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Wireless Weekly

and The Wireless Constructor.

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No. 4.

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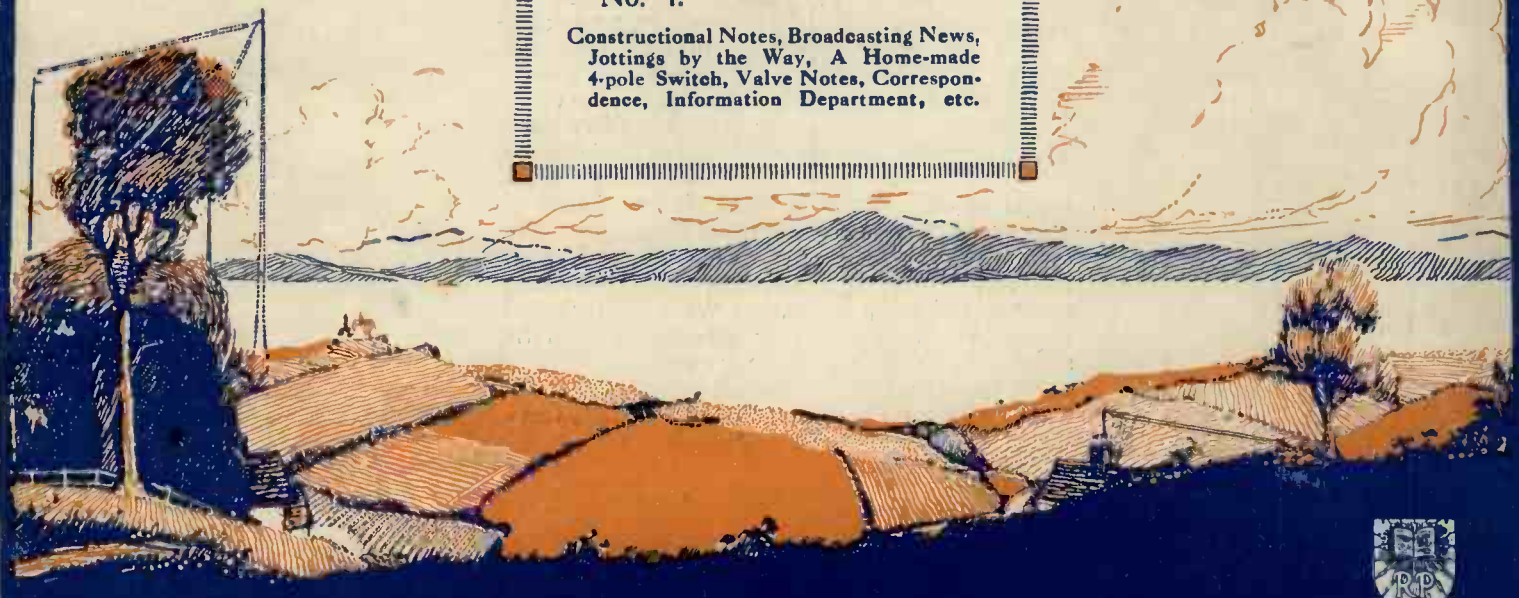

The Omni-Circuit Receiver.

Wireless Weekly

Vol. 3, No. 4
Jan. 2, 1924.

CONTENTS

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Editorial

1923—A Retrospect.

At the beginning of a new year which, unless we are much mistaken, will witness great developments in wireless, it is appropriate to consider the changes effected and progress made during the year which has just closed.

A year ago the British Broadcasting Co. had but two or three stations in operation, and these in a more or less experimental way, and the 2,000 or 3,000 wireless enthusiasts of the country, who had hitherto been obliged to be content with very brief weekly transmissions from Writtle, began to realise the pleasures and potentialities of broadcasting.

So also did the entertainment-loving public, especially as there was the added incentive of scientific interest and novelty. In embarking upon a task, the magnitude of which was perhaps scarcely realised at the time, we fear the B.B.C. did not fully realise the appeal of scientific interest and its effect in imbuing thousands with a desire to construct their own receiving apparatus.

This desire on the part of a large proportion of the public, the future supporters of broadcasting, together with a difficulty in finding a satisfactory method whereby the providers of the entertainment would be adequately remunerated, quickly led to difficulties which ultimately developed into the long-drawn-out licensing controversy, and very soon after the inception of broadcasting, the Post Office authorities were inundated with some 30,000 applications for experimental licences.

The necessity for the immediate issue of some form of constructional licence was apparent to all, but as there was considerable difficulty in effecting a satisfactory settlement between the B.B.C. and the Post Office authorities, the unfortunate expedient was adopted of appointing a Special Committee to investigate the whole position of broadcasting. This Committee was appointed on the 24th April, 1923, by Sir William Joynson-Hicks, and presented its report to Parliament in August, 1923, following which the Postmaster-General decided that interim and constructor's licences should be issued at a fee of 15s.

This settlement of the licensing question gave a real impetus to broadcasting, and by October over a quarter of a million licences of various types had been issued by the Post Office. One month later, the Postmaster-General (Sir W. Laming Worthington Evans), in opening the All-British Wireless Exhibition, stated that 492,000 licences had been issued up to that date. We congratulate the B.B.C. upon its efforts so far and upon its desire to work in harmony with other interests concerned.

Following a settlement of the licensing question, and the decision of the B.B.C. at an Extraordinary General Meeting of its members, to modify the royalty charges upon complete receiving sets, broadcasting has, at last, had an opportunity of developing, and already considerable strides have been made, both with regard to the choice and quality of individual programmes and the extension of simultaneous broadcasting, though, with regard to this latter, we are inclined to think that there is a tendency to over-do it.

Wishing You All A Happy and Prosperous New Year

1924.

In view of the progress made during the past year, despite the enormous difficulties which had to be overcome, we feel confident that in the coming year we shall see highly-satisfactory developments in broadcasting, a full measure of appreciation and support from a greatly-increased number of listeners, and well-deserved prosperity for the B.B.C. and the wireless industry generally. 1924 should, in fact, prove a year of real advancement in wireless.

OUR GIFT SCHEME.

Will readers who intend to avail themselves of our offer of books from the Radio Press Series, kindly send us a postcard advising us which book they intend to order? We shall then be able to ascertain the demand and make preparations to execute orders promptly.

SIX LECTURES ON DUAL AMPLIFICATION

No. IV.

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

The fourth article of a series of six which began in Vol. 3, No. 1.

The ST100 Circuit.

As the ST100 is so extraordinarily popular, it would result in an incomplete account of the subject if this circuit were not dealt with at some length, although most of our readers will already know the circuit well.

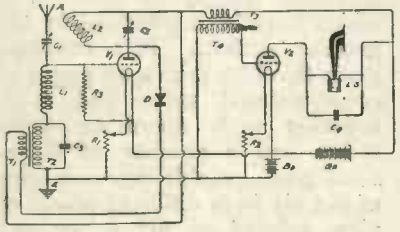


Fig. 19.—The ST100 circuit.

It is reproduced in Fig. 19. This form of the ST100 circuit was a development of that in which the circuit was originally published, and the results obtainable are much more stable in the new form of the circuit.

It will be seen from Fig. 19 that the first valve V_1 acts as a high-frequency amplifier of the incoming oscillations, the aerial circuit being tuned by means of the variable condenser C_1 and the inductance L_1. The condenser C_1 might be connected in parallel with the inductance, and the experimenter should try both methods, although the one shown in Fig. 19 will be found perfectly satisfactory. The anode circuit contains the inductance L_2 tuned by means of the variable condenser C_2, which, like C_1, has a maximum capacity of 0.0005 μF. The high-frequency oscillations in L_2 C_2 are rectified by means of the crystal detector D which, together with the primary T_1 of the intervalve step-up transformer T_1 T_2, is shunted across the variable condenser C_2, one side of the crystal detector going directly to the anode of the valve. The secondary T_2 of the step-up transformer T_1 T_2 is included both in the aerial circuit and in the grid circuit of the first valve, the object of this special connection having already been explained.

The condenser C_3 has a value of 0.001 μF. The grid potential is now varied by the low-frequency potentials across T_2 as well as the incoming high-frequency oscillations. The latter energise the oscillatory circuit L_2 C_2, whereas the low-frequency currents pass through L_2 and through the primary T_3 of a second intervalve transformer T_3 T_4. The currents through T_3 will therefore be the amplified low-frequency currents, and the potentials communicated by T_4 across the grid and filament of the second valve will result in the low-frequency currents being amplified a second time, on this occasion by the valve V_2; the amplified low-frequency currents pass through the loud-speaker LS, which is shunted by a condenser C_4, having a capacity of 0.002 μF. This condenser may have any value from 0.002 μF. to 0.05 μF, according to the type of loud-speaker and the nature of the signals desired.

The use of a condenser generally makes the signals more mellow, but weakens them to some extent.

The left-hand side of T_3, that is to say, the side nearest the anode of the first valve, should be the OP terminal of the primary winding, whereas the right-hand side should be the IP. In the case of the secondary T_4, the end connected to the grid should be the OS terminal (out secondary), while the left-hand side should be IS (in secondary) terminal.

With regard to the transformer T_1 T_2, the top end of T_2, that is to say the end which is nearest the grid, should be the O.S. terminal, whereas the other end should be the IS terminal. With regard to the primary T_1, the side connected to the crystal detector should be the OP terminal, while the other end should be the IP.

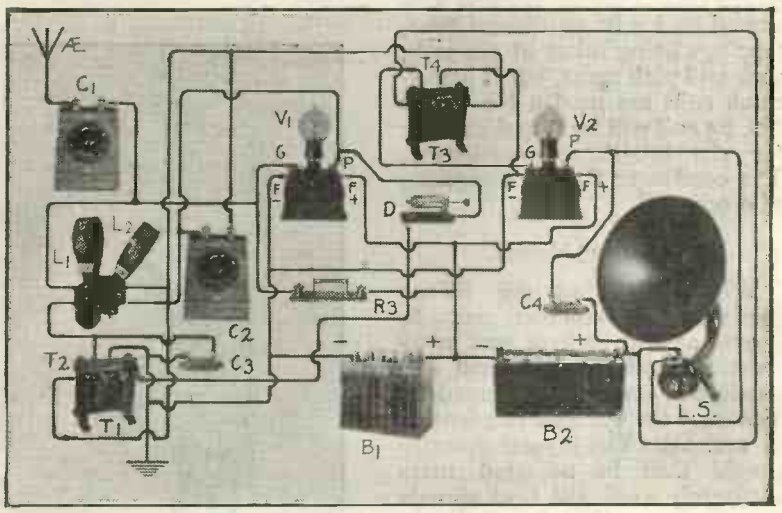


Fig. 20.—Pictorial form of the ST100 circuit.

The resistance R_3 should have a value of about 100,000 ohms, and is for the purpose of stabilising the circuit and improving the purity of the signals received. A variable resistance enabling any value from 50,000 to 100,000 ohms may be purchased and will be found excellent for this purpose. Fig. 20 is a pictorial form of the ST100 circuit.

Values of Components.

The inductance L_1 may consist of 100 turns of No. 26 gauge double cotton covered wire

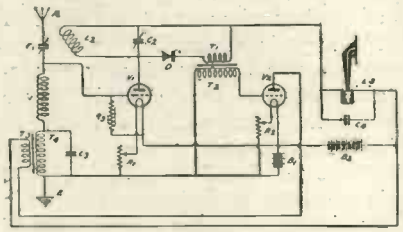


Fig. 21.—Circuit ST111.

wound on a cardboard tube 3½ ins. diameter. Tappings may be taken at the 30th, 45th, 60th, 75th and 100th turns. Alternatively, a No. 50 or No. 75 honeycomb coil might be employed. The variable condenser C_1 has a capacity of 0.0005 μF., as previously stated. The condenser C_3 has a value of 0.001 μF. The inductance L_2 may consist of 70 turns of No. 26 gauge double cotton covered wire wound on a 3 in. cardboard tube, tappings being taken at the 30th, 50th and 70th turns, but if honeycomb coils are used a No. 50 or No. 75 coil will be found suitable for the broadcast wavelength. The condenser C_2 has a capacity of 0.0005 μF.

Operating Notes.

When operating the ST100 receiver, the reaction coil L_3 should at first be kept well away from L_1, and both the grid and anode circuits carefully tuned by means of the variable condensers C_1 and C_2. The crystal detector should then be adjusted more accurately until the best signals are obtained; then bring the reaction coil L_3 a little closer to L_1 and retune on the condensers C_1 and C_2; bring the reaction coil still closer to L_1 and once more retune C_1 and C_2. It will be found that as the reaction is tightened, lower condenser values in each case will be required. If the reverse effect is noticed, try reversing the leads to the reaction coil L_3. This, in fact, should always be done in any case.

Possible Faults.

The ST100 circuit should give loud-speaker results easily up to 25 miles from a broadcasting station, even on a poor aerial. Many reports of transatlantic broadcast reception have been published by those using this circuit, but its greatest advantages are to be found when receiving from nearby broadcasting stations. In these cases the results will be very powerful, and, for ordinary family use, it forms an excellent solution to the problem of operating the loud-speaker off two valves.

Signals may be obtained when the crystal detector is cut out of circuit, but the results are not nearly as good as when the crystal is employed. When the crystal is not in use, the first valve is simply acting as a detector, and the second valve as a low-frequency amplifier. We thus have no high-frequency amplification, and only one stage of low-frequency amplification. In the case of the ST100 using the crystal detector, we have one stage of high-frequency amplification with reaction as well and *two* stages of low-frequency amplification.

If signals are as strong with the crystal detector disconnected, something is seriously wrong, and the first thing to suspect is the crystal detector itself. The special crystals containing galena, together with a cat's whisker, are found ideal for this purpose, but good specimens are necessary.

The transformer T_3 T_4 require to be a particularly good pattern, and even transformers which are perfectly satisfactory in an ordinary straight circuit will sometimes be found unsuitable for the ST100. On the other hand, the transformer T_1 T_2 may be of practically any make.

Full construction details for making a very effective ST100 receiver are given in *Radio Press* Envelope No. 1, the contents of which have been prepared by the present author. This envelope gives two blue prints, 12 pages of constructional notes and data, together with operating comments and a number of large-sized photographic reproductions of the set from different points of view printed on art paper, and full working drawings. It was found desirable to produce this envelope so that every possible detail could be explained.*

* Radio Press Envelope No. 1. Price 1/6.

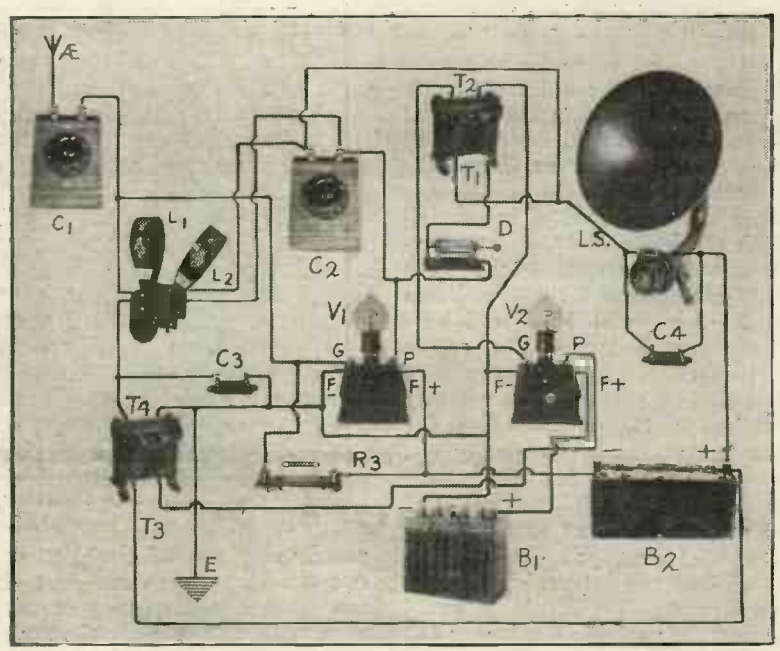


Fig. 22.—Pictorial form of ST111.

The ST111 Circuit.

The ST111 circuit is published here for the first time in a wireless periodical, although it appears in the author's new book "More Practical Valve Circuits," which contains circuits from ST68 to ST151. The circuit employs all the same component parts as the ST100, but the low-frequency stages are reversed so that the second valve now acts as the first stage of low-frequency amplification, and the first valve as the second stage.

The operation of the circuit is briefly as follows (see Fig. 21):—

The aerial circuit contains the variable condenser C_1, the inductance L_1, the condenser C_2, and the earth. The circuit is tuned by means of a condenser C_1 to the incoming signals. The high-frequency oscillations are amplified by the valve V_1, the amplified currents energising the circuit L_2 C_2, which is tuned to the same frequency. The coil L_2 may be coupled to L_1 for the purpose of producing reaction. Across C_2 we have the detector D and the primary T_1 of the step-up intervalve transformer T_1 T_2, the secondary of which is connected across the grid and filament of the second valve. This valve acts as the first low-frequency amplifier, and the amplified low-frequency currents are passed through the primary T_3 of the step-up intervalve transformer T_3 T_4, the secondary of which is included in the grid circuit of the valve. The low-frequency potentials applied to the grid of V_1 have therefore already been amplified once, and the valve V_1 provides the second stage of low-frequency amplification. The amplified low-frequency currents pass through L_2 and round through the loud-speaker LS.

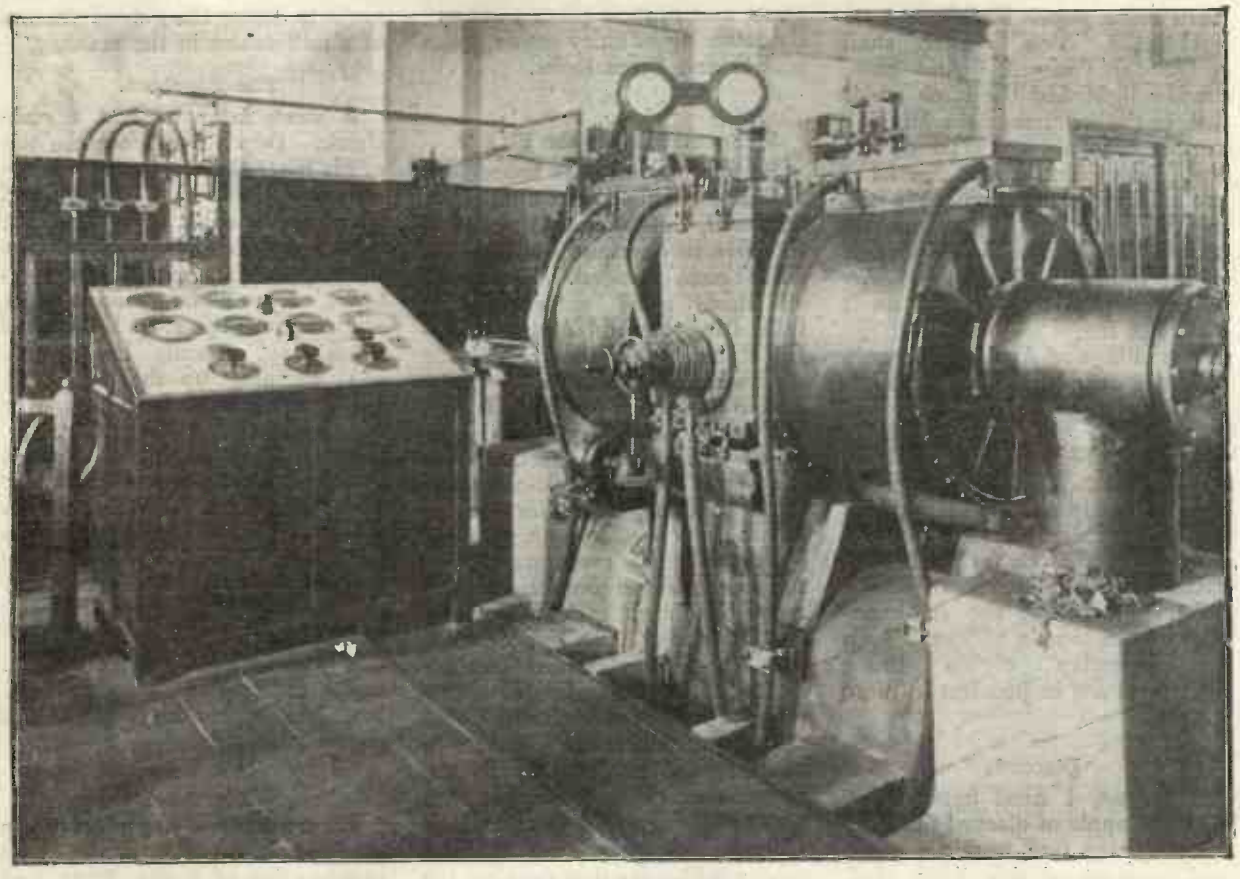
It will therefore be seen that the circuit is an inverse form of the ST100 receiver, and those who have experimented with the ST100 will no doubt be interested to try out this alternative form of a circuit involving a stage of high-frequency amplification with reaction, a crystal detector and two stages of low-frequency amplification.

