means of which the spindle is extended so as to enable remote control to be effected will be clear from Figs. 9 and 10, which show the details of the extension handles. These might be of any pattern desired, but the particular type described in this article can hardly be bettered.

It should be noted at this point that to enable delicate control of the very high frequencies involved at short wavelengths, the size of these condensers should be kept as small as is consistent with the necessary tuning range. Finer adjustment and sharper amplification is thereby possible, although for long waves, *i.e.*, over 10,000 metres, the capacity of this condenser might be increased to 0.0005 μF or even more.

It should be noted that, although the connections of the high-frequency transformers themselves have been indicated in Fig. 8, the arrangement of the pins can be readily adjusted so that the fittings may be made to agree with the scheme of connections in any transformer already in the reader's possession. A careful note should be made of the exact location of the windings, so that various types of transformer, resistance, and reactance capacity coupling may be employed. A method of coupling which might appeal to the experimenter for certain purposes is one in which valves themselves are used as adjustable anode resistances.

The reader is advised to purchase ready-made low-frequency intervalve transformers, but the following specification of an excellent transformer may prove of value to those who wish to construct their own. It might be said at this point that the results obtainable from the following transformer are quite comparable with any instrument now on the market :—

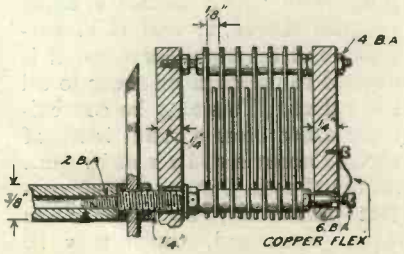


Fig. 10.—Fitting of the extension handles.

attach them that an opposing effect is produced by current flowing through their windings. 2B.A. screwed brass rod is very handy for the actual fitting to the panel of any of the more weighty parts of the apparatus, and as the ebonite is ¼in. thick this may be drilled and tapped in such a manner as to allow a secure hold to be effected.

It will be as well for the reader to purchase the leaks and condensers already made up, and for the complete instrument the necessary leaks are detailed in the first part of this article. Constancy in operation is essential when using devices of this nature, and whilst it is a comparatively easy matter to make grid condensers which will

Core.	Primary Winding.	Secondary Winding.	D.C. Resistance.	Inductance Value.	Gauge of Wire.	Quantity of Wire Required.
26 s.w.g. soft iron stampings, cross-section ½" × ½", each lamination insulated from its neighbour.	4,500 turns.	11,000 turns.	Primary 1,100 ohms. Secondary 3,600 ohms.	Primary 8 henries. Secondary 50 henries.	44 S.S.C.	Primary ½ oz. Secondary 1½ ozs.

The method of mounting these transformers will be clear from an examination of the photograph, Fig. 2, showing the rear of the instrument, and it is as well to so

remain reliable, the question of home-made leaks is always rather a dubious one. Small condensers may be made if desired from strips of tinfoil ½in. in width and having an effective overlap of 1in., separated by mica having a thickness of about 0.006in. Two foils of these dimensions per condenser will give a capacity of about 0.0003 μF.

The final item is the four-pin plug, with which contact is made between the H.T. and L.T. batteries and the amplifier when it is desired to use common feeds to all the valves. This may be conveniently made from a small block of ebonite about 2in. by 1in. by ½in., arranged as in Fig. 11. Four contact points may be made from 11/64in. brass rod, which may be tapped for a small screw as shown in the diagram. The ends of these contact pins, which fit into the socket member, might be rounded off with a file so as to ensure an easy entry, and if desired small rings may be turned round them at the points where the silver rivets bear upon them when the plug is pushed home, in order that a spring contact may be effected

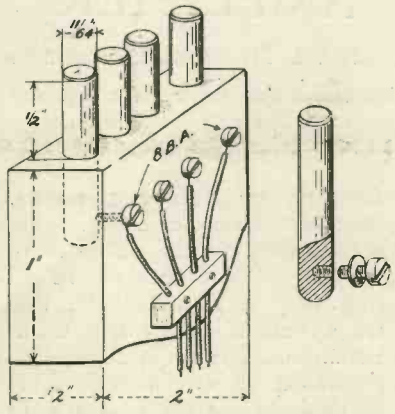


Fig. 11.—Details of the 4-pin plug.

thereby. The arrangement of the pins is such that the plug cannot be inserted the wrong way, and this makes speedy attachment and detachment of the leads possible.

The construction and assembly of such an amplifier as is here described will provide much useful information for the keen experimenter, and whilst single-valve reception might be indulged in if desired, it affords interesting opportunities of testing out various methods of high-frequency amplification and noting the results obtained. The actual instrument described in this article has received broadcasting from a station 400 miles away on a loud-speaker, using only a small indoor aerial consisting of a single wire 12ft. long. An earth connection was of course used.

It should be noted that the size of the reaction coil is just sufficient to produce reaction effects in the oscillatory circuit of the second valve, and should consist of a winding of 120 turns of No. 38 s.w.g. s.s.c. wire on a tube 1½in. by 1½in. This, as shown in Fig. 4, slides inside the first tuned anode coil to effect coupling.

FORTHCOMING EVENTS

JULY.

25th (Wed.).—General Meeting, Radio Society of Great Britain, at 6.0 p.m., at the Institution of Electrical Engineers. A paper contributed by Mr. Lionel J. Hughes and entitled "Resistance-Capacity Coupled Amplifiers" will be read by Mr. Philip R. Coursey. This will be followed by a short lecture by M. Marrec, of Paris, who will demonstrate reception on a frame aerial of American signals and explain his new arrangement for eliminating atmospherics and other interference.

Wolverhampton and District Wireless Society. Visit to the Wolverhampton Corporation Generating Station.

26th (Thurs.).—Cardiff and South Wales Wireless Society. Mr. E. Ogden will conduct experimental work.

Hackney and District Radio Society. Mr. Bell will lecture on the "Flewelling Circuit."

Finchley and District Wireless Society. Mr. Puckle will lecture on "Wireless Receivers" at the last meeting of the session.

Lewisham and Catford Radio Society. Mr. H. M. Stanley will lecture at 136, Bromley Road, Catford, S.E.6, on "How Ether Waves may be Detected."

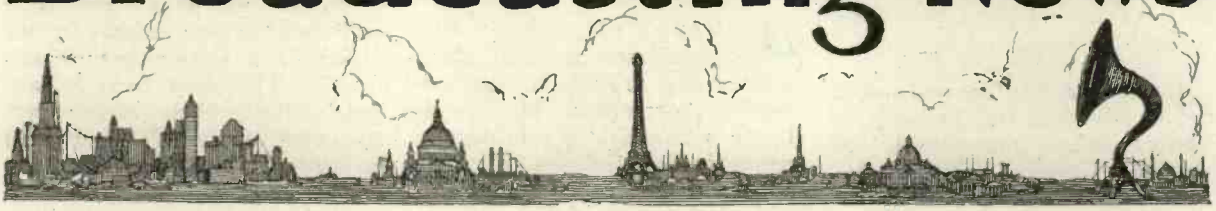
Liverpool Wireless Society. At 7.30 p.m. Messrs. S. G. Brown, Ltd., will give a "Demonstration of a New Type of Loud-speaker" at the Liverpool Royal Institution, Colquitt Street, Liverpool. Non-members should write for invitation cards and persons interested in wireless are invited to become members.

27th (Fri.).—Radio Society of Highgate. At 7.45 p.m., Mr. F. L. Hogg will lecture at the 1919 Club, South Grove, Highgate.

Brockley and District Branch of the Radio Association. Mr. G. A. Saunders will give a lecture at 8 p.m., entitled "A few considerations of Ether, Electrics and Material Phenomena" at the Headquarters, Gladstone Hall, New Cross Road.

30th (Mon.).—Hornsey and District Wireless Society. Auction of members' surplus apparatus.

Broadcasting News



By OUR SPECIAL CORRESPONDENTS

LONDON.—When Mr. Lowther was Speaker of the House of Commons he was continually being bothered by pressmen and others as to when he was going to resign. He had one unvarying good-humoured answer: "Every day brings my resignation nearer."

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That is about the utmost one can say about the House of Commons Enquiry Committee's Report. Every day brings its publication nearer. Indeed, by the time this appears it should be public property, and then we shall know where we are.

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There have been several changes in the personnel of the B.B.C. staff of late which should make for even greater efficiency. Mr. Reith, the General Manager, is to have the assistance of an efficient Deputy General Manager in the person of Mr. Carpendale, C.B. The engineering staff has also been strengthened, and the director of each station has two assistant directors to support him. These increases of staff have been made necessary by the overwhelming pressure of work in every department of the B.B.C. They have also been made with a view to assuming additional responsibilities which will be thrust upon the B.B.C. when the long days are over.

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The wireless man-hunt was amusing, and a considerable number seem to have taken part in the chase. It was perhaps not a fair test from the point of view of the possibilities of broadcasting in the detection of crime, as the various uncles who were acting the part of the criminals were rather too light-hearted about it, and took risks which no man escaping from justice could dream of taking.

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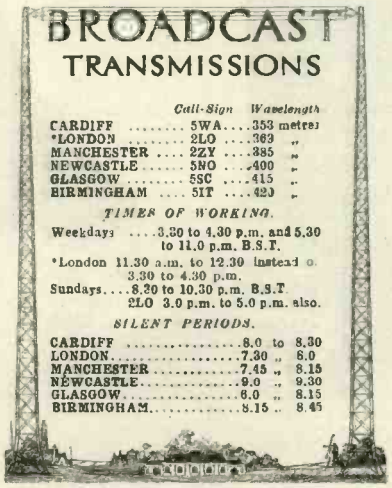
It was astonishing how quickly they were recognised, however, and there is no doubt that if the services of broadcasting were scientifically utilised, they would



form a valuable adjunct to the existing resources at the command of the police.

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The Sunday afternoon concert (July 15th) was far and away the best yet transmitted by the B.B.C. from London. Whether it was due to the acoustics of the Æolian Hall, or system of transmission, the writer cannot say, but one thing which struck him very forcibly was the excellent quality of song and music.

The rendering of the Wagnerian music on the organ (all the stops and effects came in equally good) transported one for the nonce to a large, spacious, cool hall, where one sat and heard without distortion or suppression the masterly rendering of that great composer. The singing, too, came through, liquid, flowing, and mellow, whilst both the violin and 'cello solos have never been heard to equal advantage on the wireless wave hitherto.

The piano seemed just a little metallic on several notes, and it seemed that the announcer might have spoken just a little more softly and thus avoid any semblance of an echo.

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A desire has been expressed by many experimenters that each station should close down completely for one evening weekly. The particular night might be varied from week to week, and be so arranged that only one station should be closed on any one evening. Not only would this give those living close in an opportunity of going for more distant stations, but it would prove a great relief to the greatly overworked station authorities.

Forthcoming Events

JULY.

25th (WED.).—"Seen on the Screen," by W. G. Atkinson. J. Grant Ramsay on "What to Wear."

26th (THURS.).—Sir R. Baden-Powell. Percy Scholes: Musical Criticism. Mr. C. Tate Regan on Zoology.

27th (FRI.).—W. A. Haddon: Dramatic Criticism. Ronald Baynall, Entertainer. Captain Ainslie: Astronomy.

28th (SAT.).—Mr. Philip Snowden, M.P.: "No More Wars."
30th (MON.).—W. A. Croxton Smith: "Dogs."
31st (TUES.).—Royal Air Force Band.

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ABERDEEN.—The new station for Aberdeen will probably be opened about the middle of August. Captain Eckersley has been to the granite city of the North, and has been successful in putting through the negotiations for sites very quickly. The new studio will be in Belmont Street. The Aberdeen station will not only serve the North of Scotland, but will be available for listeners-in on the East Coast, especially in Dundee.