Preliminary experiments seem to indicate that the results obtained are not quite as good as those given by the ST100 circuit, but this judgment must not be taken as final.

The pictorial arrangement of components used in ST111 is shown in Fig. 22.

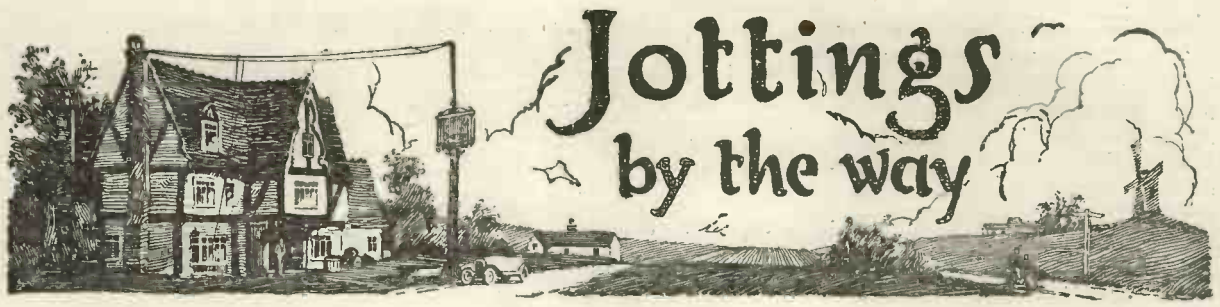
(NEXT WEEK: Part V of this series.)

A LINK IN THE IMPERIAL CHAIN



In the arc room of the station at Abu Zabal, near Cairo.

This Station is in constant direct communication with Leafield, Oxfordshire. The transmitting apparatus includes arcs by C. F. Elwell, Ltd.



News from the North.

A FRIEND who has just returned from a visit to the North tells me that there has been a terrible how-d'ye-do in one, at all events, of the remoter parts of Caledonia, stern and wild. Probably the tale that he unfolds is merely an instance of one of those international libels that sister peoples dwelling side by side in apparent amity are in the habit of flinging at one another. Probably it is nothing but a Sassenach slander upon the generous and open-handed Scot who flings his silver saxpences about as carelessly as if they were mere paper Fishers. I do not know. You, reader, shall judge for yourself. And now, having lightened the blow ere it fall, in the manner of the humane mother who always warmed her right hand before the fire as a preliminary to chastising her erring offspring lest its cold impact should be a shock to the portion of the infant to be swatted, now let me tell you the story as it comes to me.

The village of Auchwhatamuckerty has ever had a high reputation as a peaceful and righteous community. Any of its inhabitants who went a-fishing on that one of the two good days in the month that is always snapped up by the Sabbath was promptly stoned into a better frame of mind by his fellows. It was a sober place, too; the self-capacity of the simple villagers even on Saturday nights being measured not in jars but in mere bottles.

Discord.

Wireless, I need hardly say, was the apple of discord flung by a malignant fate into the peace and content of this little spot. Till its coming all men had been as brothers, helping one another home even when weather conditions were so appalling that two moons appeared side by side in the firmament. Now the place is riven by feuds, brother being set against brother and the McSporrans having sworn a vendetta against the McToories. In the bar parlour of *The Thistle,* where tongue wagging was once so general that as many as three "ayes" and a "hoots" were frequently heard within the brief space of half an hour, all is silence of an evening. No one now makes a jest, no one bursts into laughter on the following day, having seen the point of it at his leisure; all these things are gone, and in their place you have the lowering of hairy brows, grim scowls and fierce looks.

McSporran takes the Plunge.

So long as wireless broadcasting was confined to England all was well, but when things began to move in Scotland the position was at once changed. Here were all these good entertainments from Glasgow and Aberdeen flying through the ether right over Auchwhatamuckerty ready to be picked up for the asking. It was a sheer waste of golden opportunities to let such excellent free stuff pass untapped. Something must be done, but what and by whom?

For a while everyone waited for someone else to make the first move; one must go cautiously in such matters. Then Ian McSporran, the village's most wealthy man, took the plunge. The neighbours were electrified one day to find him delving a hole in his kailyard preparatory to the erection of the tall fir pole that was to be his aerial mast. Once started, the work went forward with a will. By that evening the wires were slung. Next morning McSporran wrote a constructional note on the use of whiskey bottles as insulators which has not so far appeared in *Wireless Weekly.*

As the shadow of night began to fall, tuning began in grim earnest, and before long it seemed that the smile which expanded gradually until it threatened to split McSporran's face in twain was prevented from so doing only by the pressure of the telephones upon his ears. Never had he been so popular, never had business been so brisk as it was on that evening when all and sundry pressed to listen in at a penny per head per minute. McSporran went to bed that night to dream the golden dreams of a millionaire in the making.

The Poachers.

A week later he had a rude shock. Depending from the top of his mast there was now an additional single wire, embellished with a plentiful supply of the local insulators, that ran to the house of his next-door neighbour. Even as he gazed in mute stupefaction upon it he saw a small boy, Jimmie McToorie's son, shinning up the pole with yet another wire in a coil over his shoulder.

He retired within to think it over. When he looked out again in a couple of hours' time his mast was proudly bearing no less than seven sets of wires, whose far ends were attached to the surrounding cottages. Auchwhatamuckerty had adopted in one the idea of the communal aerial mast; there was, in fact, but one dissentient from the general feeling.

The Feud.

He went round to protest; they received him with smiles and gentle cries of hoots, toots and havers. He threatened; they were unmoved. When he demanded rent they asked him to

tell them how he had acquired his pole and remarked on a suspicious gap that had appeared in the laird's fir plantation. Baffled but not despairing he returned home. As he sat brooding the fighting blood of the McSporrans began to rise. Summoning his son he bade him scale the pole and remove the offending wires one by one, taking care not to injure them, and to return them to their owners with his compliments. Next morning all were in their places again, and two additions had been made to their number. Infuriated he sent for a ladder and cut them down ruthlessly. That evening as he sat listening the strains of music were suddenly cut off as the crash of his own aerial's fall announced that reprisals had begun.

The Aftermath.

And so the stern fight went on, now one side scoring a point, now the other. The village store ran out of solder so great was the demand for it for repairing cut wires. McSporran's kailyard was so strewn with broken insulators that the brown earth was hard to see. And thus it has come about that the great feud exists. McSporran and his few supporters of his own clan are now bearing it without grinning, realising that they cannot have the music unless they endure the pirate wires. Meantime the rest of the folk are in one way quite content, not seeing why they should erect masts of their own, when they already have the use of a perfectly good one; but each is consumed by a burning jealousy of his fellows, whom he suspects of having occupied a higher point than his upon McSporran's mast. McSporran's mast resembles one of those wire bedecked poles that are to be seen above telephone exchanges, save that its insulators are far more picturesque.

That is the position of affairs at present. But there are rumours that McSporran contemplates a terrible revenge. He is thinking of buying a valve set with which to howl these dastardly poachers into grovelling submission.

The Radiopossum.

Wireless is always developing new types of its own amongst those who become its votaries. The radioliar we know well, and the radioswankist is now recognised at sight. Recently I came across quite a new one whom I have dubbed the radiopossum—you remember that engaging little animal's propensity for lyin' low an' sayin' nuthin'. I was travelling recently in the train with two or three other men, all strangers to me, who were talking wireless shop to their hearts' content. In one corner sat another fellow, a quiet sort of chap, who read his evening paper and said never a word. The talkers made several unsuccessful attempts to draw him into the conversation, and eventually by dint of persevering they succeeded in so doing.

They told him a whole lot about the wonders of wireless. He must certainly get a set, they decided, a simple crystal to begin with. They drew simple circuits out for him. Finally they recommended him a text-book. He rose to gather his impedimenta as the train slowed up. "Think that's really a good book?" he asked. "Rather! Tophole!" came the chorus. "Thanks very much," he said as he got out. "It's kind of you to recommend it. I wrote it."

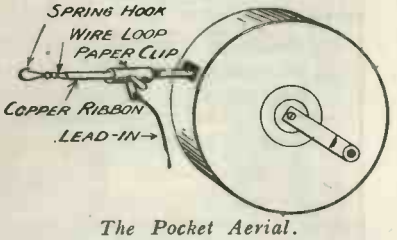
WIRELESS WAYFARER.

POCKET AERIALS.

HERE is a simple and quite inexpensive method of making an aerial of from 50 feet to the full regulation length that can be carried in the coat pocket. The first essential is a large wooden fishing reel of the Nottingham type. The reel need not be of good quality—one that will answer perfectly can be obtained for about 6s.—but its diameter must be big enough to enable it to hold up to 100 feet of thin single "flex."

The "flex" should be the thinnest that will stand a dead-weight strain of from 16 to 20 lb. Now take a piece of whipcord about a couple of feet in length, make a loop at one end, and attach the other to the drum of the reel. Knot the "flex" to the loop in the cord and wind on. The only other things that need be carried are a hank of whipcord and a single insulator.

To use the aerial, knot the end of the "flex" and the whipcord to the insulator. Unroll the cord and fasten a stone to its far end. Throw the stone over the branch of a tree—the highest you can find and reach with a throw. Remove the stone and haul in the cord until the insulator is just clear of the branches. Anchor the cord and move away, paying out the wire from the reel. When you come to the end, untie it from the cord, loop and connect to the aerial terminal of the set.



The Pocket Aerial.

An excellent American tip for making a pocket aerial is as follows:—Obtain an old cricket tape of the kind that rolls up into a leather case. These can often be picked up for a few pence, as for our purposes it does not matter in the least if the tape is broken.

Remove the tape, and substitute for it as much copper ribbon ½ in. wide as the reel will hold. To the far end solder a loop of wire provided with a spring hook such as that used for dog leads. The insulator is a length of ebonite rod into which two eyes are screwed.

To use this aerial, attach the spring hook to one eye of the insulator and a length of cord to the other. Throw over a branch and pay out as before. Attachment to the aerial terminal is made by means of a short length of wire, one end of which is provided with a spring paper clip, which is slipped on to the copper ribbon. A great advantage of this type of portable aerial is that you can use just as much or as little of it as is convenient. The unwanted part is left wound up, the clip fastener being slipped on at the point where the ribbon enters the case. R. W. H.

A REALLY SELECTIVE BROADCAST TUNER

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

The following is a constructional article describing in simple language how to make an efficient two circuit tuner.

MANY owners of powerful valve sets find that although they may perhaps get the range of reception claimed for their instruments, in actual practice they are generally limited to the local broadcast station for the greater part of the time, as interference from the latter station, as well as Morse jamming, etc., make long-distance reception impracticable, or at any rate, the reverse of enjoyable.

The remedy generally suggested is the addition of filter-circuits, wave-traps, etc., of various degrees of complication and difficulty of adjustment. These must necessarily introduce an appreciable loss of signal-strength. Extreme loose-coupling to an aperiodic aerial, as in various modifications of the Reinartz tuner, whilst giving excellent selectivity, and that silent background which is so desirable in telephony reception, involves a very noticeable loss of signal strength. If close coupled to an aperiodic aerial, as has been suggested several times recently, perhaps better signal-strength can be obtained with great ease of tuning. Nevertheless, the obvious advantages of the sharply-tuned aerial are sacrificed, and measurement shows a considerable loss of signals.

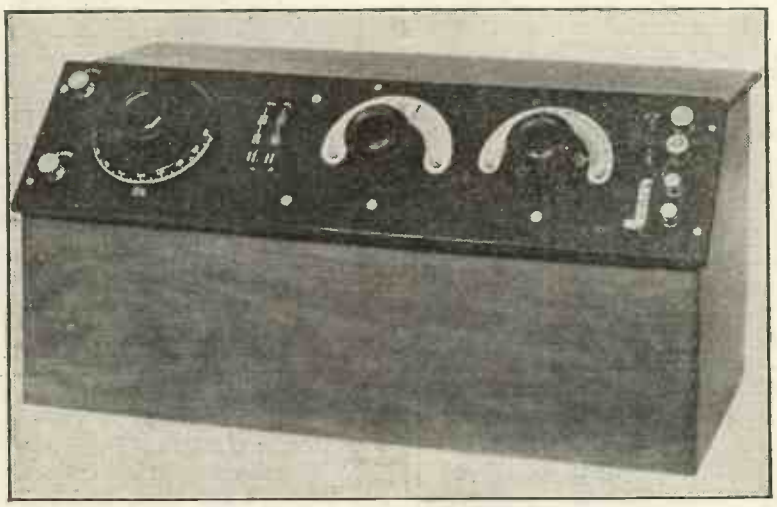


Fig. 1.—A photograph of the tuner.

In order to obtain the selectivity of the Reinartz tuner, without the loss of signal-strength associated with the latter, the circuit in the diagram, Fig. 2, was evolved. This is a slight modification of a form of circuit popular in the United States, and includes the standard type of vario-coupler and variometer in use there, reaction being obtained by means of a plate variometer.

In order to obtain the extreme selectivity desired, a very loose and non-variable coupling is provided between the primary and secondary circuits by means of *two* turns of wire forming part of the secondary actually wound on the stator of the aerial-tuning variometer at the "earth" end.

These two turns are wound on the former between the last three turns of the thick aerial-inductance wire. Both aerial and secondary circuits are wound with extremely thick d.c.c wire so as to keep H.F. resistance to a minimum, and thereby increase the sharpness of resonance, with resulting gain both in signal-strength and selectivity.

A considerable amount of experimental work, accompanied by repeated careful measurement of signal-strength with various arrangements, brought out the fact that when using No. 20 S.W.G. wire for the secondary inductance, and tuning by variometer with minimum capacities only, it did not pay to reduce the

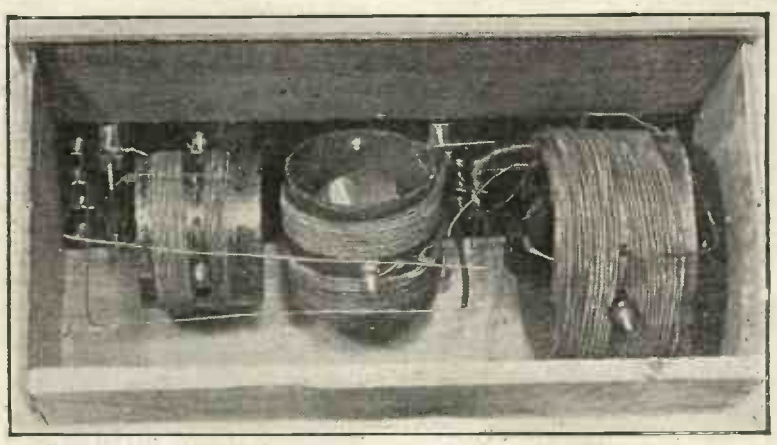


Fig. 1a.—Back of panel view of the instrument.

available tuning-capacity below about 0.0001 μF. plus the inevitable valve capacities; since the greater inductance required involved the use of so much wire that the H.F. resistance became appreciable, and cut down signals more than the expected greater potential difference across the inductance with lower capacities, built them up.

In other words, the optimum resonance was obtained with the distribution of inductance and capacity indicated; though, of course, this optimum is not very sharply defined.

Accordingly, a fixed condenser of 0.0001 μF. is used across the variometer, and the latter is wound to give the required range with the small capacity available.

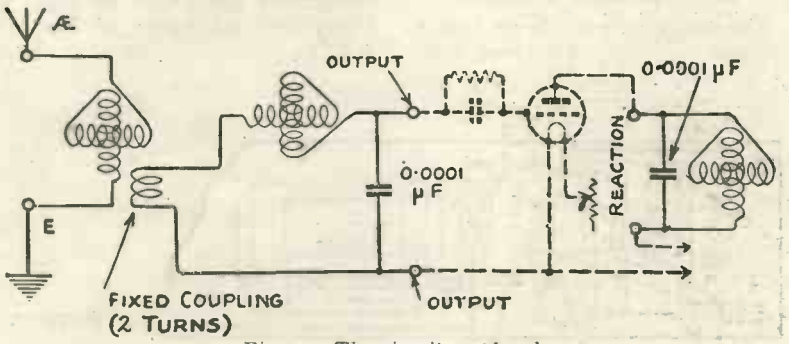


Fig. 2.—The circuit employed.

A variable condenser here of 0.0001 μF. maximum capacity, will introduce losses which are quite noticeable in the higher ranges of wave-length.

Similarly, for sharp and effective reaction, a fixed condenser of the same value is used across the reaction variometer, and the latter is wound with a wire (No. 22 S.W.G., d.c.c.) which will also give a low H.F. resistance, and in a manner which does not introduce much distribution capacity.

Careful experiment showed that it was actually worth while to use wire of as large a gauge as No. 15 S.W.G. in the aerial circuit to obtain maximum signals and selectivity. This was with a low-resistance aerial and a good earth. On a poor aerial the difference might not be noticeable between this and No. 18, e.g., if exception be taken to such relatively clumsy wire No. 18 S.W.G. can be substituted without great loss.

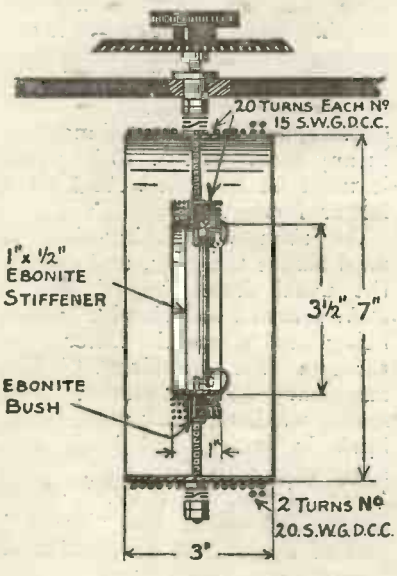
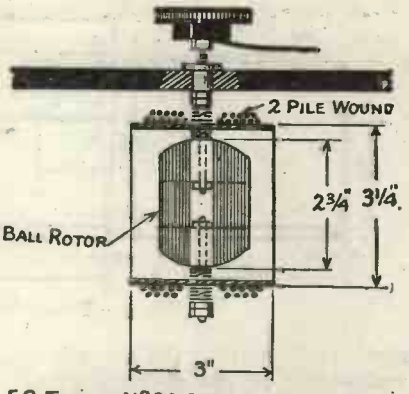


Fig. 3.—Details of the aerial tuning variometer.

The *actual results* obtained by adhering throughout to this principle of low-resistance freely-resonant circuits, extremely loosely-coupled, are rather remarkable. Measurements with a micro-ammeter on 2LO's carrier-wave at a distance of 13 miles using a crystal for rectification, gave an actual signal-strength of 80 per cent. of the best obtainable with a good direct-coupled tuner. Aural observation with the 'phones showed no sensible difference at all, when switching rapidly from one to the other.

With valve rectification using reaction, the results were, of course, distinctly louder, as the effects of reaction could be more favourably utilised. With one valve and the complete tuner, as shown in the photograph (Fig. 1), and on a low-resistance, but not particularly high twin 40-feet P.M.G. aerial in a N.W. London suburb, 2LO came in at good loud-speaker strength for a small room. Bournemouth, Newcastle, and Glasgow were read comfortably on the 'phones in the afternoon transmissions, Glasgow being particularly clear, and Birmingham at 100 miles was plainly readable on the loud-speaker. The waves of Aberdeen and Manchester could be picked up sufficiently in daylight for calibration purposes, but could not be resolved into speech.



50 TURNS Nº20.S.W.G.D.C.C.ON STATOR ROTOR FULL OF SAME.
REACTION- 40 TURNS Nº22.S.W.G.D.C.C. ON STATOR. ROTOR FULL OF SAME.

Fig. 4.—Constructional details of the secondary and reaction variometers.

At night every station (except perhaps Manchester) can be received whilst London is transmitting, with complete exclusion of the latter. A movement of a few degrees on the secondary variometer cuts 2LO right out. On a large, high aerial *one mile* from 2LO (on which an average 4-valve B.B.C. receiver still gave 2LO audibly on the loud-speaker when tuned up to 500 metres and beyond), although speech, etc., came in on a single valve with this tuner at good loud-speaker strength, and undistorted, when tuned correctly to his wave, it could be reduced to complete silence on the head-phones by tuning a few metres either way so that other stations became actually available.

Late at night, on favourable occasions, both Glasgow and Newcastle have been audible across the room on the loud-speaker with the single valve. As the tuning of the secondary circuit is sensibly independent of aerial characteristics, the scale of the secondary variometer is calibrated directly in the broadcast wavelengths (with the aid of a wave-meter and their carrier-waves), and it is a matter of a moment only to pick up any one of the short-wave European

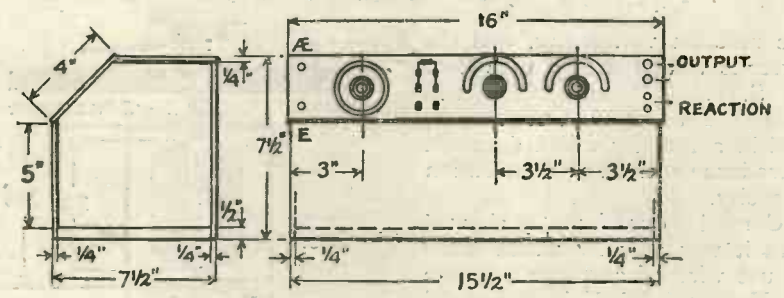


Fig. 5.—Dimensions of the cabinet.

stations by setting the secondary variometer to the corresponding mark, adjusting the reaction so that the valve is just oscillating—there need be little fear of effectively energising the aerial with this extremely loose coupling—and then swinging the aerial variometer until best results are obtained with the valve safely below oscillation. When in this condition, slightly detuning the aerial circuit in either direction will, in general, allow oscillations to commence.