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BELFAST.—Despite the hold-up in the establishment of a Northern Ireland broadcasting station, due to the delay in the Post Office and B.B.C. dispute, wireless continues to make great strides in Ulster. Almost nightly wireless concerts are featured entertainments in Belfast vicinity. As a matter of fact, at the reception given by the Lord Mayor in the City Hall, Belfast, to the Congress of the Gas Institution, dancing was enjoyed by 300 couples at one time to music broadcast from Glasgow.

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BIRMINGHAM.—The Birmingham station has taken another step towards an improvement in programmes. Mr. Joseph Lewis, a musician of considerable repute in the Midlands, has been appointed director of music, and will take up his duties shortly. Mr. Percy Edgar will, of course, remain in sole charge of the station, but Mr. Lewis will have a free hand in arranging the musical part of the programmes, and his intimate association with the musical world should be productive of some good programmes.

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One interesting suggestion which Mr. Lewis has put forward is the engagement of a permanent staff of artistes, who will perform at regular intervals, giving oratorios, selections from opera, etc.

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One of the programmes from 5IT recently was marred by the action of a Government department. The choir from a local girls' school, whose earlier performances from 5IT had been greatly enjoyed, had arranged for another visit.

At almost the last moment, however, it was announced that the Board of Education had forbidden the performance, in accordance with the Act governing the appearance of children in music halls!

A new portrait of Uncle Rex at 2LO.

CARDIFF.—The director of the Cardiff Broadcasting Station has received a letter from an official of the Royal Automobile Club at Aix-les-Bains stating that he is a regular listener-in to Cardiff. Another communication from Jersey says that the writer, with a six-valve set and a Brown's loud-speaker, derives the utmost pleasure from the programmes broadcast from the Welsh station.

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Complaints are made at Cardiff that a few owners of wireless receivers are making themselves a general nuisance every evening

during the interval from nine to nine-thirty and after the close of the programme of the Cardiff Broadcasting Station by oscillating their valves and producing such interference that other experimenters are prevented from carrying out tests or picking up other stations. As the nuisance is said to be caused purposely, several owners are co-operating in an endeavour to locate the offenders with a view to presenting a complaint to the authorities in the hope that the licences may be withdrawn, the installations confiscated and the offenders punished.

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DUBLIN.—It would seem that the Free State is going to score over Northern Ireland in having its broadcasting station almost immediately. The *Irish Independent*, usually authoritative, stated the other day that the arrangements are now complete for submission to the Free State Parliament. The plan includes one broadcasting station near Dublin for the whole of the territory, *i.e.*, the 26 counties, and awaits the approval of the military authorities. Certainly it will be a mistake if the new station is erected far from the centre of Dublin, which is so convenient for well-known artists who visit the city, as well as for the Civic Guard and other bands.

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GLASGOW.—Glasgow wireless users have betaken themselves with their sets to the silvery sea or the Highland glen for the Fair Week. Hundreds have packed their wireless apparata and rigged these up at their holiday resort. Now, whether they be by lovely Glengarry or in the midst of the revels of Rothesay, Dunoon or St. Andrews, they are in touch with the Glasgow Broadcasting Station and an admirable programme of music.

By moor and loch, too, campers' tents have sprung up, and there are few without an aerial mast. Wireless is a tremendous boon to campers, for, though they may never see a newspaper from the beginning to the end of their holiday, the Glasgow station gives them all that they want to know in the news bulletin.

Forthcoming Events

JULY.

25th (WED.).—C. A. Malcolm, M.A., Ph.D., will give a short address.

26th (THURS.). — Miss Beatrice Eveline, 'cellist.

28th (SAT.).—Wm. McDonald, humorous items.

29th (SUN.).—Prof. James Moffat, D.D., D.Litt., will give a short address.

30th (MON.). — The Grenadier Guards' Band.

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MANCHESTER. — Mr. Dan Godfrey has been appointed Director of the Manchester Station. Mr. Godfrey is the son of Sir Dan Godfrey, and he has lived, moved, and had his being in musical circles all his life. When he was in Bonn with the Army of Occupation he conducted a series of three symphony concerts, which were greatly appreciated by friends and our erstwhile foes alike.

There is no doubt that Mr. Godfrey knows the job of entertaining the public perfectly, and he will have plenty of scope for his activities and abilities in Manchester. He will find his way quickly to the hearts of the Manchester listeners-in.

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Mr. Wright, who has borne the burden of the heat of the day at Manchester, and who is responsible for bringing the programmes to their present state of excellence, will receive an important appointment at 2LO, where he will have ample scope for his wide experience.

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All listeners-in, and music lovers especially, must have enjoyed the evening which was devoted to Mozart's compositions. The two outstanding features of the programme were the piano quartet and the duet for two pianos, the latter being an especially good transmission.

The heat wave brought in its train the inevitable adjunct for summer wireless, namely, atmospherics. In Manchester these never amounted to very much, although they rendered long-distance telephony almost impossible.

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A future feature of interest to farmers is the weather forecast, which will be read at 6 p.m. for their special benefit.

Forthcoming Events

JULY.

26th (THURS.).—Classical Night. A second modern Song Recital by Helena Taylor; Chamber Music for two clarinets and piano, by Patrick Ryan, of the Radio Orchestra, and his brother, recently returned from the United States; and 40 minutes' programme by Edward Isaacs, the famous Manchester pianist, and Florence Holding, another of 2ZY's best sopranos.

27th (FRI.).—Dance programme by the Shorrocks Syncopated Dance Orchestra, with "Keyboard Kitty" in her second appearance, which will be welcome after her last week's broadcast.

28th (SAT.).—The Radio Military Band will make a welcome return with a jolly popular evening's programme.

29th (SUN.).—A Mendelssohn orchestral evening, with Frank Taylor, that admirable broadcasting Manchester tenor, singing a number of Mendelssohnian excerpts.

30th (MON.).—At 7.30 Herbert Ellingford, the well-known organist to the Liverpool Corporation, will give a chat on "The Necessity for a Broader Outlook upon Music in Cathedrals and Churches." The public who clamoured for re-engagement of Jas. Worsley, the Lancashire dialect entertainer, will be gratified to know that he appears this evening in the general programme. Nell Davies will be the vocalist.