The inclusion of the higher band of wavelengths in the broadcast belt has led to some embarrassment to designers of broadcast tuners, but the higher range (Aberdeen at 495 and Birmingham at 475 metres) can be included in this instrument by simply putting fixed condensers of 0.0001 μF. capacity across the aerial tuning and secondary variometers respectively. The reaction variometer described will suffice up to about 500 metres without any modification.

A "stand-by—Tune" switch is incorporated in the design for rapid searching as, e.g., for local experimental transmissions. When experience has been gained in the use of the tuner, and the calibrations have been marked, some experimenters may prefer to omit this and to use in its place switching arrangements for covering the higher broadcast range without connecting up external fixed condensers.

An alternative wiring diagram is given for this purpose (see Fig. 7). There is actually enough room for the two 0.0001 μF. fixed condensers behind the panel, alongside the switch and between the two smaller variometers respectively, if mounted edgewise.

Constructional Details.

The tuner was made up into a sloping-desk type of cabinet, with due consideration to economy of ebonite. Detail dimensions of this are given in Fig. 5. ¼ in. fretwood was used for the sides, ends, and top, being easy to work, and giving a good finish with the minimum of trouble by shellac varnishing, rubbing down with fine glass-paper and then applying thick shellac varnish with a soft pad of cloth and with a light touch, after the fashion of the French polisher. The top must be left loose until the panel is finally fitted. A stouter baseboard of a soft wood provides a good foundation for building up the box.

The ebonite panel, 16 ins. by 4 ins. by ¼ in. (no thinner) has the surface cleaned off as usual with fine emery paper, and finished with Brasso, followed by a rub down with an oily rag. The variometers are mounted on it by means of counter-sunk No. 4 B.A. screws and nuts. The condensers used were the Grafton Company's clip-in type, the clips being fixed by further No. 4 B.A. screws and nuts. The D.P.D.T. switch is of the neat type marketed by the same firm, in which the contact pieces are mounted direct on the panel by small bolts.

Details of the aerial-tuning variometer are given in Fig. 3. There are 20 turns of No. 15 S.W.G. d.c.c. wire for both stator and rotor. The latter is built up on a narrow cardboard ring only 3½ ins. diameter, as the wire has to be bunched up roughly on each side to get it on, and taped up in place. With such large wire it is hardly practicable to arrange a regular winding scheme, and it is of small moment in any case. If No. 18 be used, it must be two-pile-wound on a larger former.

An ebonite stiffening-piece is used across the ring, and carries the usual stub-axles of No. 2 B.A. screwed rod ebonite bushes being used where the latter pass through the windings. The customary arrangement of spring-washers, lock-nuts, brass bush in panel, and knob and scale above, is indicated. Two turns of No. 20 S.W.G. d.c.c are wound on at the "earth" end of the stator, as mentioned before.

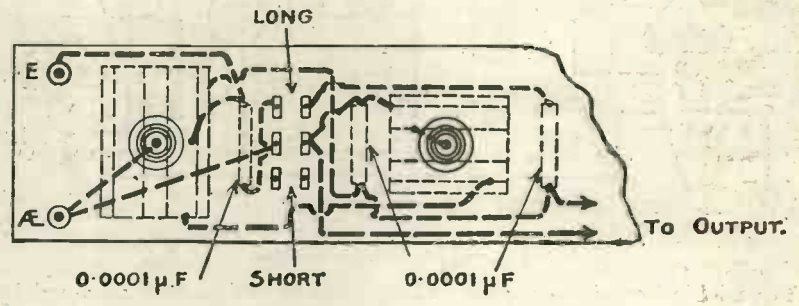


Fig. 7.—An alternative arrangement of wiring.

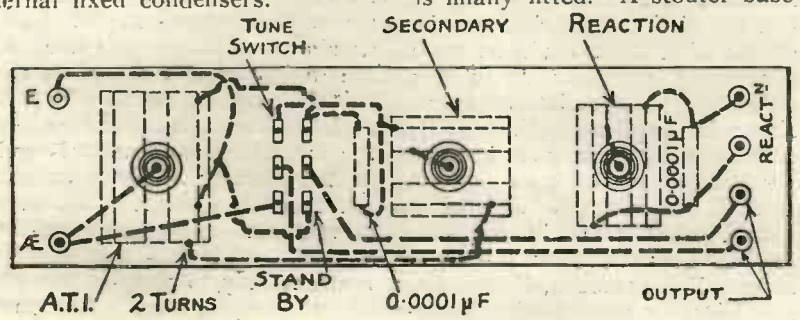


Fig. 6.—Wiring diagram.

(*Concluded on page 130.*)

HOW TO DESIGN YOUR OWN SET

No. IV.

By PERCY W. HARRIS, Assistant Editor.

The fourth article of a series of six which began in Vol. 3, No. 1.

Disadvantage of Variometers.

The disadvantage of variometers is that it is by no means easy to arrange reaction on to them. Another disadvantage is that unless they are very efficient, the range of wavelength obtainable is not particularly great. In choosing a commercially-wound variometer look for one in which the wire is of reasonable thickness. Variometers which are heavily impregnated with shellac are not recommended. A certain amount of shellac is not detrimental, but a large quantity giving the appearance of a heavy coating of shiny varnish over the whole coil is undoubtedly bad. Variometers wound with thick silk covered wire are probably as good as any. With variometers, as with every other component, you "get what you pay for."

Switches for Tuning Inductances.

In designing the switches for tuning inductances, be careful to arrange the studs so that the distance between them is less than the width of the switch arm. If this is not done there will be a risk of the blade dropping between two studs. Apart from this it is wise to keep the studs as far apart as possible, so as to reduce the capacity between them to a minimum. For the same reason the lead from the coil to the switch should be kept very short.

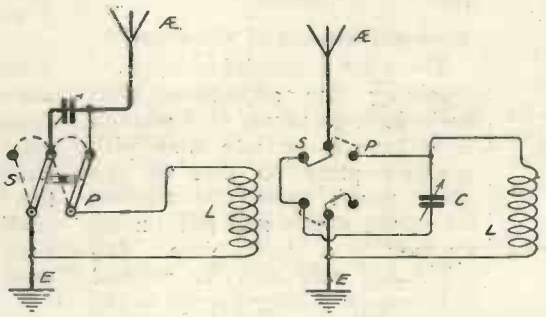


Fig. 1.—Illustrating switching for series-parallel capacity using 5- and 6-point switches.

Fig. 1.

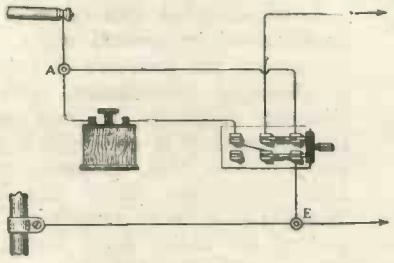


Fig. 2.

Fig. 2.—Another method of series-parallel switching employing a double-pole throw-over switch.

Fig. 3.—An arrangement of terminals permitting series-parallel arrangement. With the aerial at A1 the condenser is in series. With the aerial at A2 and a connecting strap across Æ and A1, the condenser is in parallel.

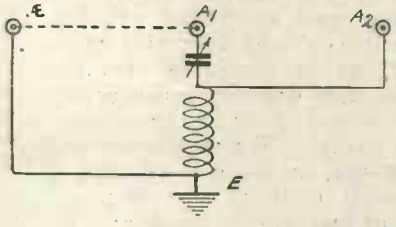


Fig. 3.

Method of attaching Inductance Coils to Panel.

The formers of inductance coils can very easily be attached to panels by drilling two holes, one at each end of the former. Similar holes should be drilled in the panel, so as to come immediately over the holes in the former. Metal screws can then be passed through both holes and the former secured by a lock nut on each screw. It is wise to include a thick washer between the former and the panel so as to keep the windings away from the surface of the panel. A more professional way, of course, is to fix end-pieces in the former and to attach these to supports screwed into the panel. In the majority of cases, however, the method previously mentioned will be quite good enough, and will have the advantage of keeping the coil as close as possible to the switch points, should these be used.

Variable Condensers.

These can be bought ready made or can be assembled by the experimenter himself from component parts. Unfortunately, owing to a lack of standardisation, and probably also to a general carelessness in making claims, the average variable condenser sold has a smaller capacity than it is stated to have. Indeed, I have been tempted to publish a list of condensers readily obtainable in dealers' shops (condensers of well-known manufacture, too), and to place side by side with the capacity the

condenser is stated to possess the actual figure on measurement. These figures would, I am sure, occasion considerable surprise. It is not too much to say that not one condenser in ten for which a capacity of 0.0005 μF is claimed has a higher capacity than 0.0004 μF. One manufacturer who takes large advertising space in every one of the wireless periodicals is a particular offender in this regard.

Possibly one of the causes of this bad rating of condensers is the absurd system of endeavouring to calculate the capacity by counting the number of plates. The capacity of a condenser is dependent upon the total area of the plates and their separation. If, for example, you have a condenser made up of 10 fixed plates and 9 moving, the separation being $\frac{1}{8}$ in. between plates, this condenser will have only a half of the capacity of one in which the separation is 1-16 in. Obviously, too, the size of the plates has a bearing on the capacity, so that the mere statement of the number of plates is no indication whatever of the capacity of a condenser.

Importance of Correct Capacity in Condensers

It is very important that a condenser sold as 0.0005 μF, for example, should have this capacity, as in designing sets the amount of capacity is frequently determined by the tuning coils we are using. We may make our tappings on the coil of such a separation that a 0.0005 μF would just bridge tappings. If, then, we buy a condenser of a smaller capacity than we desire, we shall not be able to tune all wavelengths with this particular tapped coil.

Importance of Minimum Capacity.

Whilst it is of great importance that we should know correctly the capacity at a maximum of our variable condenser which we are using in the tuning unit, it is equally necessary to have a condenser which has not too large a minimum. It is quite a mistake to imagine that any variable condenser has no capacity whatever when the plates are at their widest separation. There is always a certain amount of capacity in the space between the two sets of plates and between the supports. Condensers which have metal end-plates with very thin bushings between the spindle and the end-plates (*i.e.*, between the fixed and moving plates) have a larger minimum capacity than those in which the end-plates are of an insulating material. Mica dielectric variable condensers of the compact type have a larger minimum than most air dielectric condensers. Of course, so long as we allow for this minimum in arranging our tappings or in choosing our coils, no great harm will be done, but particularly in tuned anode and tuned transformer circuits, the smaller the minimum capacity, the larger range of wavelength can we cover efficiently with a particular variable condenser.

Fine Adjustment of Condensers.

There are two chief methods of obtaining fine adjustment with variable condensers. One method is to have a separate knob with a single plate, so that we can effect rough tuning by moving all of the plates and fine tuning by moving a single plate. Another and very effective method is to attach a long handle to the moving plate and get fine adjustment in this way. There are also devices marketed by which a small wheel at the end of a rod can be made to rub against the edge of the dial, also giving a fine adjustment.

Suitable Values for Tuning Condensers.

If a condenser is used in series with the aerial tuning coil, a capacity of 0.001 μF is advisable. In parallel, a maximum of 0.0005 to 0.00075 μF is the most recommended on short waves, whilst 0.001 μF is suitable for longer waves. In general, we should try to do our tuning in such a way that a minimum of capacity is in parallel with a given coil, for the more capacity we have, the more we are likely to reduce the potential applied to the crystal or the valve. In tuned anode and tuned transformer circuits it is particularly important to keep the capacity low if we want to get maximum signal strength. In tuned anode circuits, for example, it is wise to choose a variable condenser of as low a minimum as possible and a maximum of about 0.00025 to 0.0003 μF for concert wavelengths. The same values should rule with tuned transformers.

Series Parallel Switches in Tuners

It is frequently an advantage to fit our tuner with adjustment by which the aerial tuning condenser can be placed either in series or in parallel with the inductance. There are several ways of doing this with switches, and one good way without switches. These are shown in the illustration.

A Very Simple and Efficient Tuner for Plug-in Coils.

An extremely simple yet efficient tuner for plug-in coils can be constructed by screwing on to a variable condenser box a plug socket for plug-in coils. Terminals should be placed on the socket and on the variable condenser, and in this way it is possible to arrange the condenser either in series or in parallel with the inductance coil. If it is desired to use reaction on to the aerial coil, a 2-coil holder can be used instead of the single socket.

Loose-Coupled Tuners.

Loose-coupled tuners can be constructed in several ways. If we make the primary coil as a single-layer inductance, with a slider or tappings, we can make the secondary a coil which will slide inside this primary coil, and this can have tappings brought out to a switch on the end of the coil. Such forms of tuner, however, are rather cumbrous, and are little seen in the modern experimenter's workshop. The simplest form of loose-coupled tuner is that made up with a two-coil holder and a pair of condensers.

The condensers can be in separate boxes near by, connected by a flexible lead, or, better still, the tuner can be made up as a panel, carrying the two condensers and the coil holder. A series parallel switch should be provided to place the aerial condenser either in series or in parallel.

"WIRELESS WEEKLY" UNIVERSAL VALVE PANEL

Below appear further circuits of the twenty possible arrangements, using this panel as the main unit. Constructional details were given in Vol. 3, Nos. 1 & 2.

CIRCUIT No. 9.
A SINGLE-VALVE REFLEX RECEIVER.

Connecting Up.

GRID condenser "out." Grid leak "out." Primary of H.F. transformer connected to terminal P and to one side of telephones. The remaining telephone lead connected to terminal No. 3. Secondary of H.F. transformer connected to terminal No. 1 and −L.T. terminal. Fixed condenser 0.001 μF across −E and −L.T. Plug the crystal detector into sockets Nos. 1 and 2. Battery strap in position. Fixed condenser 0.01 μF connected across telephones and H.T. battery.

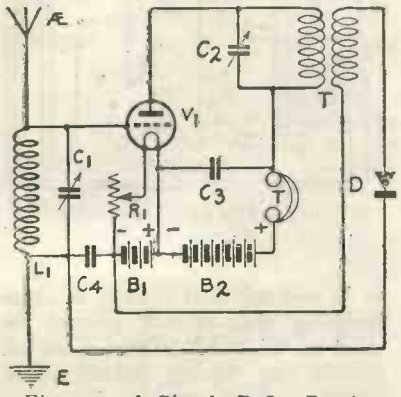


Fig. 9A.—A Simple Reflex Receiver.

NOTE.—The H.F. transformer may consist of two basket coils constructed as described in Vol. 3 – No. 2. With both windings in the same direction, connect the outer end of the primary to terminal P, and the outer end of the secondary to −L.T. terminal. The primary of the transformer is tuned with a small variable condenser (capacity 0.0002 μF).

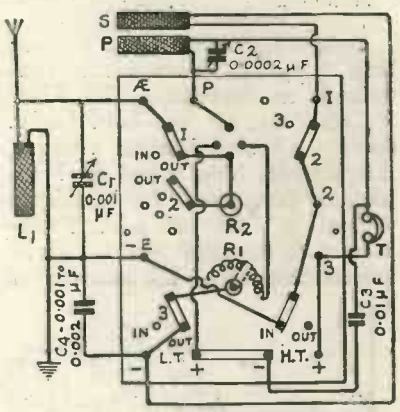


Fig. 9B.—The panel connections of Figure 9A.

General Notes.

This is probably the simplest form of reflex circuit, and, if carefully adjusted, may be made to yield excellent results. The incoming oscillatory currents are amplified by the valve, applied to the crystal detector *via* the H.F. transformer windings and are then fed back into the grid circuit again to undergo L.F. amplification before finally appearing in the telephone receivers. The valve is thus made to amplify both high-frequency and low-frequency currents at the same time.

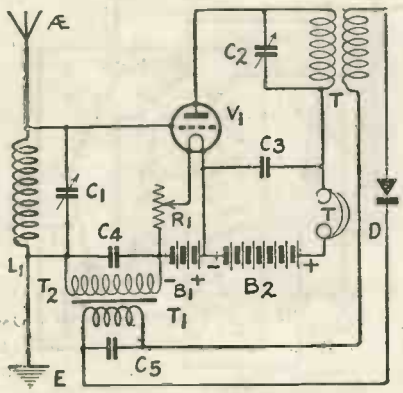


Fig. 10A.—A Reflex Receiver with Transformer.

Connecting Up.

Grid condenser "out." Grid leak "out." Primary of H.F. transformer connected to terminal P and to one telephone lead. The remaining telephone lead connected to terminal No. 3. Secondary of H.F. transformer connected to terminal No. 1 and to IP of L.F. transformer. OP of L.F. transformer connected to terminal No. 2. IS of L.F. transformer connected to −LT, and OS of transformer to −E. Crystal detector plugged into sockets Nos. 1 and 2. Battery strap in position. Fixed condenser 0.001 μF across primary of L.F. transformer. Fixed condenser, 0.01 μF. across telephones and H.T. battery. Variable condenser, 0.0002 μF across primary of H.F. transformer.

General Notes.

Comparing this circuit with the preceding one, it will be noticed that the two are very similar, but that a low-frequency transformer has been added. By this addition the efficiency of the L.F. amplification is decidedly improved, and quite good signals are receivable over a considerable distance, whilst, within 10 or 15 miles of a broadcasting station, sufficient energy will be available to operate a small loud-speaker.

CIRCUIT No. 10.
AN IMPROVED SINGLE-VALVE REFLEX RECEIVER.

It will be noticed that the L.F. transformer is so connected as to give a step-up voltage effect to the L.F. currents applied to the grid. It is advised that this transformer be of good manufacture.

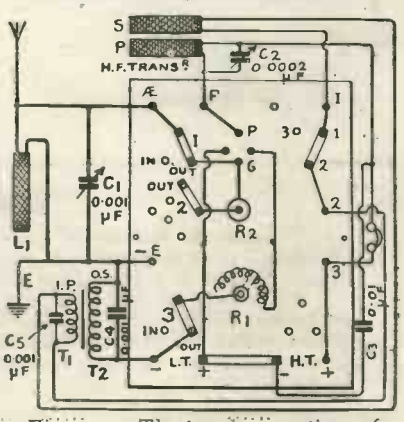


Fig. 10B.—The panel connections of Figure 10A.

Connecting Up.

Grid condenser "out." Grid leak "out." Variometer connected to terminals P, XHT +, also to IP of L.F. transformer. Crystal detector plugged into sockets Nos. 1 and 3. Telephones connected to terminals 2 and 3. OP of L.F. transformer to terminal No. 1. IS of transformer to – LT and OS of

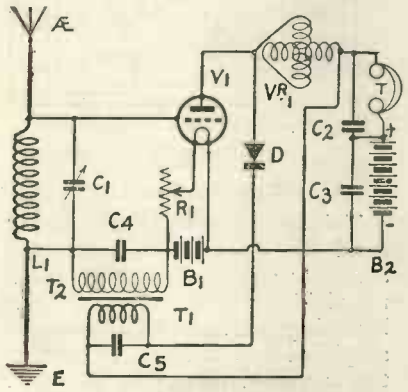


Fig. 11A.—A Reflex Receiver with Variometer Tuned Anode.

Connecting Up.

Grid condenser "in." Grid leak "shunted" (S). Reaction coil connected to terminals P and XHT +. Telephones connected to terminals 2 and 3. FC plug No. 4 "in." Change over LT

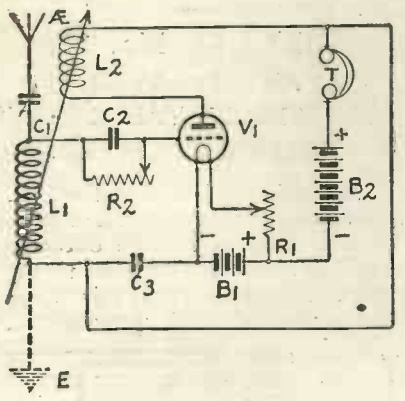


Fig. 12A.
A Modified Flewelling Receiver.

CIRCUIT No. 11.

SINGLE-VALVE DUAL AMPLIFICATION, WITH VARIOMETER TUNED PLATE CIRCUIT.

transformer to –E. Battery strap in position. Condensers across telephones, primary of L.F. transformer, and H.T. battery.

NOTE.—A No. 75 coil of the honeycomb type, shunted by a 0.0002 μF variable condenser, may be substituted for the variometer.

General Notes.

In this circuit the tuned anode method of high-frequency amplification is employed instead of the transformer method, as described in the two previous circuits. The operation of a receiving set employing this circuit is not at all difficult, and various modifications can easily be tried. For instance, a variometer may be used for tuning the aerial circuit instead of the coil and condenser. The tuning is sharp, and the complete set will be found to be selective. Provided a really good detector and L.F. transformer are used, this circuit will be found very satisfactory.