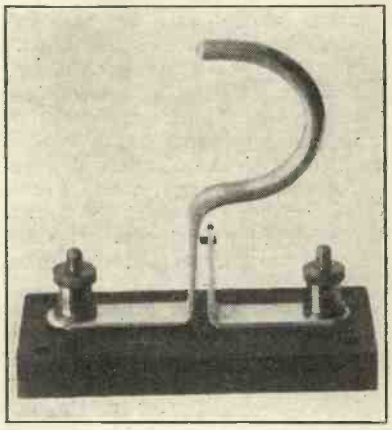
31st (TUES.).—Fredk. Garnett, whose caricatures are a feature of the English press, will give a talk on "Caricature"; and in the subsequent programme Mr. McCafferty, Irish baritone, who visited 2ZY some time ago, and Madge Taylor, the operatic soprano, will perform with the Radio Orchestra.

Apparatus we have tested

Conducted by A. D. COWPER, B.Sc. (London), M.Sc.

A Combined Lightning Arrester and 'Phone Hook

MOST of us have experienced at some time or other that guilty feeling when, waking up in the middle of the night to hear a thunderstorm approaching, we recollect that we have omitted to earth the aerial. Messrs. George Palmer (Universal Cinema Supplies), Ltd., have sent for trial a fitting



The safety 'phone hook.

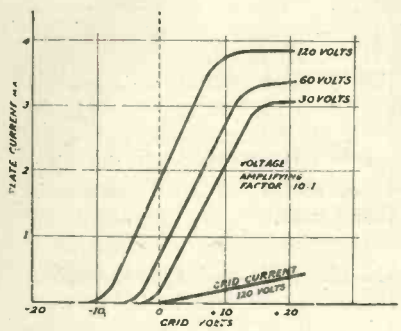
which will effectively prevent this anxiety, by making it impossible to forget the earthing of the aerial, in the form of a large aluminium hook mounted on an ebonite base fitted with two terminals, intended to be so connected that when the 'phones are hung on this hook, after the manner of the ordinary land-line 'phone, a contact is made that connects the aerial directly to earth.

The fitting is nicely finished, and has good insulation, as shown by test. We might suggest that the hook be made a little stronger.

The New Xtraudion Valve

The Economic Electric Co., Ltd., have placed on the market a new edition of their Xtraudion valve, a sample of which we have been able to test. The characteristic curves obtained for 30, 60, and 120 volts respectively show a long, straight portion, with sharp bends at both extremes, that at 30 volts bending very sharply at just about zero grid volts.

At 4 volts L.T. the filament current was a shade under ½ ampere, and no blue glow was observable at 150 volts on the plate, so that the valve belongs to the hard category. As a rectifier the new Xtraudion gave an excellent performance: best with a 2 megohm gridleak to the L.T. plus; or, alternatively, with a 4 megohm to the H.T. plus. With the former, local broadcasting was comfortably clear (at 13 miles) with no H.T. battery at all; every 4-volt cell of H.T. added gave some increase in signal-strength, up to 70 volts, the highest tried, though the increase was slower above 30 volts H.T. With 30 volts, no sort of reaction, a low-resistance variometer tuner, and middling good aerial, signals were very strong. As a low-frequency amplifier, the valve practically replaced an ordinary R in the first stage; in simple, simultaneous amplification circuits there was little to choose between a French R and this valve, though the R valve took a much larger current. On the ST100 it gave a fine roar with 2LO's dance music, audible at the end of a large suburban garden, the first (simultaneous action) valve having 80 volts on the plate, and an ordinary R valve as power-amplifier beyond. For high-frequency alone, or in more complex dual circuits, the smaller filament emission appeared to militate against it: we understand that the makers make no special claims for use in this manner. In the single-valve



Xtraudion characteristic curve.

Armstrong it functioned quite well on moderate plate voltage; best, of course, on short waves.

With the voltage-amplification factor of about 10, and the moderate demands both in filament current and high-tension, it will prove a useful and economical general-purposes valve. It is too early to speak of the life of the filament in ordinary usage; we understand that the filament fitted is rather more sturdy than that in preceding patterns, and no trouble should be experienced on this score.

Mainly about Valves

Our weekly causerie written by the Editor.

L.T. and H.T. Switches

WHEN switching off a valve set many experimenters simply switch off the filament current without taking the high-tension plug out. I have always regarded this as an unwise proceeding. If the high-tension battery is left in the circuit, the chances are that it will gradually discharge itself across the leakage path, which, while making little difference when actual reception is going on, is sufficient to allow the passing of current from the high-tension battery. Even if this leakage passes through only a matter of one megohm resistance, it will not take long for a high-tension battery to become useless. It is, therefore, desirable to take the plug out of, say, the positive terminal of a high-tension battery when not receiving.

Reaction into Untuned Circuits

I do not believe in introducing reaction into an untuned or aperiodic circuit. Fig. 1 shows a receiver in which transformer coupling is used between the valves. Reaction is introduced from the anode circuit of the second valve to the grid circuit of that valve. In such a case, where neither transformer winding is tuned, it is quite likely that the application of reaction will weaken the signals. One of the principal effects of reaction is the reduction of the damping of the circuit, thereby making it very much more selective to the wavelength to which it is tuned. By coupling the anode coil to the grid coil, the selectivity of this grid circuit is greatly increased.

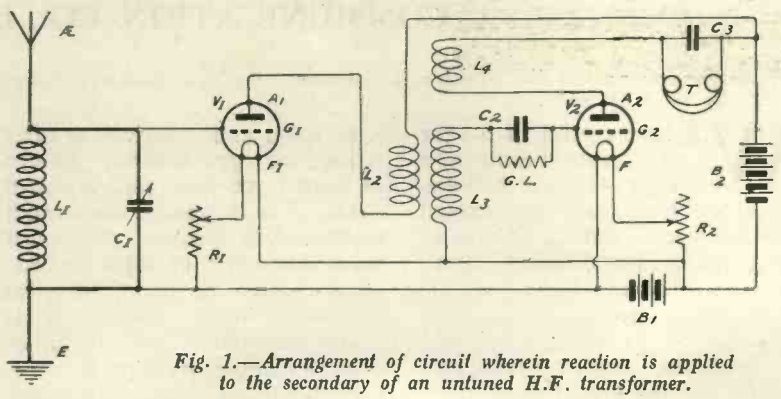


Fig. 1.—Arrangement of circuit wherein reaction is applied to the secondary of an untuned H.F. transformer.