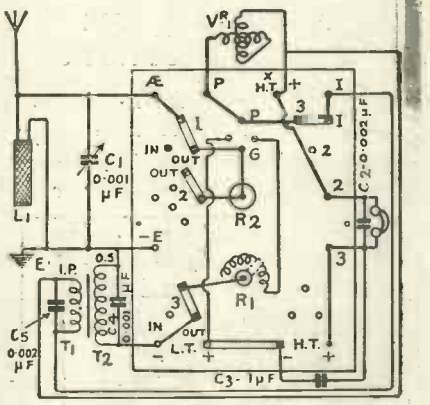


Fig. 11B.—The panel connections of Figure 11A.

It is not advised that a set embodying this circuit should be used on an outdoor aerial, at all events not during broadcasting hours, as it is capable of causing serious interference.

CIRCUIT No. 12.

A MODIFIED FLEWELLING CIRCUIT.

leads, – to +. Fixed condenser (capacity 0.006 μF), connected between –E terminal and –LT lead.

NOTE.—A variometer may be substituted for the reaction coil if desired. The variable grid leak should be adjusted to about 1 megohm.

General Notes.

Full details of the original and modified Flewelling circuits have been given in previous issues of this journal (see Vol. 2, No. 5). Critical adjustment of reaction coupling and of the variable grid leak is called for, and on a frame or short indoor aerial extraordinary results are obtainable.

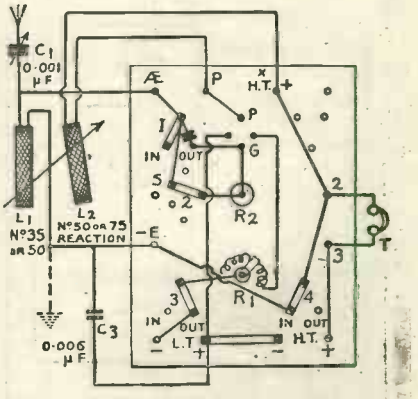


Fig. 12B.—The panel connections of Figure 12A.

A SINGLE-VALVE BROADCAST RECEIVER

By E. REDPATH, Assistant Editor.

High Efficiency and Low Cost of Construction are the outstanding points of the Receiving Set described in the following article.

THE Post Office Regulations now permit the use of reaction direct on to the aerial circuit, provided that it is used with care, and that interference with adjacent receiving stations is scrupulously avoided.

With the exercise of reasonable care in the operation of a set in which reaction is so used, no such interference need be caused, and it is quite surprising, after some experience with two-, three-valve, and dual amplification sets, what excellent results can be obtained upon a little set such as that illustrated in Fig. 1.

The General Arrangement.

Referring to the circuit diagram, Fig. 2, the simplicity of the arrangement will be seen. The aerial circuit comprises the aerial itself, Æ; aerial series condenser, C_1, with short circuiting switch S; a variometer; a fixed inductance L_1, and the usual earth connection.

The tuning of the aerial circuit is accomplished by means of the variometer in conjunction with the series condenser C_1. With this condenser in circuit the range of wavelengths covered is from 330 to 460 metres, whilst, with the condenser short-circuited by means of the switch S, a second range of from 450 to 600 metres is obtainable.

The aerial end of the variometer is connected to the grid of the valve *viâ* the grid condenser C_2 and the gridleak R_2, whilst the lower or earth end of L_1 is connected direct to the positive side of the filament.

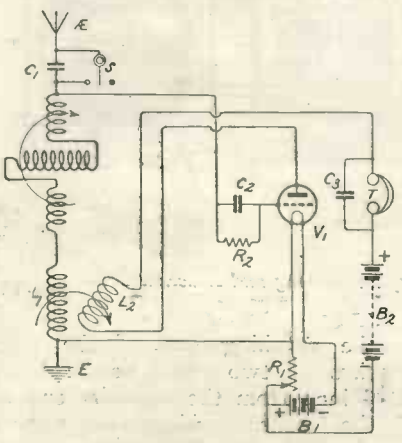


Fig. 2. The Circuit arrangement.

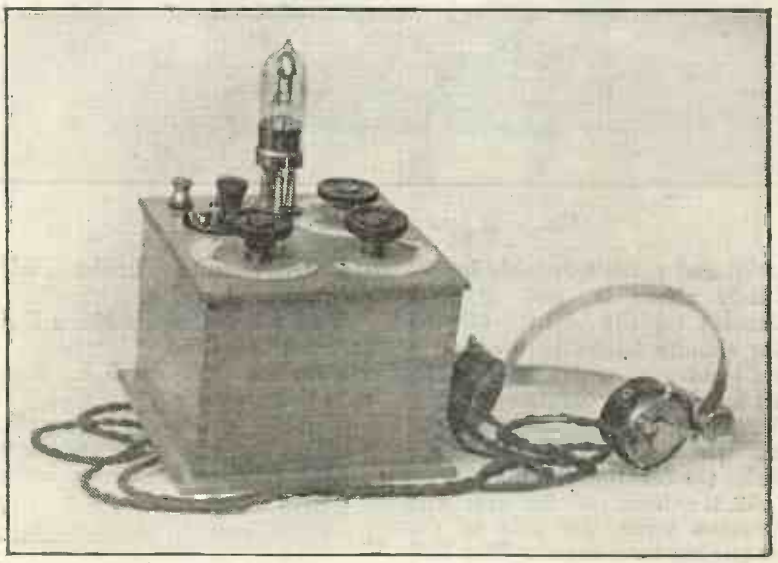


Fig. 1. The completed Receiver.

The anode circuit of the valve includes the reaction coil L_2 (which rotates inside the inductance L_1), the telephone receivers T, shunted by the fixed condenser C_3 and the H.T. battery B_2, the negative side of which is connected to the positive side of the 4- or 6-volt filament lighting battery B_1. R_1 is the usual filament rheostat.

Values of Components.

Full constructional details of the variometer, the fixed inductance (L_1), and the reaction coil (L_2) will be given presently. The aerial series condenser, C_1, has a capacity of 0.0003 μF; the grid condenser C_2 is of similar value; the gridleak R_2 is from 1½ to 2 megohms; the telephone condenser C_3 is of 0.001 or 0.002 μF. The voltage of the high-tension battery, B_2, will depend to some extent upon the type of valve used, and may vary from 45 to 100 volts. The telephones (T) are of high resistance, namely, from 4,000 to 8,000 ohms. If it is desired to use low resistance telephones instead, a step-down telephone transformer should be employed, with its fine wire winding connected in the anode circuit, the low resistance telephones being connected to the ends of the thick wire winding of the transformer.

Arrangement of Controls.

The photograph, Fig. 3, shows a close-up plan view of the set. The valve-holder, of the Bowyer-Lowe type, suitable for mounting upon wood, will be seen in the centre with the condenser short-circuiting switch on the left, the

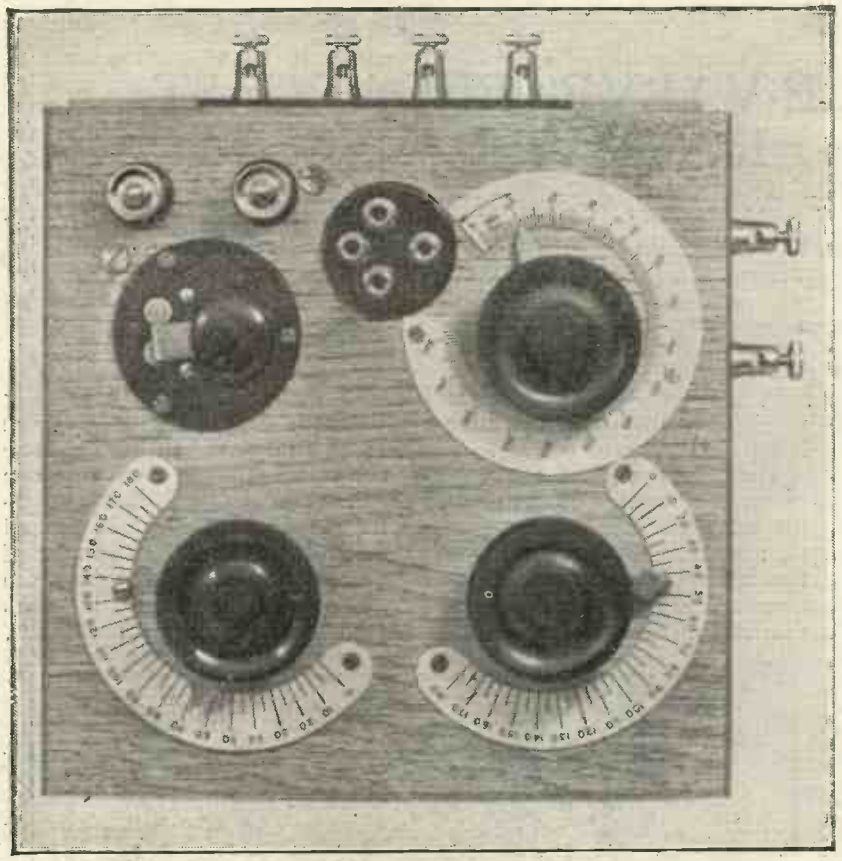


Fig. 3. A plan of the Instrument.

aerial and earth terminals immediately above it, and filament rheostat on the right. Of the two ebonite knobs with pointers and graduated scales, that on the left operates the variometer rotor and so alters the tuning of the set, whilst that upon the right varies the reaction coupling.

At the back of the set, and mounted upon the side of the containing box, are the four battery terminals, namely, H.T. positive, H.T. negative, L.T. positive, and L.T. negative, counting from the right-hand side. The two telephone terminals are mounted upon the right-hand side of the containing box, and all these terminals are fitted upon narrow strips of ebonite.

List of Materials Required.

One containing box, with wooden top panel, to the dimensions given in Fig. 7. The box illustrated in the photograph is actually one of Pickett Bros.' standard sizes.

One valve holder.

One 2-way switch.

One filament rheostat.

Two ebonite knobs with pointers and scales.

Two 4-inch lengths No. 2 B.A. screwed brass rod.

Fourteen No. 2 B.A. brass nuts and washers.

Eight condenser spacing washers and two spring washers.

One cardboard tube, 3 inches outside diameter by $5\frac{1}{4}$ inches long.

Two cardboard tubes, each two inches outside diameter by $1\frac{5}{8}$ inches long.

6 ozs. (approx.) No. 22 S.W.G. l.c.c. copper wire.

1 oz. (approx.) No. 26 S.W.G. d.s.c., or No. 28 S.W.G. d.c.c. copper wire.

1 oz. (approx.) No. 32 S.W.G. d.s.c., or No. 34 S.W.G. d.c.c. copper wire.

Two fixed condensers, each 0.0005 μF.

One fixed condenser, 0.001 μF.

One gridleak, $1\frac{1}{2}$ to 2 megohms.

Eight terminals.

The Tuning and Reaction Coils.

In Fig. 4 are given full details of the windings of the main inductance, the variometer rotor, and the reaction coils. Deal first with the main inductance. Take the 3-inch cardboard tube, and, with a large needle or a small drill, make two small holes, $\frac{3}{8}$ inch from one end, and thread the ends of the No. 22 S.W.G. wire into one hole and out of the other to secure it. Measure off along the tube a length of $\frac{5}{8}$ inch, and make two more holes with the needle, then wind complete the first section of 16 turns, securing the finished end by threading through the holes in the usual manner. Leave a clear space of $\frac{1}{2}$ inch, and wind a further 16 turns, but upon completing these turns do not cut the wire but carry it in a wide spiral along the tube for a distance of 1 inch and wind two further sections, each of 16 turns, and separated by a space of $\frac{1}{2}$ inch, finally threading the finishing end of the wire through two small needle holes $\frac{3}{8}$ inch from the opposite end of the tube. Altogether there should be four loose ends of wire,

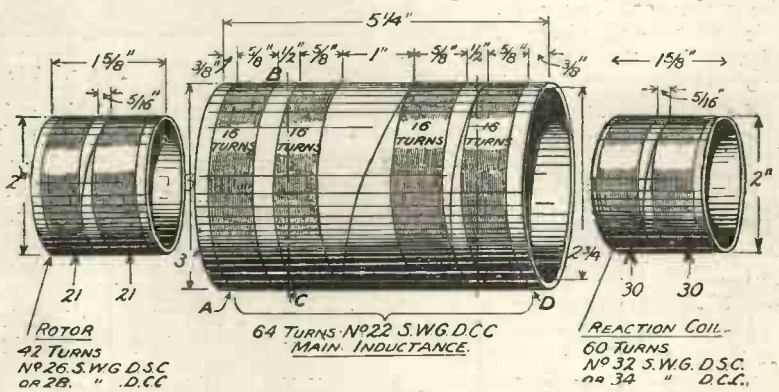


Fig. 4. Constructional details of the Tuning and Reaction Coils.

at A, B, C and D, as shown in Fig. 4. When completed, these windings should receive two good coats of thin shellac varnish and be placed aside to dry.

The windings of the rotor and reaction coil are to consist of 42 turns of No. 26 S.W.G. d.s.c., and 60 turns of No. 32 S.W.G.

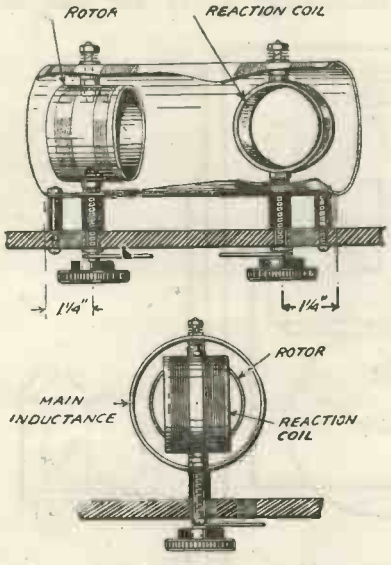


Fig. 5. Illustrating method of pivoting the small coils within the main coil.

d.s.c. copper wire respectively, but in each case the starting and finishing ends of the coil (which may be wound in one length from start to finish) are to project inside the cardboard tube for subsequent soldering to the brass spindles, by means of which these coils are rotated. Details of these coils are also given in Fig. 4,

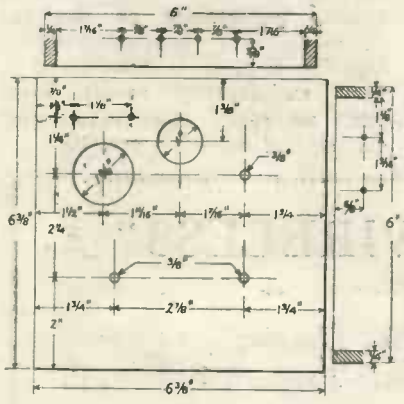


Fig. 6. Drilling plan of Panel.

whilst Fig. 5 (A) and (B) shows how these two smaller coils are to be pivoted inside the main inductance coil, and how the latter is to be attached to the underside of the wooden panel. Connections are to be taken from the moving spindles, by means of lengths of light insulated flexible wire, carefully soldered to each spindle and wrapped twice round it so as to allow sufficient freedom of movement without risk of breaking the wire.

The flexible leads from the spindles of the variometer rotor are subsequently to be connected to the short projecting ends of wire shown at (B) and (C) respectively in Fig. 4.

The Containing Box.

Fig. 6 shows a drilling plan of the top panel of the containing box, whilst Fig. 7 gives full dimensions of the box itself, the choice of materials being, as usual, left to the individual taste of the reader. Should any departure be made from the original specification of components it will, of course, be necessary to modify the dimensions of the box and the holes drilled in the top panel, to suit.

At the back of the box holes should be drilled to permit the points of the terminal screws to project into the box without coming into contact with the box itself, and similar provision should be made for the telephone terminals upon the right-hand side of the box. The aerial and earth terminals, illustrated in Fig. 3, are of the Bowyer-Lowe type, and merely require a ⅜-inch hole to be drilled in the wood. If preferred, all the terminals may be of this type, which enables the strip of 3/16-inch ebonite to be dispensed with.

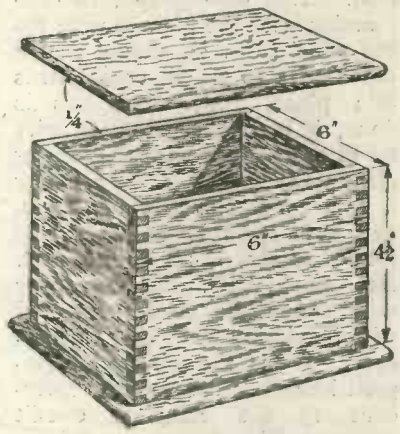
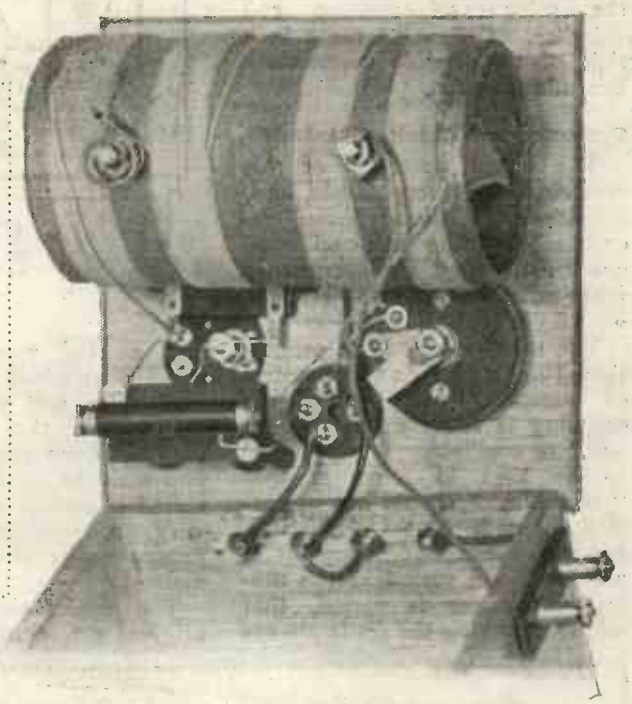


Fig. 7. The containing box.

Fig. 8.

A close-up of the instrument with the panel lifted to permit the various components and connections to be seen.



Assembling and Connecting Up.

The photograph, Fig. 8, shows how the various components are arranged on the underside of the top panel and, incidentally, how the connections are made to the L.T. battery and one telephone terminal upon the sides of the box. Note that, in order to economise space, the grid condenser and leak are mounted upon two small distance pieces,

above the aerial and earth terminals, at a sufficient height to enable the latter to be reached with the point of the soldering iron. This photograph, in conjunction with the plan view of the top panel (Fig. 3), should enable the reader to fit all components into place, and, when this is done, it merely remains to wire up in accordance with the wiring diagram (Fig. 9). There are only a few connections to be made, and it is strongly recommended that they should all be soldered. No. 20 S.W.G. tinned copper wire should be used, protected with insulating sleeving as necessary. When the wiring is completed check it carefully by reference to the complete circuit diagram, Fig. 2.

Although not provided in the original set it is advised that "stops" be fitted at the ends of the scales, to prevent complete rotation of the knobs attached to the rotor and reaction coil spindles. Otherwise there is a risk of the flexible connections becoming broken.

Operation and Results Obtainable.

The actual operation of this receiving set is very simple, and, provided the often-repeated remarks regarding self-oscillation are kept in mind, no interference with adjacent receiving stations need be caused.

The reaction coil is so proportioned as to give an easy control of reaction, and, unless the coupling is fairly tight, the set will not oscillate. The principle to be kept in mind is that "searching" should not be carried out with the set oscillating, but with the reaction coupling so adjusted, and varied as the tuning variometer is varied, that whilst searching the set is always a little short of oscillating point.

To operate the set, first connect up the L.T. battery, insert the valve into the holder, and rotate the filament rheostat to see that the valve lights up correctly. If all is in order, connect up the aerial and earth leads, the H.T. battery, and the telephones to their respective terminals. With the aerial condenser in circuit a 180° movement of the pointer attached to the tuning variometer will vary the wavelength over the shorter range (namely, from 330 to 460 metres), and with the condenser short circuited a similar movement will vary the wavelength over the longer range (from 450 to 600 metres).

The results obtained with the original set, constructed exactly in accordance with the foregoing particulars, includes fairly good "loud-speaker" reception of 2 LO at a distance of 15 miles; clear reception in the telephones of several other British broadcasting stations (this involving, of course, the careful but not excessively critical adjustment of reaction) and distinct, but not loud, reception in one pair of telephone receivers of speech and music transmitted from the American broadcasting station WGY. This last-named reception was, of course, after broadcasting hours, and did involve critical adjustment of the reaction coupling, but, even allowing for this, it is considered a very satisfactory result from such an easily constructed and economical receiving set.