Without the effect of reaction, the transformer coupling would serve for a comparatively wide range of wavelengths; for example, two or three of the Broadcasting Stations might be heard quite clearly. The windings are to a certain extent aperiodic, but this is not altogether true; the coil in the grid circuit of the second valve has some capacity, and there is also the grid-filament capacity in parallel with the grid coil. The grid circuit, therefore, has a certain natural wavelength, which, we will assume, is 380 metres. The grid coil, however, is not very particular within limits as regards the wavelength of the signals to be received. If the waves were of a length of 380 metres, the grid circuit would be happiest, but it would be quite content to pass on high-frequency currents having different frequencies.

When, however, reaction is introduced from the anode circuit of the valve, the selectivity of the grid circuit is greatly increased, and it will no longer allow the currents to be passed on through it, other than those corresponding to a wavelength of 380 metres. The more reaction is introduced into this grid circuit the more stubborn does it become, and

if, for example, the signals from 2LO (369 metres) were trying to come in, they would be greatly weakened owing to the greater selectivity of the grid circuit. If we had a variable condenser across the grid circuit, we could make the grid circuit particularly selective for 2LO, but in the example given it would be better to do without reaction altogether. If, of course, the transformer does happen to be wound to the right wavelength, the introduction of reaction may increase the signal strength, but, in any case, the transformer will not be suitable for covering a range of wavelengths.

Frame Aerials and Their Use

Very frequently the wonderful results that are obtained on a frame aerial with a special circuit are treated as something to be emulated. Personally, reading that circuits will give signals on a two-foot frame from all the broadcasting stations, leaves me cold. Who wants to use a frame, anyway? By the use of a frame and a particularly sensitive circuit, distortion in many cases is liable to result, and in any case, who wants to use a frame when he can use an effective indoor aerial or a standard outside aerial? If, of course, the object of using a frame aerial is to eliminate interference by taking advantage of directive effects, this is a different matter, but if the only commendation the circuit has is that it will give good results on a frame aerial, I fail to see any particular merit. Of course, there are cases where a frame aerial only can be used. Such cases are moving vehicles and where the police, or other moving persons, desire to keep in touch with headquarters. To get really good signals on a short indoor aerial, or on a standard P.M.G. aerial, should be the aim of designers of apparatus. To carry the argument *ad absurdum*, who would waste their energy in developing an apparatus which would receive signals on a two-inch frame aerial?

As for those circuits which *only* give good results on a frame aerial, they really benefit the average listener-in very little. In special cases, they may be extremely effective, but the average man desires circuits which will give loud and selective results on the aerial he uses, not the aerial which he might have to use under very special circumstances.

THE MARCONI INTERNATIONAL MARINE COMMUNICATION CO., LTD.

WE have received from the above-named company a copy of their balance-sheet and profit and loss account for the year ending December 31st, 1922. The directors' report reads as follows:—

The gross revenue for the year amounted to £1,103,970 15s. 5d., as compared with £1,084,460 6s. 8d. for the preceding year.

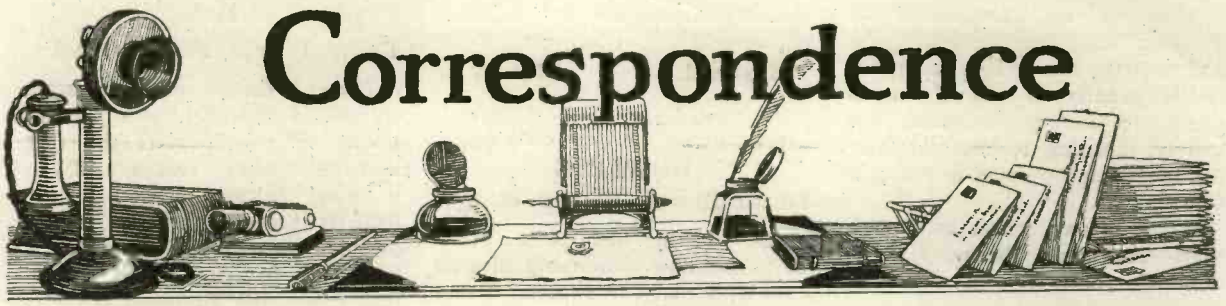
The net profit for the year amounts to £171,848 4s. 2d.

This is an increase as compared with 1921, and is arrived at after writing off approximately £8,000 in respect of bad and doubtful debts. The increase is due in part to additional business consequent upon the return of ships to commission after the period of great depression in the shipping trade which necessitated the laying up of a large number of ships in 1921, and also to economies which have been effected throughout the organisation in the methods of working and control.

Your directors recommend the payment of a final dividend at the rate of 7½ per cent., which, together with the interim dividend declared in December last, will make a total of 12½ per cent.

During the year under review 63 debentures of a par value of £1,260 were redeemed.

The directors retiring by rotation are Senatore G. Marconi, Mr. Alfanso Marconi, and Captain H. Riall Sankey, who, being eligible, offer themselves for re-election.



ST100

To the Editor, *Wireless Weekly*.

Sir,—Please permit me to express my appreciation of your two fine magazines, also the remarkable ST100 circuit. I have held an experimental licence since the close of the war, and during that time have tried out all the usual and unusual circuits, but the results I obtained with ST100 startled me. The nearest broadcasting station is Newcastle, perhaps sixty miles away, and I can truthfully say that ST100 gives 100 per cent. better results on the loud-speaker than the usual four-valve set (one H.F., rectifier, and two L.F.). I find the circuit easy to operate, stable, and the speech, etc., very pure. I find ordinary Galena—with a short length of graphite from a lead pencil as a contact—gives the best results.