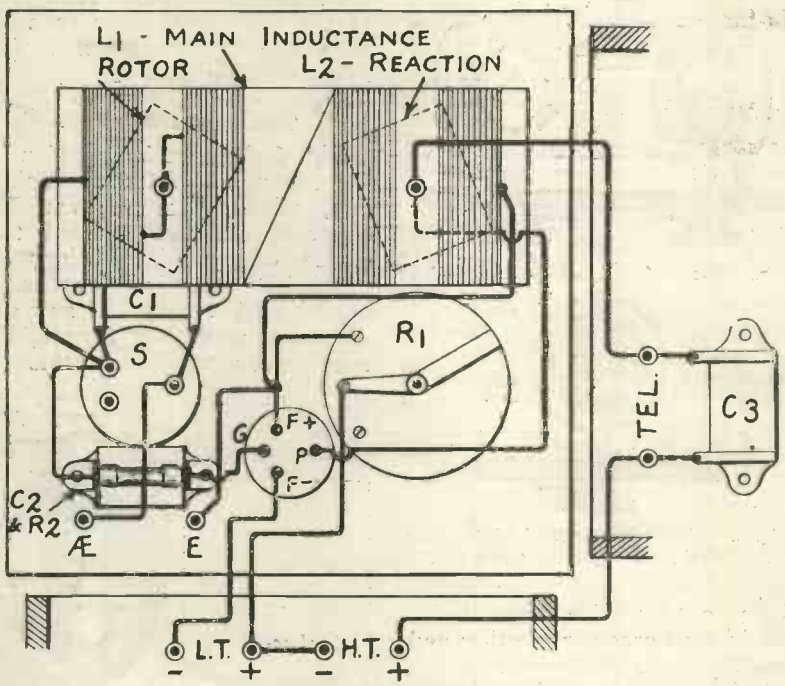


Fig. 9. Wiring diagram.

A NOVEL IDEA FOR LOOSE COUPLER SECONDARIES

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

A constructional note for the amateur worker.

THE secondaries of all loose couplers on the market are made with a number of tappings which are taken to a selector switch, so that one has to do fine tuning by increasing or decreasing the capacity in the circuit and not by varying its inductance, since the number of turns taken in by each stud is usually rather large.

For the best results it is desirable to be able to balance inductance against capacity until the optimum value of each is obtained. This can be done only if it is possble to take a single turn of the coil, and the best means of accomplishing this desired end is to use a sliding contact. The ordinary method of mounting the slider outside the coil is hardly suitable, for if it were used the secondary would have to be of very much smaller diameter than the primary, in order to allow room for the slider and its supporting rod.

It occurred to the writer some time ago that there was no reason why the slider should not be mounted inside the secondary, its point pressing upwards against the turns of wire through a slot cut in the cardboard former. This works most satisfactorily, and it makes a particularly neat job.

To make the device, buy or roll a stout cardboard tube, the external diameter of which need be only ½ in. less than the internal diameter of the primary, into which it is intended to fit. Draw upon the tube two parallel lines ¼ in. apart, extending to within an inch of each end, at which points a ¼-in. hole should be drilled. Cut along each line, so as to make a slot ¼ in. wide, as shown in Fig. 1, with an old razor blade.

Give the tube a good coat of shellac, both inside and out, not neglecting the edges of the slot. Now wind on the wire as tightly as possible, giving the turns a coat of shellac when they are in place. Seccotine a piece of fine glass cloth to one edge of a small piece of wood rather less than ¼ in. wide, and by moving it up and down in the slot remove the enamel from the underside of the turns of wire.

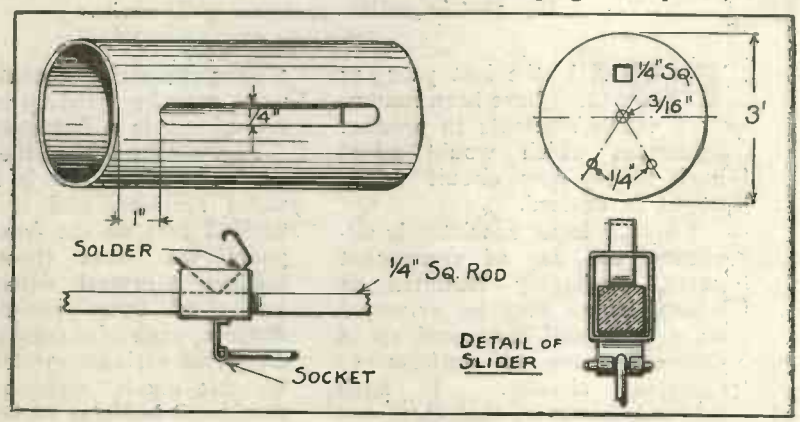
The end pieces should be made from ¼-in. ebonite. They should be of such diameter that they fit quite easily into the tube. Fig. 2 shows the way in which they are laid out and drilled. The only difference between them is that one only has a 3/16-in. hole, which allows the control rod for the slider to pass through it.

Now obtain a piece of square brass rod, which should be ¾ in. longer than the total length of the coil. Turn the ends round and thread them for 1 in. If you have not the tools for doing this, any garage will carry out the job for a very small charge. Place a nut upon each of the screwed ends, then put the endpieces in place upon the rod, fixing them with two more nuts. Adjust the distance between the endpieces until it is exactly equal to the length of the coil.

We can now proceed to make the slider, the details of which are given in Figs. 3 and 4. Cut out a strip of sheet brass 1 in. wide and 1¾ in. long. Bend it to the shape shown in Fig. 4, and solder. In the top edge cut two slots 3/16 in. long and just wide enough to allow a piece of springy phosphor bronze to pass through them. Take a piece of this metal about 1½ in. in length, bend it into the shape shown in Fig. 3, and pass its end through the slots in the slider, soldering it at one point only, as shown. To the lower side of the slider attach a small bracket, the details of which are shown in Figs. 3 and 4. It will be seen that the lower part of this bracket is cleft and bent up to form a bearing for a pin.

Take a piece of 3/16-in. round brass rod, 1 in. longer than the coil. Thread one end for ½ in. or so and deal with the other as follows. Soften it by heating in a Bunsen flame or a blow lamp, and plunging it quickly into water. Then flatten it with a hammer and drill a 6B.A. clearance hole through it. Attach this rod to the bracket of the slider by means of a 6B.A. bolt, the end of which may be riveted over. Now remove the endpiece containing the 3/16 in. hole. Pass the slider on to its rod, bring the end of the control rod through the 3/16 in. hole, and refix the end piece. Fix an ebonite knob to the end of the control rod. Endpieces, complete with slider, may now be inserted into the coil, great care being taken that the contact point falls into the slot in the tube, and that it is sufficiently bent upwards to make a firm contact.

All that is now necessary is to fix the endpieces in place by means of 4B.A. screws driven into them through the cardboard tube, and the secondary is now ready to be mounted in the loose-coupler.



Figs. 1, 2, 3 and 4, showing constructional details of the secondary coil and slider.

Fig. 1.—The general appearance of the receiver.

T "WIRELESS OMNI-CIRCU

JOHN SCOTT-TAGG

The first published description wireless receivers which enables circuits to be tried out with a m

DURING the last year or two there have been innumerable attempts to produce apparatus which would adapt itself to any new circuit which might be devised.

I myself have consistently advocated the use of component parts, preferably mounted in boxes, which may be arranged on a table and connected up in different ways to conform to different circuits. I have realised, however, that there are a very large number of experimenters and constructors who like to have a set which presents a nice appearance and which may be readily operated by members of the family other than the experimenter himself.

Until comparatively recently I felt that there was no compromise. Of course, we have had different kinds of unit receivers and combination sets which, however, are strictly limited as regards the number of circuits which may be used with them. We have also had board sets in which the components have been mounted on a board and have been provided with terminals, the wiring all being visible and on the surface. These, however, are obviously experimental receivers, and when wired up do not present the appearance of a finished set.

I have spent the last few weeks in developing an entirely new type of receiver which, while always presenting a neat appearance, may be wired up to almost any circuit in a few minutes.

Fig. 1 shows what the finished set looks like. It is a three-valve receiver, and it will be noticed that on the front of the panel we have three valve holders, a crystal detector, the knobs of three variable condensers, each of 0.0005 μF capacity, two variable gridleaks, one variable anode resistance, two single-coil holders, an aerial and earth terminal, terminals for the H.T. and L.T., and at the bottom two terminals for the loud-speaker or telephone receivers; three rheostat controls are provided.

On the left-hand side of the cabinet we have a three-way coil holder; inside the cabinet we have an intervalve step-up transformer, an iron-core choke coil, two condensers of 0.002 μF capacity, one condenser of 0.001 μF capacity, one condenser of 0.0001 μF capacity, two condensers of 0.0003 μF capacity.

Anyone looking at Fig. 1 would imagine that it was an ordinary three-valve receiver fitted, perhaps, with one or two more gadgets than usual. Readers will agree, however, that the set has a finished commercial appearance and would do justice to any drawing-room table. If, however, we raise the lid of the cabinet, we find that the top is hinged at the back and that the raising of the top of the cabinet discloses a neatly arranged terminal board. This is illustrated in Fig. 2.

The terminal board itself presents the appearance shown in Fig. 3. Each of the terminals on the board goes to one terminal of a component inside the

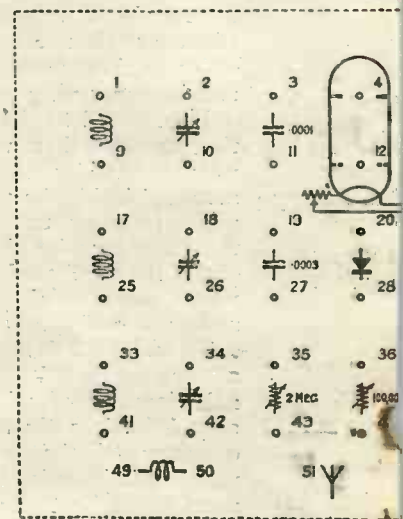


Fig. 3.—The appearan

cabinet. All these components are mounted on the back of the front sloping cabinet, except the three-coil holder, which is mounted on the outside of the cabinet at the left. For example, the terminal 2, shown in Fig. 3, goes to one side of one of the three variable condensers seen on the front of the panel;

IE

WEEKLY" T RECEIVER

RT, F.Inst. P., Editor.

f an entirely new departure in undreds and even thousands of nimum of trouble.

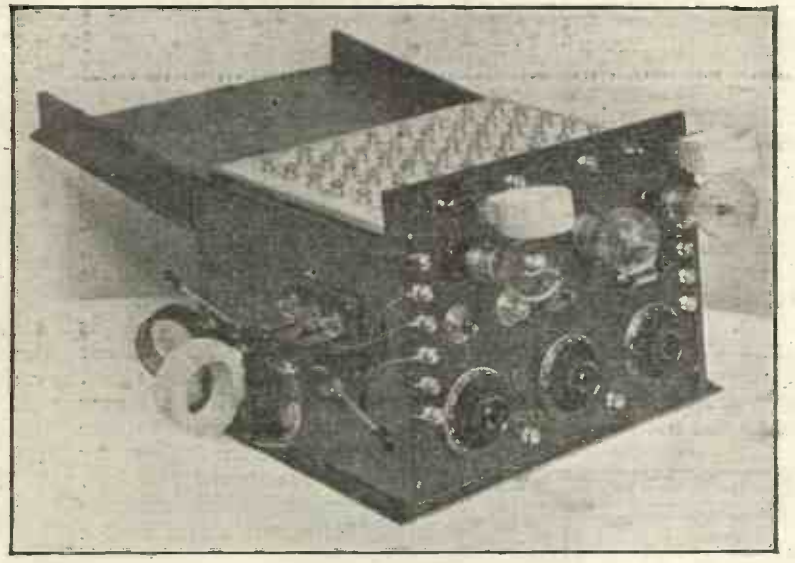
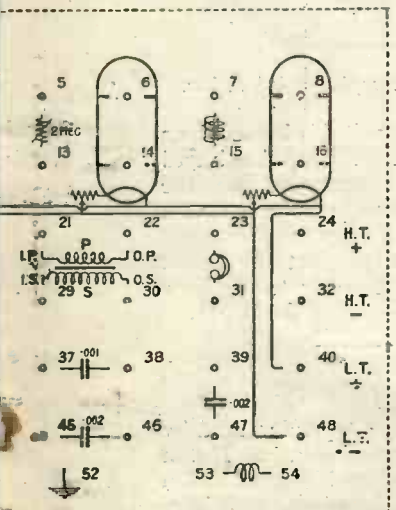


Fig. 2.—The receiver with the lid opened.

the terminal 10 goes to the other side of this condenser. Similarly, the terminal 5 is connected to one side of a 2 megohm grid-leak, while the terminal 13 goes to the other end. It will thus be seen that all the terminals are unconnected, except to their respective component parts, and



of the terminal board.

except in the case of the filament connections. All the filaments are already connected in parallel, with a rheostat in each negative lead; these rheostats are of the carbon-plate pattern, which are suitable for use either with dull emitter or ordinary valves. The rheostat controls, of which there are three, cannot be seen in the two photographs because they are hidden by the valves.

To wire the set up to any circuit, all that is necessary is to use a number of rubber-covered flexible wires and to join up the terminals on the horizontal terminal panel shown in Fig. 2. The flexible wires consist of copper strand covered with rubber, the leads being of about three different lengths for convenience, and each lead is fitted with a fishtail, or spade, terminal which will slip under the ordinary terminals on the terminal board.

Having joined up the different terminals by means of these flexible leads, the lid is returned to its normal position, and the high-tension battery, and other connections, are made to the terminals on the front panel. The set now presents the appearance of an ordinary commercial receiver, and none of the wiring is visible.

If we now desire at any time to change the circuit, we simply raise the lid, disconnect the leads, and rewire the terminals. Then the lid is closed, and once more the set appears exactly as before, although the circuit employed may be entirely different.

The experimenter will probably not want to bother with the numbers on the panel, but it will be obvious that the veriest tyro could wire up any circuit if he is given a key list of the numbers, even though he may know nothing about the theory or action of the circuit, and yet he can gain valuable experience.

Sufficient has been said here to indicate the immense possibilities of this new receiver. Some further details and photographs appear in the next issue of *Modern Wireless*, published on January 4. It is proposed to give *Wireless Weekly* a series of exclusive constructional articles dealing with this set in the immediate future. When a sufficient number of readers have made the set, it is proposed to give regularly in *Wireless Weekly* circuits specially for use with this receiver with notes on them, together with a key of the connections.

Innumerable circuits have been tried out with this particular set, and it is only after the fullest tests that I have decided to publish the full details of the receiver.

Lastly, I would point out that the set may be used with one, two or three valves, or even as a crystal receiver, so that there is no necessity to purchase all the valves at once. It was found that a three-valve set would cost practically the same as a two-valve set.

[*Next week: More about the* WIRELESS WEEKLY OMNI-CIRCUIT RECEIVER.]

A HOME-MADE FOUR-POLE SWITCH

FROM the experimenter's point of view, there can be few more useful pieces of apparatus than the four-pole change-over switch, for by its use one is enabled to test one piece of apparatus against another better than any other arrangement. Suppose, for example, it is desired to compare the performances of two high-frequency transformers. If they are wired up and tried in turn, no

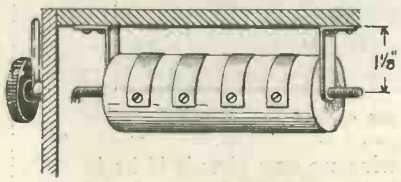


Fig. 1.—The Barrel.

real comparison of their merits can be obtained, for the following reasons. The wiring-up takes some time; it is difficult to retain in one's mind the exact impression made by either one; by the time the second is ready, the strength of the signal used for test purposes may have altered.

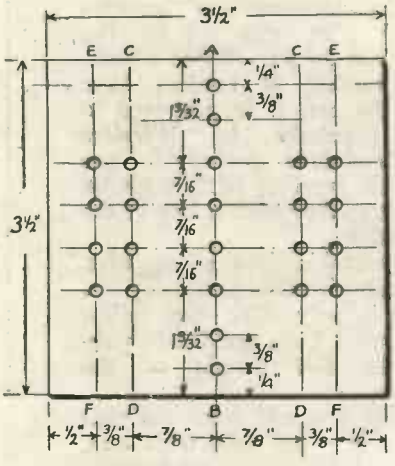


Fig. 2.—Constructional details of panel.

The best type of switch is that known as the "barrel" owing to its very low capacity. These are expensive to buy, but one can be made up in the workshop at small cost, and with the simplest tool outfit.

The barrel is a 2-in. length of round ebonite rod, 1½ in. in diameter. A 2B.A. clearance hole is drilled exactly through the long axis. Into this is inserted a piece of 2B.A. studding, 4 in. in length, ½ in. protruding from one end and 1½ in. from the other. The screwed rod is clamped in place by nuts. Four strips of thin brass, each 1½ in. long and 3-16 in. wide, are now cut out and fastened to the barrel, as shown in Fig. 1, by means of countersunk 6B.A. screws, heads of which must be carefully trimmed down with a fine file.

Two brackets are now cut from stouter brass to act as supports for the barrel. They should suspend it so that the spindle is 1⅛ in. from the panel.

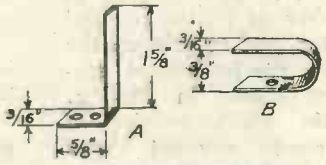


Fig. 3.—Details of the two types of contacts.

The panel is a piece of ¼-in. ebonite measuring 3½ in. square. Fig. 2 shows how it is laid out and drilled. All holes are 4B.A. clearance.

The fixed contacts are now cut from some thin and really springy sheet metal, such as phosphor-bronze. These are of two kinds, as seen in Fig. 3. We shall need eight of those marked A and four of those marked B.

We now mount these contacts on the panel. Those of the A type are secured by terminals along the lines CD (Fig. 2) and bolts along the lines EF. The B-type contacts are fastened by terminals only along the line AB.

The barrel is now placed in position as seen in Fig. 4, the A-type contacts being pressed well inwards so as to rest tightly against it. It will be seen that when the switch is in the position shown in the drawing, the middle row of terminals is connected *via* the brass strips on the barrel to

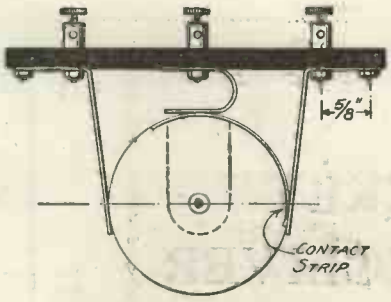


Fig. 4.—The barrel in position.

those on the right. When the knob is turned to the left, the connections are reversed, the path for currents then lying between the middle terminals and those on the left.

It remains only to provide the

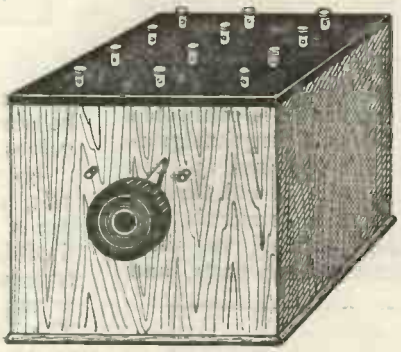


Fig. 5.—The complete switch in box.

switch with a suitable box such as that seen in Fig. 5. A knob and a pointer are mounted on the protruding end of the spindle, and two small stop pins inserted into the wood prevent the barrel from turning too far to right or left.

R. W. H.

Amateur Reception.

We are given to understand by Mr. T. Tappenbeck, a Dutch correspondent residing at Villa Margaretha, Noordwijk aam Zee, Holland, that the following call signs have been received by him:—

2AO, 2CW, 2DF, 2FN, 2FU, 2GG, 2GM, 2GN, 2GZ, 2HF, 2JF, 2KF, 2KR, 2KT, 2KW, 2KX, 2NM, 2OD, 2ON, 2RG, 2SZ, 2TB, 2VN, 2WA, 5BV, 5CI, 5GS, 5KO, 5DN, 5LL, 5MU, 5RZ, 5WR, 6BF, 6NI, 6OY, 6RY, 7ZM, 8AQ, 8BA, 8BE, 8BF, 8BN, 8BM, 8BV, 8BW, 8CM, 8CS, 8CZ, 8DA, 8DK, 8WA, 8ZZ.

Broadcasting News

LONDON.—It must be fine to be an uncle these days! It is rumoured that Uncle Caractacus has received so many boxes of chocolates and cigarettes that he is thinking of retiring from the B.B.C. and setting up in business as a tobacconist and confectioner.

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Uncle Arthur, Uncle Jeff, Uncle Rex, Aunt Sophia and Aunt Phyllis likewise have all been remembered. There is no doubt that so far as their listeners are concerned, the B.B.C. live in an atmosphere of goodwill.

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We have just had another most excellent Request Night. As these are very enjoyable nights, may the writer be permitted to suggest that each of the eight broadcasting stations have one request night every eight weeks; that such transmissions be simultaneously broadcast, thus leading to an interchange of views and tastes all over the country? This would mean that if, say, every Tuesday were set aside for the simultaneous broadcasting of these popular request items, we would be able to hear in London, for instance, Manchester's programme one Tuesday, next week that of Bournemouth, and so on.

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Forthcoming Events

JANUARY.

2nd (WED.).—Mr. Archibald Haddon. Miss Irene Wynne, soprano. Mr. Stanley Holt, piano syncopations. Mr. Joseph Blascheck, entertainer.

3rd (THURS.).—Short Modern English Programme. Mr. Madoc Davies, baritone. Miss Katie Goldsmith, solo violin. Dance Music.

4th (FRI.).—Popular Night. Wireless Orchestra. Mr. Charles Stainer, solo banjo. Miss Mabel Twemlow, soprano. Pitt and Marks, entertainers.

5th (SAT.).—Prof. Winifred Culles. Orchestra. Miss Gladys Naish, soprano. Mr. Frank Wood, entertainer.

6th (SUN.).—Service relayed from St. Martin's-in-the-Fields.

8th (TUES.).—The Anglo-Hawaiian Players. The Happy Family Concert Party.

9th (WED.).—Popular Concert. Items by Miss Georgia Drayson and Miss Irene Cryer.

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ABERDEEN. — Christmas, and what is more important in the North, the coming of the

New Year, have provided the 2BD Directors with an opportunity for surpassing all previous performances. Night after night the close-down call has not come until 12.30 a.m., and listeners even at that late hour have heard it with regret.

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Forthcoming Events

JANUARY.

2nd (WED.).—Jazz Orchestra. Mr. Gus Stratton and Mr. A. B. Henderson, entertainers.

3rd (THURS.).—Vocal and Instrumental Music by Russian composers.

4th (FRI.).—Band of the British Legion.

5th (SAT.).—Aul' 'Eel or Sowens Nicht. The programme will consist almost entirely of Scottish items. Messrs. Harvey and MacCallum, entertainers.

7th (MON.).—S.B. of concert from London. Overture and Third Act of the "Meistersingers."

8th (TUES.).—Classical Night. Mr. Julian Rosseti's Trio. Mr. W. Anderson, baritone. Miss Margaret Thackeray, contralto.

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BIRMINGHAM.—If there is one thing upon which 5IT may pride itself more than upon any other, it is the interest which is being maintained among the thousands of children who are members of its radio circle. The Saturday afternoon kiddies' concerts are one indication of this interest. They are invariably charming, and not infrequently the little performers attain a high level of artistic merit. A little chap not yet four sang recently!

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Forthcoming Events

JANUARY.

2nd (WED.).—3.30, Paul Rimmer's Orchestra. 7.30, Symphony Programme. Mr. John Hendry, solo 'cellist. Miss Hilda Kirkby, song recitals. Mr. Donald Sparrow, blind solo pianist, and the Station Orchestra. 10.30, Morse Practice.

3rd (THURS.).—3.30, Mr. Sidonie Wasserman, solo pianist. Station Orchestra. Mr. Eric Sidney, siffleur. Mr. W. H. Beach, clarionet soloist, and Mr. Sidney Leighton, entertainer. Mr. Paget Bowman, Managing Director of the B.N.O.C., on "The Forthcoming Opera Season." Major Vernon Brook, Bi-weekly Talk, Engineering Review.

4th (FRI.).—3.30, Miss Hilda Raybould, contralto. 7.30, Mr.

Arnold Nickson, singer, Mr. Walter R. Stokes, F.R.G.S., on "Saturn and Its Rings." Mr. Bert Ashmore, tenor. 8.45, Programme of Chamber Music by the String Trio of the Leamington Spa Pump Room. 10.30, Language Talk by Mr. H. Cecil Pearson: Subject, French

5th (SAT.).—3.30, Kiddies' Concert. 7.15, Coombs Wood Male Voice Choir. Band of 48th S.M.D. Royal Corps of Signals.

6th (SUN.).—3.30, Royal Air Force Band. Talk to the Children by Mr. Arthur Burrows. Orchestra. Mr. Edward Isaacs, solo pianist. Miss Eva Halford, 'celliste. Talk by the Rev. S. D. Morris.

7th (MON.).—3.30, Paul Rimmer's Orchestra. 7.30, Selections from "The Meistersingers," as played at Covent Garden (S.B. from London).

8th (TUES.).—3.30, Miss Isabel Tebbe, soprano, and Miss Lilian Clutterbuck, contralto. The Greys Concert Party. Mr. Colin Gardiner, Talk, "Wireless Hints to Beginners."

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BOURNEMOUTH. — Monday, December 17, was a remarkable night in more senses than one. First came the request programme simultaneously broadcast from London. This in itself was thoroughly enjoyable, when one considers that artistes like Miss Sophie Rowlands, Mr. Tom Kinneburgh and Mr. Ronald Gourley were performing. It is probably the first time that a great many Bournemouth people have heard Mr. Ronald Gourley, and his entertainment was thoroughly appreciated. Then "The Beggar's Opera," with its quaint melodies, came through, when the audience at the Lyric was quiet. The wild enthusiasm of a London audience at the last night of a popular opera was an eye-opener to a great many.

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Forthcoming Events.

JANUARY.

2nd (WED.).—A Night of Memories. Old Time Vocal and Instrumental Selections.

3rd (THURS.).—Folk Song Concert.

4th (FRI.).—Gounod, assisted by Mr. Robert Parker, of the B.N.O.C., and others.

5th (SAT.).—Musical Comedy Night. Selections from all the favourites.

6th (SUN.).—Rev. E. Moor and the Wilton Ainsley Quartette.

8th (TUES.).—Light Opera Night, assisted by Mr. Herbert Smith and Miss Gertrude Newsom.

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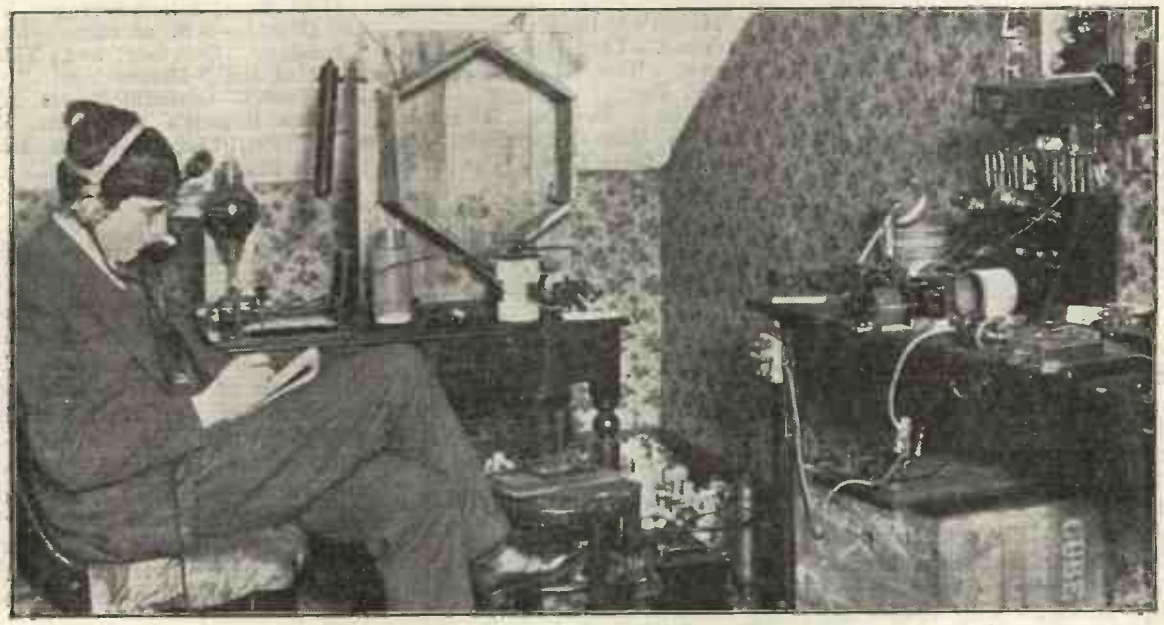
CARDIFF.—The meeting held at the Cory Hall, Cardiff, on Wednesday, Dec. 19, proved of immense interest to amateurs and wireless enthusiasts in general. The principal speakers were Mr. Arthur Burrows and Capt. Eckersley, Director of Programmes and Chief Engineer of the B.B.C. respectively, and Major Corbitt Smith. The hall was packed, and an overflow meeting was held in a hall adjoining, which was also filled. Mr. Arthur Burrows gave an interesting discourse on the troubles of the Director of Programmes, whilst Capt. Eckersley, in his usual breezy manner, which delighted the numerous amateurs assembled, gave his soul-inspiring topic — Howling and Howlers. His "don't do it!" reminded the old hands at wireless of the good old Writtle days. Altogether the meeting was a tremendous success, and the reception accorded Capt. Eckersley served to show the popularity he has gained in the district.



Our photograph shows Mr. Frederick L. Hogg, who has established communication with another amateur in Toronto, and held such communication for some two hours.

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Forthcoming Events

JANUARY.

2nd (WED.).—Mr. Edward Isaacs, pianoforte recital. Shakespeare's Tragedy, "Richard III."

3rd (THURS.).—Mr. Sam Lucas, baritone. Emrys Price, solo violin. Miss Lillian Lewis, contralto. Major Gunn on "Dogs."

4th (FRI.).—The Eclipse Prize Singers: Vocalist, Mr. Harry J. Smith, tenor. Mr. E. Hall Williams, Organiser of the Great Western Railway Housing Scheme: Chat on "Co-operative Garden Villages."

5th (SAT.).—Mr. Willie C. Clissitt on "Sport of the Week." Mr.

Ivor Morgan, baritone. Mr. Sidney Evans and Mr. Bert Siese, entertainers. Mr. T. Howard Coath, F.A.A.

6th (SUN.).—St. Catherine's Church (Cardiff) Choir. Rev. Cyril Williams-Millar, M.A., St. Catherine's Church, Cardiff. Johannes Brahms Night. Vocalist: Robert Parker. Pianoforte duets, Madame Vera McComb Thomas and Mr. Thomas Riley.

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GLASGOW. — Wireless has played a prominent part during the festive season in the entertainment of house-parties throughout the country. The narration of weird ghost stories around the blazing Yuletide fire has given place to the merry strains of wireless music and the announcement of important happenings all over the world. Instead of being isolated in some big remote country mansion, the house party was in a moment switched on to the "hub of things" and joined the great community of listeners-in.

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Forthcoming Events

JANUARY.

2nd (WED.).—Mozart Night. Solos by Mr. Frank Phillip and Miss Annie Ballantyne.

3rd (THURS.).—Popular Programme.

4th (FRI.).—Dance Night. Solos by Mr. R. E. Cunningham.

5th (SAT.).—Popular Orchestral Night. The Boys' Brigade Band, 47th Glasgow.

6th (SUN.).—The Rev. Colin M. Kerr, B.D., B.Sc., Ph.D., of St. George's-in-the-Fields Parish Church. Sonata for Violin and Piano, by Mr. William Rogers, solo violin, and Mr. Herbert Carruthers at the piano.

8th (TUES.).—Popular Orchestral Night.

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MANCHESTER.—The studio at the Manchester station of the B.B.C. has now been ingeniously enlarged by making the artists' room convertible into a part of the studio when required to accommodate an augmented orchestra. The symphony concerts recently given have revealed a wonderful improvement in blend and harmony, being free from blasting or the effects of outstanding instruments. The permanent orchestra is now being increased from 11 to 16 players.

Are we getting too much simultaneous broadcasting? Whilst it is undoubtedly good for crystal-set users, in that it enables them to hear other stations, multi-valve users are unable to make full use of their sets when only one programme is provided. S.B. serves its purpose when there is some special feature to be transmitted, or news broadcast, but we suggest that it should stop there.

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Forthcoming Events

JANUARY.

2nd (WED.).—3.30, Miss P. Gregory, soprano. Mr. John Palmer, tenor. Mr. B. West, baritone. 6.30, Organ Recital, Piccadilly Picture House. 8, 10th Symphony Concert. Solo pianist, Mr. Arnold Perry.

3rd (THURS.).—11.30, 2ZY Trio. 6.40, German Talk. 8, Concert by 2ZY Orchestra. Mr. Joseph Markham, tenor. Talk on "How Animals Spend the Winter," by Mr. T. A. Coward, M.Sc. 9.10, Talk by Mr. Paget Bowman (S.B. from London). 10, Savoy Orpheans.

4th (FRI.).—Mme. M. Walker, soprano. Mme. E. Dibb, contralto. Mr. R. Hirst, tenor. Mr. W. Blackburn, concertina soloist. 8, 2ZY Orchestra. Mme. Tomson de Kenchen, soprano. Mr. J. Worsley, dialect entertainer. 10.5, Spanish Talk. 10.20, Weekly Morse Practice.

5th (SAT.).—Oxford Picture House Orchestra. Organ Recital. Concert by the Three M's. Mr. T. H. Morrison, solo violin.

6th (SUN.).—Royal Air Force Band. Mr. Arthur Burrows will talk to the children, assisted by the Wireless Orchestra and Mr. Hayden Coffin, baritone. 8, Talk to Young People by Mr. S. G. Honey. 8.35, The Very Rev. the Dean of Manchester. 8.50, The Melody Four.

7th (MON.).—Orchestra. French Talk. 7.30, Concert S.B. from London.

8th (TUES.).—2ZY Trio. 7.30, 2ZY Orchestra. Miss Rachel Hunt, contralto. 8.15, Nature Talk by Prof. F. E. Weiss, D.Sc., F.R.S. 8.30, Mock Trial by Jury (S.B. from London).

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NEWCASTLE.—It has undoubtedly been a wireless Christmas in the North. We had fully believed that everyone likely to join the large band of listeners had by now installed his set. A visit to any of the local wireless shops, however, reveals the fact that sets as well as components are selling like the proverbial hot cakes.

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Forthcoming Events.

JANUARY.

2nd (WED.).—3.45, Melody Four Quartette. Orchestra. Mr. Robert Strangeways, baritone. Miss Ida Gowey, soprano. Mr. W. A. Crosse, piano. Mr. Van Hee, 'cello.

3rd (THURS.).—3.45, Mr. A. J. Beatty, piano. Mr. and Miss Golightly, duets. 7.30, Orchestra. Mr. A. Nockles, tenor. Miss Lilian Rowell, contralto. Mr. Kelley, saxophone. Mr. Babbs, violin.

4th (FRI.).—Miss Florence Farrar, piano. Miss Ethel Cowell, soprano. Mr. Arthur Robins, cornet.

5th (SAT.). — 3.45, Nord-Maitre Singers. 7.30, Orchestra. Mr. Wm. Peacock, bass. Miss May Osborne, mezzo-soprano. Messrs. Charlton and Wright, entertainers.

6th (SUN.).—Durham Road Baptist Church Choir. Rev. C. F. Knyvett, address.

7th (MON.).—3.45, Miss Florence Hicks, soprano. Mr. W. Fairgrieve, saxophone.

8th (TUES.).—3.45, Miss Olive Tomlinson, piano. Miss Dora Robson, contralto. Mr. Starkey, banjo. 7.30, Orchestra. Mr. Lambert Harvey, tenor. Mme. Evelyn Longstaffe, contralto. Mr. W. A. Crosse, clarionet.

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Simultaneous Broadcast Events.

JANUARY.

3rd (THURS.).—7.30, Modern English Programme. The Roosters Concert Party. Mr. Paget Bowman.

4th (FRI.).—Popular Programme.

6th (SUN.).—H.M. Royal Air Force Band. Children's Corner, conducted by Mr. Arthur R. Burrows.

7th (MON.).—Mr. John Strachey, "Weekly Book Talk." Talk by the Radio Association. The London Eight Concert Party. Mr. H. German on "The Farmers' Position To-day." "The Meistersingers," Act 3, from Covent Garden.

8th (TUES.).—Prof. A. J. Ireland on "Episodes in English History." The Death of William the Conqueror. Dance Band (all stations except Newcastle). The Greys Concert Party.

A SIMPLE THREE-VALVE RECEIVER

By
STANLEY G. RATTEE,
Staff Editor.

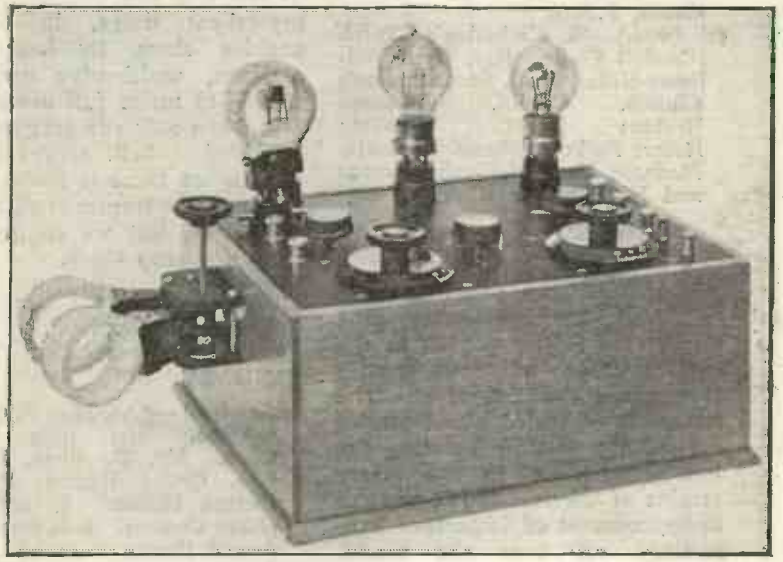


Fig. 1.—A photograph of the completed receiver.

OF all the straight-circuit valve receivers, probably the most popular is the three-valve combination of one high-frequency valve, detector and note magnifier. With such a combination one may reasonably expect to receive the majority, if not all, of the B.B.C. stations, with the nearest of them of such volume as to operate a loud-speaker.

General Considerations.

In the set about to be described, the writer has utilised the plug-in coil system of tuning, thereby permitting the tuning circuits to be adjusted to any wavelength according to the coils used.

Reaction is introduced into the set, and since it is now permissible to use reaction direct on to the aerial circuit, this method is employed. At this point, it may be well to remind readers that though aerial reaction is now permitted, the concession does not in any way justify listeners in energising their aerials, and for those readers who still prefer the safer tuned-anode method of reaction, the desired effect may be obtained by reversing the positions of the aerial and anode-tuning coils with their respective connections.

The general appearance of the instrument may be observed from the photograph, Fig. 1, wherein may be seen on the right the two telephone terminals, the H.T. positive, the L.T. positive, and H.T. and L.T. negative (a common terminal). The 2-coil holder for the aerial and reaction coils may be seen on the left-hand side of the containing box with the aerial and earth terminals mounted immediately above it on the ebonite panel.

The single coil mounted in front of the first valve is the anode coil, which is tuned by the condenser having its dial on the left-hand side of the panel. The knob and dial for operating the condenser in the aerial circuit is seen to the right of the photograph. The adjusting knobs for the filament resistances may be seen in the centre of the panel, these being the three small knobs with pointers.

Materials and Components.

Though the components may be any that the constructor may choose, subject to their values being correct, the components and materials embodied in the set under description and seen in the photographs are as enumerated below:—

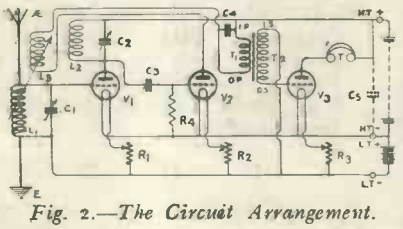


Fig. 2.—The Circuit Arrangement.

One ebonite panel, 12 in. by 9 in. by ¼ in.

Two variable condensers of 0.0005 μF capacity (Radio Instruments, Ltd.).

Three Igranic filament resistances.

One fixed condenser, 0.0003 μF capacity (Dubilier).

One fixed condenser, 0.001 μF capacity (Dubilier).

One grid-leak of 2 megohms resistance (Dubilier).

One Polar cam-vernier 2-coil holder (Radio Communication Co.).

One single coil mount (L. McMichael).

One intervalve low-frequency transformer (Radio Instruments, Ltd.).

Seven terminals.

Three valve holders.

Set of Atlas coils for the wavelengths desired. (Clarke & Co).

Quantity of No. 18 or 20 tinned copper wire for connecting purposes. Quantity of insulating sleeving.

The Circuit.

This is illustrated in Fig. 2, the general arrangement being as follows:—

The valve V_1 is the high-frequency valve, V_2 the detector, and V_3 the low-frequency valve. The aerial circuit L_1, C_1 comprises a honeycomb coil of the

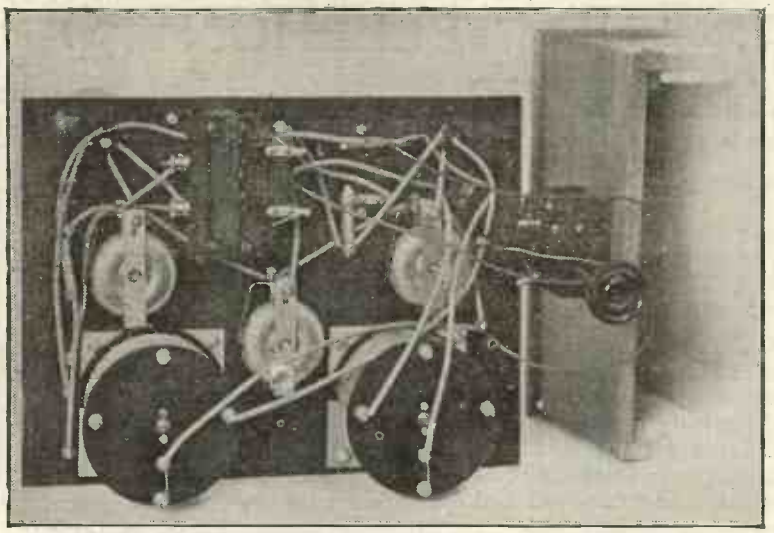


Fig. 3.—Back of panel view showing disposition of components.