In conlusion, I would strongly advise any beginner who desires maximum results at minimum cost to get busy and hook up this arrangement. I am, etc.,

Yorkshire. T. Hight.

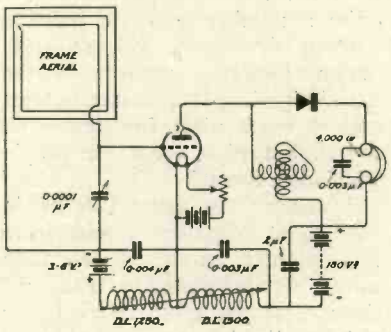
A LONG-DISTANCE SUPER-REGENERATIVE RECEIVER

To the Editor, *Wireless Weekly*.

Sir,—I have found a variation of the single-valve super-regenerative circuit which, though not suitable for handling extremely loud signals, gives remarkably good results with very weak signals and with any that are not strong enough to burn out the crystal employed.

With ordinary single-valve super-regenerative circuits, the valve has to perform three separate functions, *i.e.*, oscillate at the signal frequency, oscillate at the quenching frequency, and rectify as well. It would seem that when receiving weak signals better results are obtained if one can lighten the work of the valve, so to speak, by using other means to produce rectification.

The simplest way of doing this is shown in the accompanying diagram. It is to be noted that there is no coupling between the grid and anode circuits apart from the in-



The circuit referred to by Mr. Beddington.

herent electrostatic coupling existing between the grid and plate. The variometer is of a type that consists of coils supported by an aluminium cage; this cage is connected to the positive end of the high-tension battery, thus entirely doing away with hand-capacity effects.

With a frame aerial 2ft. 1in. square, consisting of seventeen turns of wire space 1 cm. apart, a condenser with a maximum value of 0.0001 µF just covers the whole of the broadcasting band of wavelengths.

With the circuit and frame aerial described, using an R valve with 180 volts on the anode operating on the ground floor of a house in Bournemouth, the transmissions of L'Ecole Superieure des Postes et Telegraphes can be heard with the telephones laid on the table. Cardiff and London come in well, and with careful tuning Birmingham and Manchester can be received quite satisfactorily.

This circuit also seems to filter out to a considerable extent the annoying high-pitched whistle which is characteristic of super-regenerative circuits.

I am, etc.,

Guy C. Beddington.

A PIRATE REPLIES

To the Editor, *Wireless Weekly*.

Sir,—I notice in your issue No. 11 that a problem which has been puzzling the brains of every expert and others in the United Kingdom, viz., "Pirates, and how to exterminate them," has been solved by someone in the person of A. B. Brown, S.E.16.

It is a very big boast to claim having solved a problem which has baffled all others; but let us congratulate the worthy gentleman before we proceed further, at any rate I raised my hat as soon as I read the article.

Now as regards the exterminating of "Pirates."

I shamefully have to confess that I am one of them, and I have serious doubts as to whether "pirates" like the idea of being exterminated: answering for myself, I do not.

To exterminate a person (I suppose we are persons) is to finally dispose of him, and it is not considered just to lay aside persons in such a final manner. I think the expression should be modified.

Most of us have heard of Peeping Tom, and the penalty he had to pay, but it is a somewhat severe penalty to pay if one is going to be exterminated for merely listening to an entertainment (although we may be doing it for nix).

A. B. Brown writes as though every unlicensed listener-in is a criminal, and this is entirely ignorance on his part.

Does not A. B. Brown know that there are thousands of listeners-in who possess sets constructed by themselves, and that those listeners-in are unable to obtain licences; had he fully absorbed the press reports he would have realised the position better than he appears to now.

The majority of us so-called pirates who enjoy the broadcasting would be willing to pay the paltry sum necessary to purchase a licence were we able, but can this ultra-wise gentleman inform the pirates where licences can be obtained? I submit that the fault does not lie with the pirates.

Apparently A. B. Brown's grievance is that, having acquired a set bearing the stamp of the B.B.C., he begrudges the purchasing of his licence, and were he able, he would probably now be a pirate too; but why vent his spite on the innocent listener-in?

Possibly "A. B." is the possessor of an expensive valve set for which he was able to pay a fair sum, in which case let him think more sympathetically of those less fortunate people who owing to force of circumstances have to purchase sets a part at a time out of poor pay and rig them up when circumstances permit, and these enthusiasts are much more likely to appreciate the broadcasting than he.

As regards "A. B.'s" suggestion about showing licences every time one desires to purchase a twopenny insulator, etc., well, it is too silly to comment upon.

In conclusion please allow me to request "A. B." to concentrate his inventive energies in some other direction where they may be appreciated.

Every success to your valuable publication. I am, etc.,

Eynsford. PIRATE.

HOWLING

TO THE EDITOR, *Wireless Weekly*.

SIR,—In the first place, allow me to say how thoroughly pleased I am with your two papers. I find them both descriptive in a very interesting and fascinating manner.

There has been some considerable attention devoted to "howlers" and "condenser swishers," and although this matter is becoming somewhat stale it is, nevertheless, a big item. I should, therefore, like to point out one or two facts to present, or would-be, "howlers."

I suppose there are some thousands of people who use the "tuned anode" method of reception, but I also suppose there are quite a number who use reaction without the anode coil, *i.e.*, reaction directly applied to the aerial circuit. It is so much easier and so much nicer for those who use it, but what about the people who don't use it?

I wonder how many listeners-in wish these "howlers" somewhere in a slightly warmer climate than ours? It is probably many of these listeners-in to "condenser swishers" who cause some of the trouble unconsciously.

Very often one can hear CW with a crystal set. Why? Not because a crystal set should receive CW on its own accord, but because it is being heterodyned by either a local oscillator or a neighbouring reactioner.

To those using single-valve sets, or multi-valve sets (not including tuned anode circuits), next time you are worried with those whistles, try separating your coils as far as possible. The effect is wonderful—to others, even if it does decrease signal strength slightly, do not be so selfish as to think of yourself only, think of your neighbours! I am, etc.,

C. L. SOLOMON.

Brondesbury, N.W.6.