An article dealing with the construction of a three-valve set, capable of receiving all British and Continental broadcasting wave-lengths.

required value, shunted by the 0.0005 μF variable condenser, which circuit has, according to the wavelength being received, a certain frequency to which must be tuned the high-frequency circuit of the valve V_1; this latter circuit is formed by the inductance L_2 and the 0.0005 μF variable condenser C_2.

R_1, R_2 and R_3 are the filament resistances controlling the filament current of V_1, V_2 and V_3 respectively. C_3 is the grid condenser of 0.0003 μF capacity, whilst R_4 is the gridleak of 2 megohms resistance. L_3 is the reaction coil connected between the plate of the detector valve and the O.P. terminal of the intervalve transformer; across the primary of this latter is connected the 0.001 μF fixed condenser C_4.

T represents the telephones, whilst C_5 is a fixed condenser of 1 μF capacity, connected across the H.T. battery. The purpose of this condenser is to smooth out any irregularity in the supply of voltage given by the battery, thereby reducing to some extent the noises of the set. This condenser is shown dotted in Fig. 2 for the reason that it is not always necessary, the condition of the H.T. battery deciding. In the writer's case C_5 is omitted without disadvantage.

It will be observed that the negative side of the L.T. battery is earthed in accordance with the usual practice, but should the set show any tendency to burst into self-oscillation, independent of the reaction coil, then the constructor should earth the positive side of this battery, when all tendency to self-oscillation will be overcome. It may be argued that this latter connection will result in certain losses in the efficiency of the set, but with judicious use of reaction all such losses may be easily overcome.

The Panel.

This is made from ebonite 12 in. by 9 in. by $\frac{1}{4}$ in., drilled in accordance with the dimensions shown in Fig. 4. When completely drilled and the holes countersunk for the screw heads, the panel should be rubbed on both sides with fine emery cloth or pumice powder, in order to remove any extraneous and conductive matter buried in its glossy surface. To obtain an even and neat finish, the panel should, after rubbing, be treated with a clean rag and a few drops of vegetable oil until all traces of its previous treatment are removed.

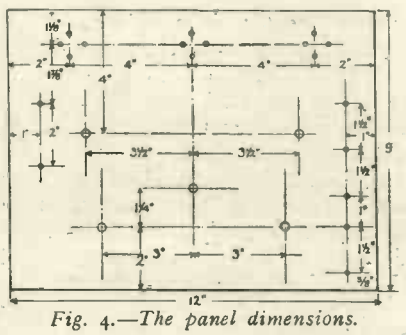


Fig. 4.—The panel dimensions.

Preliminary Tests.

At this stage everything is ready for assembling the receiver, but before mounting the various components for the final connecting up, the reader is advised to lay them out upon a baseboard and connect them up in accordance with the circuit diagram, Fig. 2.

Should the constructor decide to mount his components and connect them as a finished instrument without preliminary test and then fail to obtain satisfactory results, not only will time be wasted and labour expended upon neat wiring, etc., but the task of locating the fault will be rendered more difficult.

The success of the finished instrument depends upon the correct arrangement of the circuit, and for this reason it is advocated that the components be first connected together in such a way as to permit easy alteration in the event of misunderstanding.

In next week's issue will be given complete instructions for wiring up the mounted components in accordance with the wiring diagram. Instruction in operation and details as to the results obtained with this receiver will also be given.

A SIMPLE C.W. AND TELEPHONY TRANSMITTER

[The concluding constructional details and some notes on the operation of the completed instrument.]

Materials Required for Completion.

In the following specification the components enumerated are as actually fitted to the original instrument. It will be understood, of course, that modifications may be made as regards the type of components, at the discretion of the reader.

1 containing box to the dimensions given in Fig. 7, the choice of material, finish, etc., being left to the individual taste as usual.

1 variable condenser, capacity 0.0005 μF. The insulation of this condenser should be good and the plates should be well spaced. That illustrated is by the Fallon Co.

1 valve-holder and rheostat combined (Bowyer-Lowe).

1 5-point and

1 3-point tuning switch (Bowyer-Lowe).

1 fixed condenser 0.0003 μF. (Dubilier) (not 0.003 μF as inadvertently stated last week).

1 fixed condenser, 0.001 μF (Dubilier).

1 2- or 4-volt flashlamp and holder.

1 hot wire ammeter (ex Disposal Board). (If possible, one having a maximum reading of 0.25 ampere should be obtained.)

1 buzzer (Economic Electric Co.).

9 terminals (Bowyer-Lowe).

1 solid-back microphone (ex Disposal Board).

Assembling and Connecting Up.

The general arrangement of the controls, the hot wire ammeter, microphone and buzzer, upon the front of the instrument was clearly shown in the photograph of the completed instrument (Fig. 1), whilst the disposal of the components inside the cabinet will be seen on reference to Fig. 3.

One detail, however, is not very clearly shown in Fig. 3, namely, the method of fixing the small flashlamp. In order to avoid actual contact between the metal holder and the wood of the box, the ordinary type of holder supplied for the small flashlamp was modified somewhat, the bottom portion being removed and the remainder being attached to a small square of ebonite. The socket of the holder was then bushed with fibre and passed through a $\frac{3}{8}$ in. diameter hole in the front panel, to the back of which the square ebonite base plate was screwed.

Having fitted all the components neatly into place, it remains to connect them up in accordance with the back-of-panel wiring diagram, Fig. 8. Although there may appear to be rather a number of connections, no real difficulty should be experienced provided the work is carried out carefully and methodically.

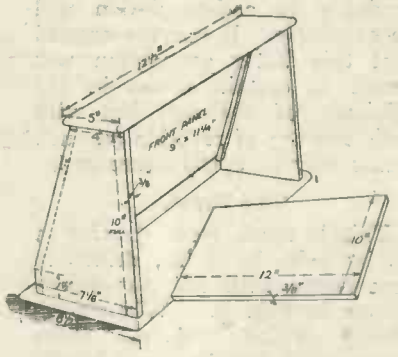


Fig. 7.—Dimensions of the cabinet.

First of all, dispose of the connections between the 5-point aerial tuning switch and the tappings of the aerial coil. Connect the innermost tapping to the left-hand stud of the switch, preferably with a length of No. 20 S.W.G. tinned copper wire covered with insulating sleeving. The 2nd, 3rd and 4th tappings are to be similarly connected to the 2nd, 3rd and 4th studs, counting from the left (remembering that the *back* of the panel is referred to), whilst the outer end of the aerial coil is to be connected to the 5th and last contact stud. Proceed with the remaining connections, leaving the fitting and connecting up of the microphone transformer to the last. When connecting the flexible leads from the reaction coil, remember that it may prove necessary to reverse them.

Operating the Set.

There is a good deal more in the final testing and putting into operation of a transmitting set than there is with a receiving set. In the latter case, apart from the usual preliminary trial of the valve filament lighting circuit, etc., it is merely a question of making careful adjustment until the best results are evidenced by the signals in the telephones. With a transmitter, however, it is necessary to arrange as many visible indications of satisfactory operation as possible, but, even then, the final results may not be quite as indicated and require confirmation by reports from more or less distant receiving stations.

When putting this transmitting set into operation for the first time, and having carefully checked all connections with the wiring diagram (Fig. 8) and the complete theoretical circuit diagram, Fig. 2, proceed as follows:—

(1) Connect the six-volt accumulator, observing correct polarity, and make the necessary intermediate connection, giving 4 volts to operate the microphone and 2 volts to operate the buzzer. Rotate the filament rheostat knob and observe that the valve lights up correctly. During transmission the valve should be burning

at its full brilliancy and, although most receiving valves will operate in a transmitter using only 100 volts H.T. supply, some will not stand the full 6 volts across the filament. The writer found the Cossor valve gave better results than several others which were tried.

(2) Connect the transmitting key to its terminals; place the 3-point switch on the centre or "C.W." stud, and connect up the H.T. supply. Depress the key and note whether the flashlamp glows. Screw down the transmitting key and adjust the primary circuit condenser and the reaction coupling until the lamp glows as brightly as possible. This indicates that oscillatory currents are being generated in the primary or closed oscillatory circuit. Set the variable condenser to the desired wavelength (if previously ascertained by means of a wavemeter), or, if the wavelength is not known, set the condenser at about ¾ of its maximum value, which will give a wavelength of approximately 200 metres with the primary winding as specified. Readjust the reaction coupling in order to obtain the brightest glow in the lamp, without moving the variable condenser.

(3) Connect up the aerial and earth leads to appropriate terminals. As the second of these is connected, the flashlamp will probably be extinguished, even though no appreciable movement of the needle of the hot wire ammeter takes place. Move the aerial tuning switch slowly over the 5 studs and note whether the flashlamp glows again. Tighten the reaction coupling until the lamp is made to glow again, moving the arm of the aerial tuning switch over the stud as before. When the lamp is made to glow, thus showing that oscillatory currents are flowing in the primary or closed oscillatory circuit, vary the setting of the aerial tuning switch, at the same time moving the reaction coil slightly, as necessary, until on one particular stud the glow in the lamp is either extinguished or very greatly reduced and, at the same time, the maximum deflection of the needle of the hot-wire ammeter is obtained. Moving the switch one stud to either side should cause the lamp to glow brightly, as the aerial circuit is thrown out of resonance.

(4) Should difficulty be experienced in adjusting matters so that the lamp is extinguished on one stud only, vary the setting of the variable condenser a few degrees either way, at the same time making a *slight* readjustment of the reaction coupling. The object is to transfer the greatest amount of energy from the primary circuit (where it is indicated by the glow of the flashlamp) to the aerial circuit, where it should be indicated by the deflection of the hot wire ammeter.

(5) When the foregoing adjustments have been carefully carried out, manipulation of the transmitting key will result in the transmission of pure continuous waves at the predetermined wavelength.

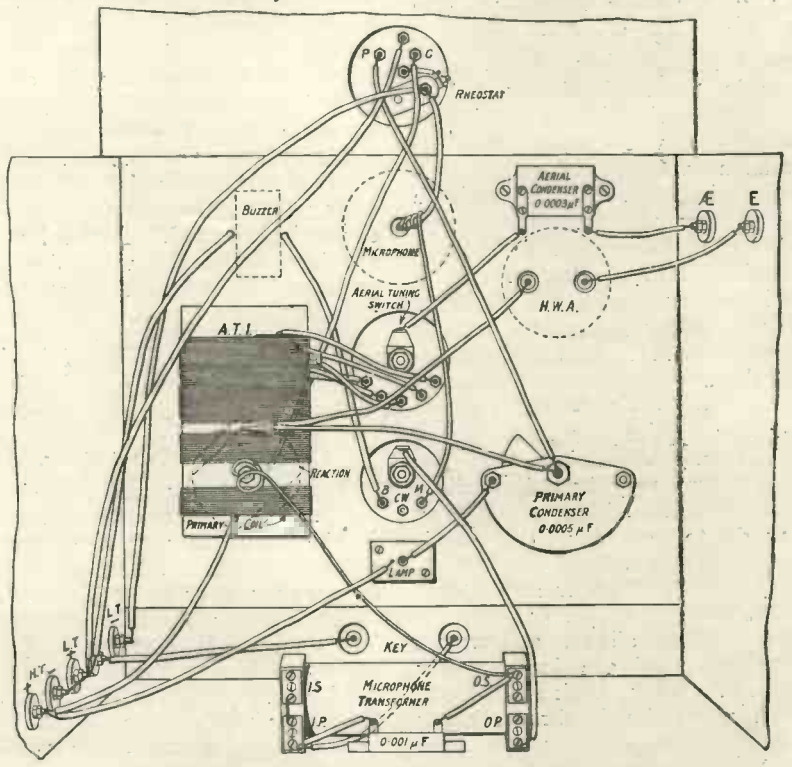


Fig. 8.—Complete wiring diagram of the Transmitter.

(6) Release the key; move the arm of the 3-point switch on to the right-hand or "buzzer" stud, and interrupted or "buzzer modulated" C.W. may be transmitted on the same wavelength and by the same transmitting key.

(7) Move the arm of the 3-point switch on to the left-hand or "microphone" stud, and either hold down or screw down the key. This completes both grid and microphone circuits, and speech may be transmitted, without alteration of wavelength or any necessity for readjustments.

In the course of tests with the completed instrument, using a high-tension supply of 140 volts, an aerial current of 0.04 ampere was obtained, and the first reply by wireless was received from a station eleven miles distant, the owner of which reported that the C.W. and "buzzer" signals were received quite strongly upon 2 valves. Speech was then tried and was reported as being of good quality, but rather feeble.

It was at first suspected that the microphone was the cause of the poor modulation, and actual tests showed that it was not functioning quite satisfactorily, whilst a reversal of the connections of the microphone transformer also gave improved results and increased the modulation accordingly.

Further tests have been carried out and Morse signals transmitted quite clearly over a distance of 20 miles, but on this occasion considerable interference was experienced at the receiving station and speech was not clearly received. It is confidently expected that a few further trials will result in the above-mentioned distances being considerably increased.

A Loud-Speaker Hint.

As in practically all cases the anode current flows directly through the windings of a loud-speaker, it is desirable to pass the anode current through the windings in such a direction that it helps to increase the permanent magnetism of the magnet in the loud-speaker. The current flowing in the anode circuit of a vaive using a high-tension voltage of, say, 100 volts is sufficiently appreciable to weaken the permanent magnetism of the magnet in the loud-speaker or in telephone receivers if it flows through the windings in the wrong direction. I think that manufacturers of loud-speakers ought to mark the terminals of their products + and −; this applies also to telephone receivers. Assuming that the diaphragm may be adjusted, a good way of telling which way round to connect the loud-speaker is as follows :—

Using about 10 or 20 volts of H.T. and the filament of the valve being alight, adjust the diaphragm of the loud-speaker until a tinny click is heard; then move the diaphragm away from the magnet until a loud plonk is heard. This is the best adjustment for the loud-speaker for this voltage. Now use the full high-tension voltage, say, 100 volts; the diaphragm should strike the magnet with a tinny click as the high-tension plug is put in. If this happens, it is an indication that the loud-speaker is connected the right way round, and a slight turn of the adjusting knob will once more result in the loud plonk being heard, indicating that the diaphragm is correctly adjusted. If the loud-speaker terminals were incorrectly connected to the set terminals, the increase of high-tension voltage would not draw the diaphragm against the magnet.

Dull Emitter Vocabulary.

The popularity of the dull emitter will cause certain changes in the vocabulary of those who write about valves. For example, how can we continue to write about filament accumulators when half one's readers are using dry batteries? Shall we have to speak of filament batteries in future? Even this will not be correct in many cases, because the word battery implies two or more cells, and there are at least two types of dull-emitter valves on the market which only require one cell. Readers must not be surprised if they read of the negative terminal of the source of filament current!

Rheostats for Dull Emitters.

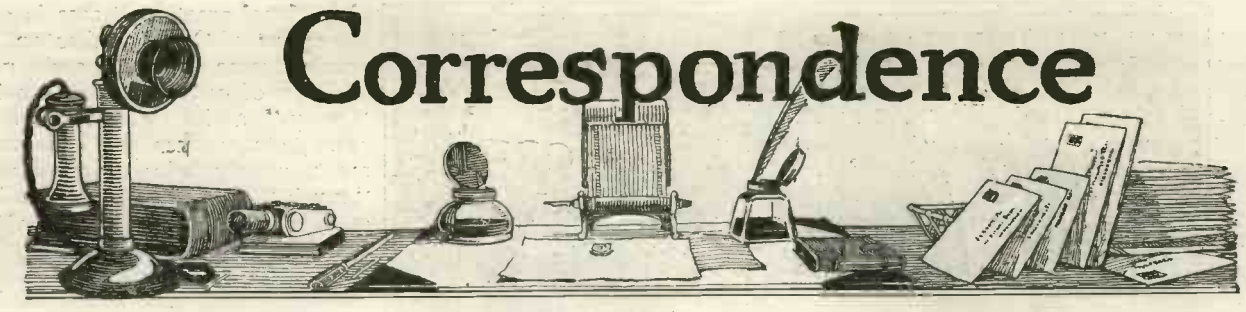
The ordinary rheostat of about 7 ohms value is of little use in the case of dull emitters. When one considers that the resistance in the filament of some of these dull emitters is of the order of 50 ohms, a 7-ohm rheostat is not much use for controlling the current through it. A rheostat of something like 40 ohms is nearer the mark. I have seen a very neat wire rheostat, giving both rough and vernier adjustments, which is ideal for this purpose. The type of rheostat which consists of carbon plates which may be compressed to varying degrees, is also very effective for use, either with dull emitters or ordinary valves. These rheostats are silent in operation and a very fine adjustment is obtainable, quite apart from the fact that a big variation of resistance is obtainable with them.

A REALLY SELECTIVE BROADCAST TUNER.

(*Concluded from page* 110).

The secondary tuning and reaction variometers are similar, having two pile-wound stators of 3¼-in. cardboard tubing, and the common type of wooden ball rotor, about 2¾ ins. diameter, wound full of wire in a single layer. The former variometer has 50 turns of No. 20 S.W.G. d.c.c. wire on stator, and the same wire on the rotor (about 42 turns). The reaction variometer has 40 turns of No. 22 S.W.G. d.c.c. on stator, and the rotor full of the same wire (about 56 turns). The reaction variometer is mounted at right angles to its neighbour to avoid unwanted coupling.

In each case contact is taken to the rotor by means of a stout ring of wire around the spindle, a spring washer and ordinary washer, with nut and lock-nut, providing a certain pressure on this to give noiseless contact. The wiring is done with bare No. 18 S.W.G., all joints being soldered and the wire being well spaced. All cardboard and wood should be soaked in hot paraffin wax before use, and the wire shellac-varnished and gently baked to expel moisture from the insulation before assembling.



Correspondence

ON SUPERS

SIR,—I should like to enter a protest against the practice, which has become common lately, of advocating and illustrating (alleged) Flewelling types of super-regeneration circuits for the purpose of broadcast reception on an outside aerial. The circuits in question show close-coupled magnetic reaction directly on the aerial, generally with tuned plate in addition, and some arrangement of condensers and feed-back from above the 'phones which is supposed to provide super-regeneration, and are accompanied by statements as to loud-speaking strength of signals at a score of miles, and generally, in addition, by a triumphant assertion that the quenching whistle characteristic of "super" circuits has been "tuned out."

Those who have spent many months in experimenting with, improving and testing in a scientific manner the successful "super" circuits, are only too bitterly aware that none published to date will give any real measure of shouting with a single valve on a loud-speaker; the loudest, which is the Armstrong, gives some measure of loud speaking with a power valve and excessive H.T., but even at short distances and with the optimum possible aerial, the very nature of the "super" action in a single-valve circuit prohibits really noisy results. Measurements made recently by Mr. D. F. Stedman with the cathode-ray oscillograph show very clearly what experimenters had already deduced from less precise observations. The fraction of the power of the valve available for H.F. build-up is extremely small, only a portion of the extreme top of the positive half-wave of grid potential swing being available. Even with a four-electrode valve Armstrong, investigated by the same observer, where the Armstrong oscillation on the one grid controls in the most positive manner possible the H.F. build-up with the second grid and common

plate, local amateurs come in as strong as 2LO at 5 miles on a small frame aerial, and no addition of outside aerial, small "relay" aerial close to frame aerial, etc., makes any improvement, merely bringing in more "mush." How then is a P.M.G. outside aerial going to help the far feebler and less definitely stabilised Flewelling super? The latter is admittedly more sensitive for extremely feeble signals, but its grid-leak-howl quenching mechanism cannot at least give much more time for radio-frequency build-up than is available in the simpler sine-wave quenching oscillation of the Armstrong.

At the same time, using a P.M.G. aerial, any reasonable value of H.T. and ordinary valves, it is not very practicable to expect to generate a nearly super-audio-frequency grid-leak howl with a grid-leak of some 1 to 2 megohms (the values generally indicated) to the L.T. plus, but this is how things are actually arranged in the forms of "Flewelling" circuit suggested. The particular arrangement of large blocking condensers (which are merely easy bye-passes for radio-frequency) does not affect the case. With the heavy load of an outside aerial, as figured, these circuits are merely single-valve circuits with close reaction directly on the aerial, and not "super" at all. As such, they will give some loud-speaking at a dozen or so miles from the broadcast centre, on a fairly good aerial, as any one of a half-dozen different reaction circuits will notoriously do; but even if merely oscillating quietly exactly in step with the powerful transmission—which will drag up into step such a receiver if the difference is not too great — such devices are certain centres of interference for some miles around and are to be strongly deprecated, to say the least of it.—I am, etc.,

EXPERIMENTA-DECENT.