2WS

TO THE EDITOR, *Wireless Weekly*.

SIR,—I should be very much obliged if you could bring to the notice of your readers the fact that this Society's call-sign, 2WS, is being illegally used. I have recently received several reports on the transmissions from 2WS, but 2WS has not been transmitting at all, and somebody is therefore making use of the call-sign without authority. I should welcome reports from anybody hearing this call-sign, as we may thereby be able to find the locality of the offender. I am, etc.,

J. F. STANLEY.

The Radio Society of Highgate.
Highgate, N.6.

A DOMINION BROADCASTING STATION

(Continued from page 82.)

is the station in which the concerts radiated have their origin. The broadcasting studio is a room 21ft. long and 15ft. wide, and, in a manner similar to our own familiar stations, is especially constructed and furnished so as to reduce echo and reflection of sound to a minimum.

The walls and ceiling are completely covered with heavy green curtains, which may be drawn aside, disclosing doors and windows.

The floor is covered with thick rugs, thus making the room entirely free from echo, eliminating all undesirable noises and allowing a true reproduction of the performance.

The items of the transmissions are somewhat similar to those broadcast from the American stations, and, apart from the usual evening concerts, there are transmitted at noon of each day market and weather reports of particular interest to farmers.

S. G. R.

Information Department

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P. assisted by A. L. M. DOUGLAS.

In this section will appear only selected replies to queries of general interest or arising from articles in "Wireless Weekly," "Modern Wireless" or from any Radio Press Handbook.

All queries will be replied to by post, as promptly as possible, providing the following conditions are complied with.

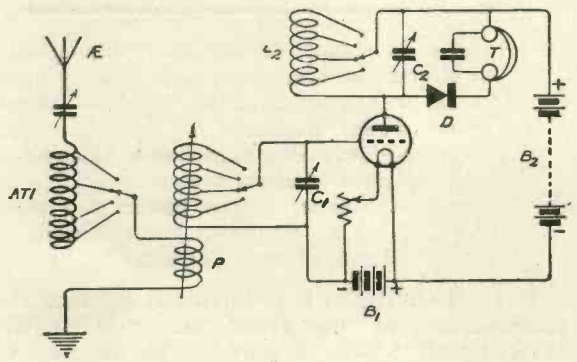
1. A Postal Order to the value of 1s. for each question must be enclosed, together with the Coupon from the current issue, and a stamped addressed envelope.

2. Not more than three questions will be answered at once.

3. Queries should be forwarded in an envelope marked "Query" in the top left-hand corner and addressed to Information Dept., Radio Press, Limited, Devereux Court, Strand, London. W.C.2.

B. P. (NEWCASTLE) requests a circuit diagram of a set to comprise an inductively coupled tuner, high-frequency valve with tuned anode circuit and crystal detector.

The diagram herewith shows a very suitable arrangement. The aerial circuit comprises the aerial tuning inductance ATI, which may be either a tapped coil or a slider inductance, and the coupling coil P, which may be wound upon a wooden ball and pivoted inside the secondary coil. The closed oscillatory circuit comprises the inductance and

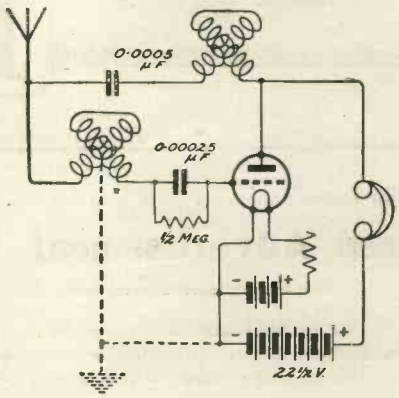


the variable condenser C_1, the opposite plate of the latter being connected to the grid and negative side of the filament of the valve. The tuned anode circuit comprises the tapped inductance L_2 and variable condenser C_2, the crystal detector and high resistance telephones being shunted across the condenser. B_1 is a filament lighting battery, 6 volts, and B_2 the high tension battery of 50 to 100 volts. The values of the inductances and variable condensers will, of course, depend upon the wavelength to be received, and particulars of suitable coils are given in previous issues.

D. A. (WORCESTER) requests particulars of suitable windings for a step-down telephone transformer.

The output windings, to be connected to the low resistance telephones, should consist of 1,000 turns of No. 30 s.w.g. d.s.c. copper wire wound upon a soft iron core $\frac{3}{8}$in. in diameter. The primary or input winding should consist of about 12,000 turns of No. 40 s.w.g. d.s.c. wire. Full constructional details of a suitable transformer are given on page 33 of our last issue.

A. Y. (BIRMINGHAM) requests a diagram of a new circuit which he might test.

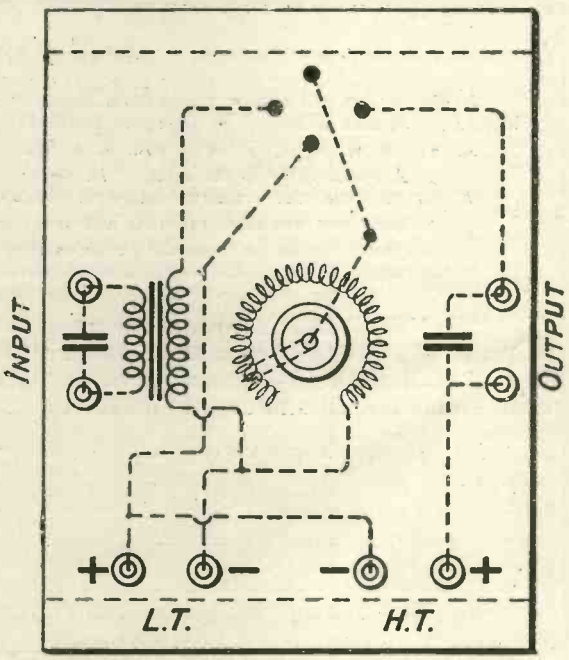


We give above a novel circuit for which good results are claimed in America. If an earth connection is used with the aerial it should be connected as indi-

cated by the dotted lines. We suggest you try with the McClelland variometer, which should enable you to obtain good results on the broadcast band of wavelengths.

I. H. P. (MANCHESTER) requests a circuit diagram and details of a single valve low-frequency amplifier suitable for use with his crystal receiving set.

We give below a diagram of a serviceable L.F. amplifying panel, the components required being as follows :—



1 panel of ebonite or dry wood impregnated with paraffin wax, about 4½in. wide by 6½in. long, with cross piece at each end shown dotted in the diagram.
1 iron-core intervalve transformer, having a step-up ratio of about 1 to 4.
1 filament rheostat, 1 valve holder or 4 valve legs, 2 small fixed condensers, capacity 0·002 μF, and 8 brass terminals.

P. L. (LONDON, E.1) writes regarding the four-valve set described in "MODERN WIRELESS" Nos. 3 and 4. He desires to arrange the components in one cabinet.

Provided that care is taken to fit the variometers some distance apart and to avoid connecting wires running parallel and close together, a very servicable cabinet set could be made. In reply to a further question we fear you will not be able to entirely eliminate 2LO, only two miles distant. If you desire to experiment in this direction, make use of an inductively coupled tuner.

J. F. T. (CALLANDER) submits a diagram of a proposed valve-crystal circuit and enquires with regard to the use of a condenser in parallel with the anode coil.

The condenser is necessary in order to obtain accurate tuning of the anode circuit. Quite good results are obtained by the use of one of the tapped anode reactance coils now on the market, which, of course, are claimed to function without any condenser, although one of small capacity (say, 0.0001 μF) will probably be found an advantage. With a good aerial and careful operation of the set, you may receive 2LO, and should certainly get excellent results from 5SC.

G. H. T. (GOLDERS GREEN) enquires regarding the use of the microphone amplifier described in "WIRELESS WEEKLY."

We do not think your proposed arrangement will give satisfactory results, but a few experiments will determine this. Sac Leclanche cells may be used in conjunction with the microphone, but the amount of current required imposes rather a heavy load, and it may be necessary to employ two sets of batteries with a change-over switch, so that as one is exhausted the other can be brought into use.

M. T. S. (GLASTONBURY) asks one or two questions regarding crystal detectors. The nature of the questions will be gathered from the following reply.

The majority of crystals now on the market are very reliable. Many dealers supply crystals which have actually been tested. Instability is one of the unfortunate drawbacks to the use of almost all crystal detectors, but especially those of the "cat whisker" variety, and it is usually necessary to reset the detector prior to using the apparatus.

J. L. B. (GLASGOW) refers to the two-valve broadcast receiver described in "WIRELESS WEEKLY" No. 4, and enquires regarding the probable receiving range of the set when used with a really good aerial.

Many readers are obtaining excellent results with the apparatus in question. An experimenter at Shrewsbury informs us that he receives Birmingham, Manchester, and in the late evening London, Newcastle, and Glasgow. When trying to receive distant stations, the tuning adjustment must be very carefully carried out. We shall be pleased to learn of your success in due course.

A. E. M. (SIDCUP) proposes to employ a relay for recording purposes and enquires regarding the possibility of operating it from a crystal receiver.

You will not be able to operate any type of mechanical relay direct from a crystal, unless the transmitting station is very close to you indeed. The actual output from the crystal set is so small that it is a difficult matter to measure it. We would strongly advise you to couple a valve amplifier, such as the two-valve amplifier described in WIRELESS WEEKLY No. 3, to your crystal set and connect the relay to the output terminals of the amplifier.

BRIEF REPLIES

R. K. (PENZANCE).—We fear you will always experience some interference from the near-by Coast Station. Your receiver is not at all selective. Try an inductively coupled tuner and report results in due course.

A. H. H. (LEICESTER).—In the absence of a circuit diagram of your apparatus we are unable to assist you.

A. W. G. T. (——).—Your circuit appears quite correct, but results would probably be improved by the addition of a small fixed condenser (0.001 μF) across the telephones and a large one (up to 0.5 μF) across the H.T. battery.

H. H. (ROCHDALE).—We have no knowledge of the apparatus and advise you to write to the manufacturers.

E. F. A. (FOREST GATE).—Full details of the regulations regarding the issue of licences are given in "Wireless Licences and How to Obtain Them," Radio Press, Limited, price 1s.

J. W. F. (ILFORD).—It is scarcely economical to attempt to construct such large capacity condensers. Purchase one or two Mansbridge telephone condensers. These are obtainable from dealers in ex-Government apparatus.

W. T. M. (SOUTHAMPTON).—With a good aerial and careful adjustment of your apparatus you should be able to hear 2LO. We understand, however, that Southampton is considered somewhat of a blind spot.

D. P. (CORNWALL).—For the inductively coupled receiver, as described in *Modern Wireless* No. 3, you will require a little over 1 lb. of wire for the primary and about ¾ lb. for the secondary.

L. B. (WORTHING).—The condenser C_2, as fitted in the detector unit shown on page 126 of *Modern Wireless* No. 2, should have a capacity of 0.002 μF.

C. R. (DUNDEE).—An arrow drawn through a coil indicates that the inductance of the coil is variable. Drawn through two adjacent coils, it indicates that the coupling between the coils is variable, and drawn through a condenser that the capacity of the condenser is variable.

W. P. R. (WEST ACTON).—By all means try the arrangement, but, in general, the effective receiving range of a crystal set with an indoor aerial is about three or four miles. A great deal depends upon the situation of the indoor aerial, whether under the roof or on an intermediate floor.

M. W. F. (PADIHAM).—Although a crystal detector may be connected directly to the grid of a low-frequency amplifying valve, considerable improvement is effected by the introduction of a step-up iron core transformer.

M. D. M. (CRICKLEWOOD).—The connections of the L.F. transformer are important. Try the effect of reversing them. Reflex circuits have very strange characteristics, and it is important to well insulate and carefully space the various components.

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