According to reports, postmen in the S.W. London district distributed on Dec. 24th notices of renewal to holders of the 10/- B.B.C licences which expire at the end of 1923.

Information Department

E. G. (MANCHESTER) has constructed a two-valve broadcast receiver, but is unable to receive from distant stations.

In the receiver referred to, the tuned anode method of high-frequency amplification is employed. This necessitates the accurate tuning of the anode circuit to resonance with the aerial circuit and with the incoming wave, in order to obtain maximum efficiency, and this calls for more turns on the anode coil or a small parallel condenser.

J. B. E. (LIVERPOOL) asks which is the best straightforward arrangement employing three valves.

For efficiency, combined with simplicity of construction and operation, we recommend the arrangement of circuit ST45 (*Practical Wireless Valve Circuits*), in which the first valve acts as a high-frequency amplifier, the second as the detector, and the third valve as a low-frequency amplifier, whilst electromagnetic reaction is provided on to the tuned anode coil of the first valve, an arrangement which minimises interference with adjacent stations. Reaction on to the aerial circuit is now permitted by the Post Office regulations, but if employed, it should be used with all care. An article describing a simple three-valve receiver which should meet your purpose admirably commences in this issue.

G. R. B. (LONDON, S.W.5) submits for criticism a diagram showing a modified arrangement of a proposed ST100 receiver.

The modifications comprise the introduction of various switches, and, although the circuit diagram is quite in order, we regret that the pro-

posed switching arrangements are impracticable. It is one thing to devise such a scheme on paper, but quite another to incorporate it in a receiving set and get it to work. The stability of the receiver would be completely upset by the long leads introduced, and the set would become unworkable.

R. M. D. (LANCASTER) asks what wavelengths have been allotted for experimental transmission.

According to the terms of the licences at present in use, the following wavelengths may be employed for experimental transmissions :—

180 to 200 metres ... Spark, continuous wave, interrupted C.W. (sometimes termed "tonic train") and radio telephony.

440 metres ... ... (All the above except spark).

J. D. F. (SIDCUP) asks how to calculate the capacity of a moving vane type of variable condenser.

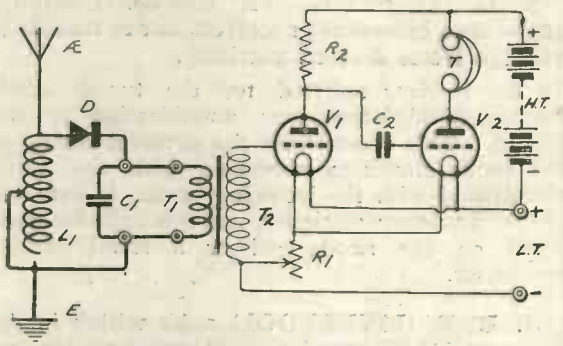
The capacity may easily be calculated from the following formula :—

$$C(\mu F) = K \frac{A}{4\pi D \times 900{,}000}$$

where A equals the total area of dielectric under strain; π equals 3.14159; d equals the thickness of dielectric (that is to say, the distance separating the plates); and k equals the dielectric constants, which is 1 for air, 2.5 for ebonite, about 6 for glass, according to the quality, and 8 for best quality mica. All the dimensions are in centimetres and the resultant capacity in microfarads (μF).

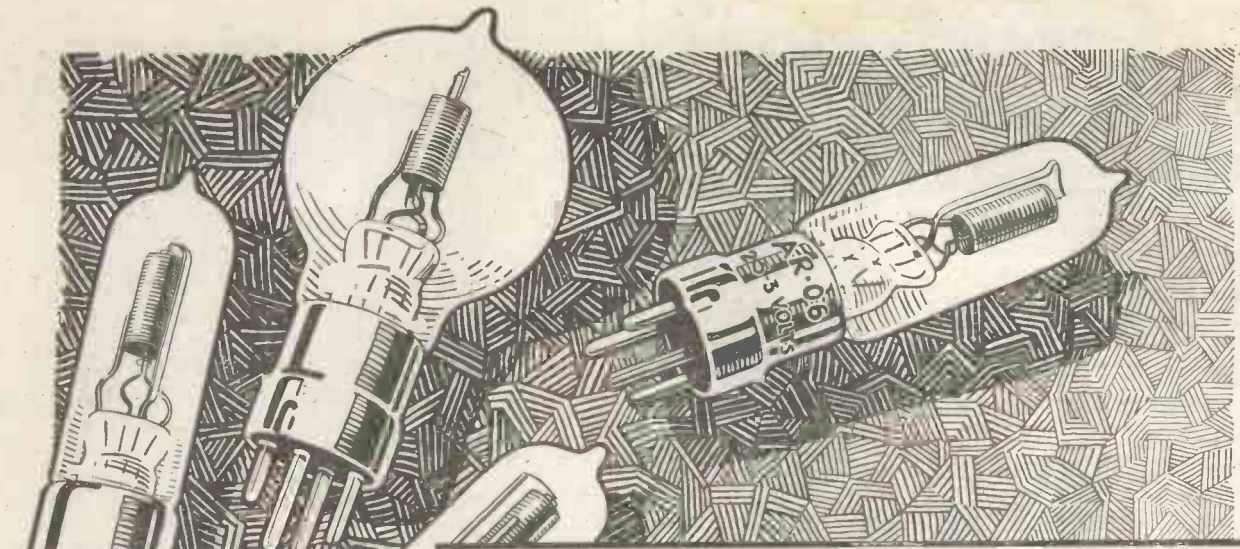
F. H. (NEW CROSS) asks which is the best method of increasing signal strength when it is desired to use several pairs of telephones or a small loud-speaker.

At your distance from the broadcasting station, the addition of a simple low-frequency amplifying



panel (as described in last week's issue) will probably meet your requirements. Should it not do so, however, we advise you to add 2 L.F. valves, which may be arranged so as to require only one L.F. transformer, as shown in the diagram herewith.

Keep advertising and advertising will keep you.



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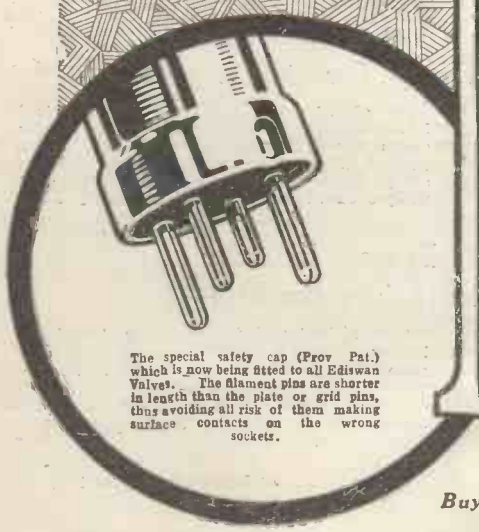

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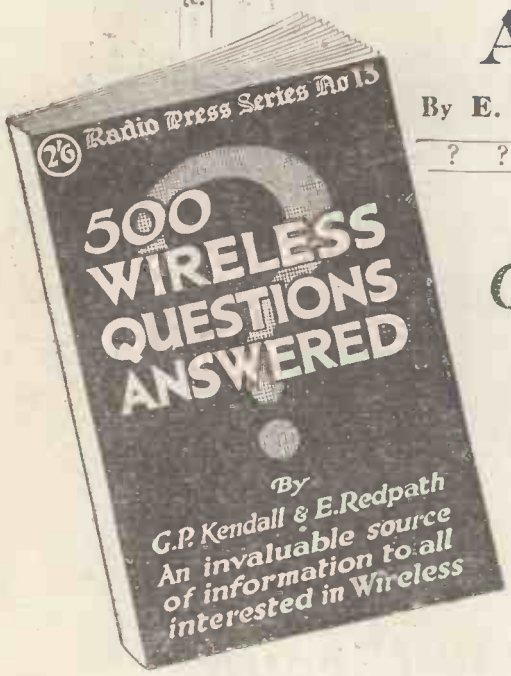

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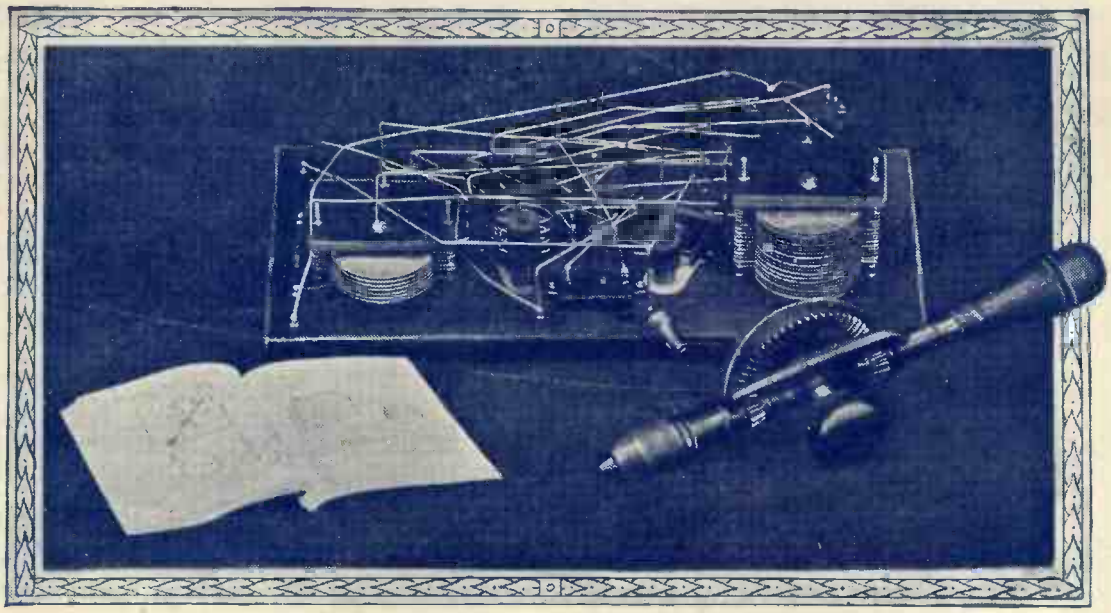

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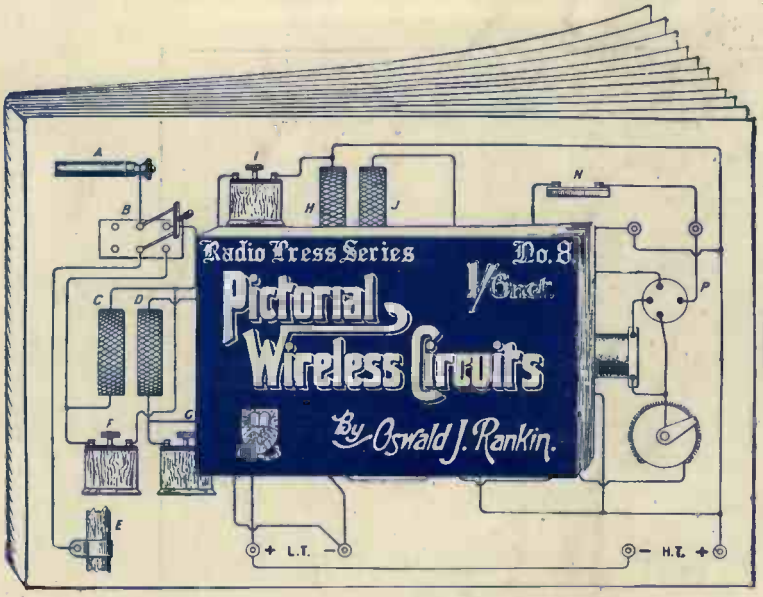

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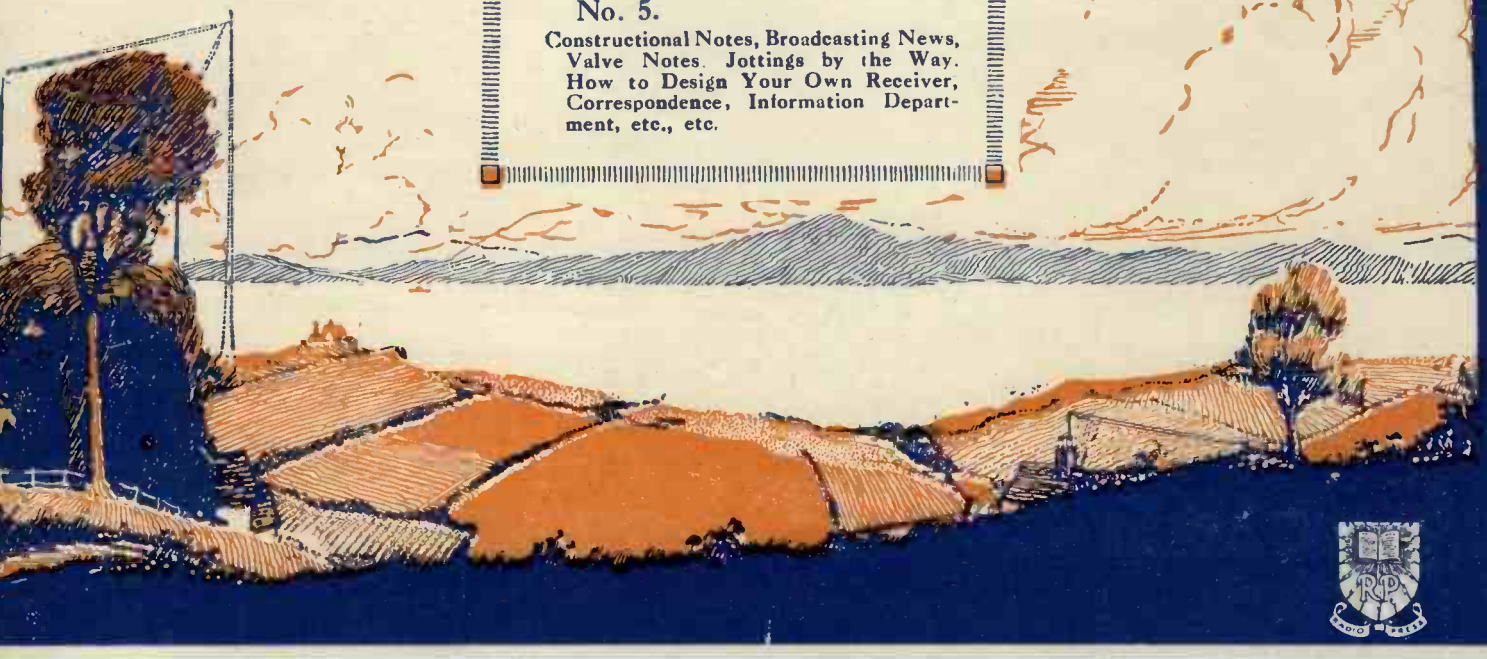

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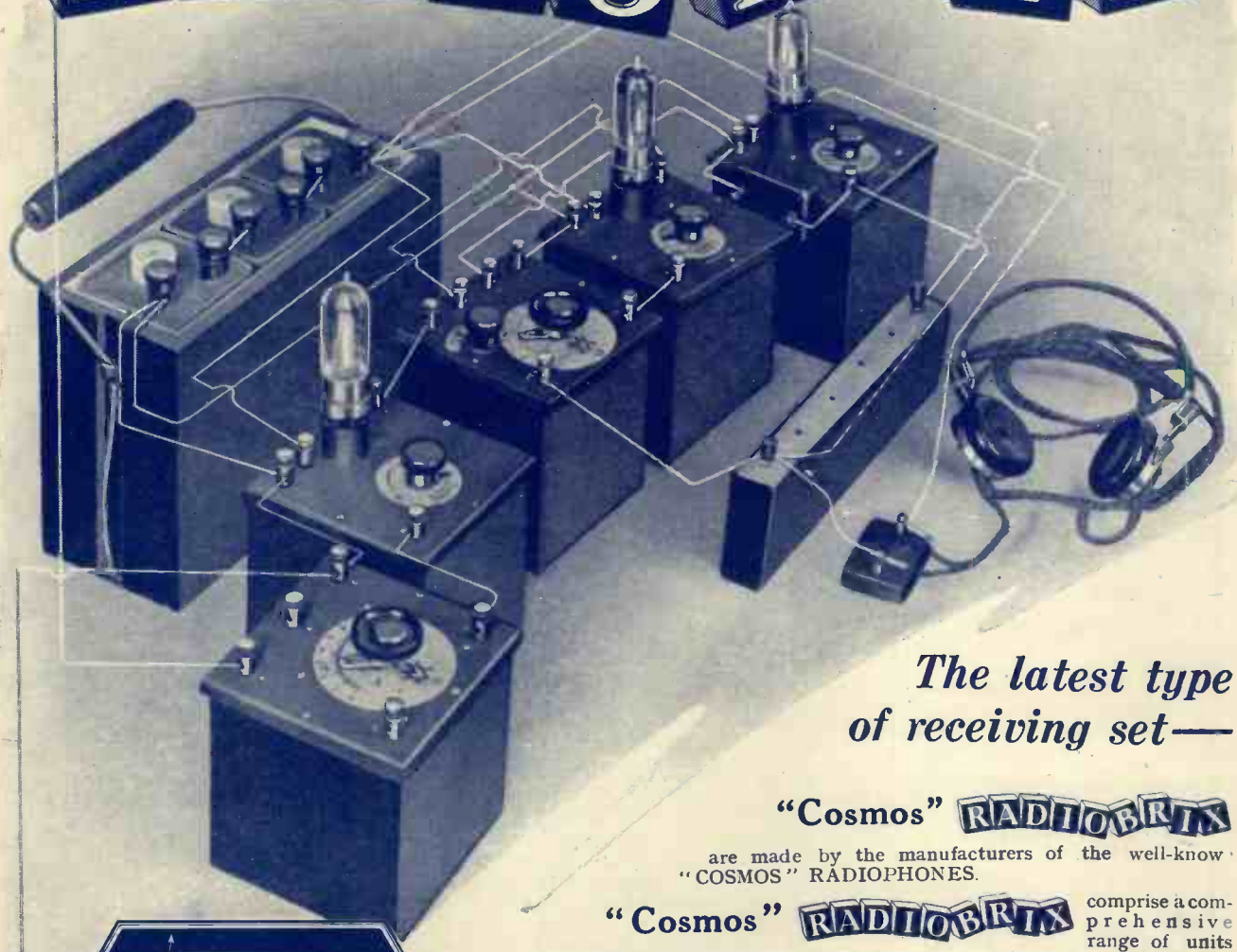

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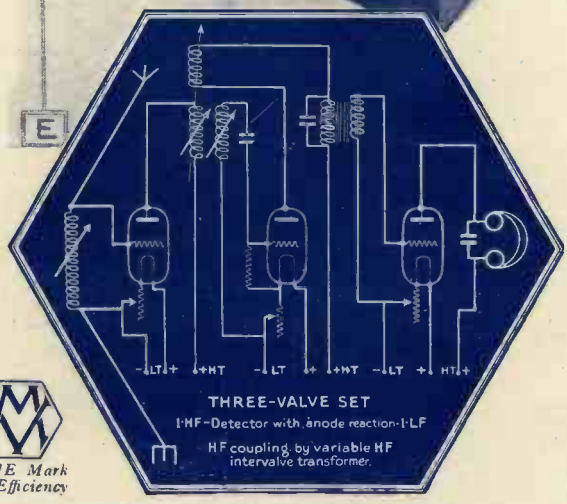

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Wireless Weekly

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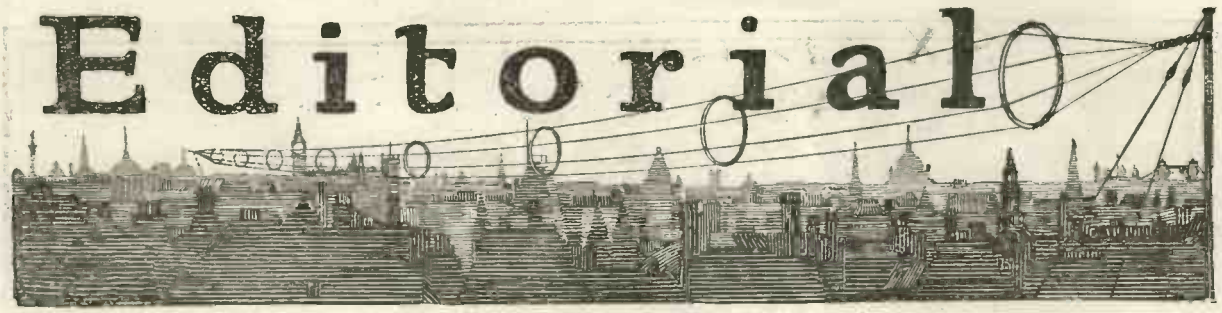


The Radio Society's New Constitution.

REFERRING to our Editorial comments in the issue of December 26th, we give below a verbatim report of the protest made by Mr. Percy W. Harris against the rush tactics adopted. This report will enable readers to judge of the reasonable nature of the protest made in the Society's interests.

Mr. Harris: At the risk of being in a minority, I should like to make one or two remarks which I think are in the general interests of the Society, although they may not please all the members. First of all, however, I would like to join with Mr. Rivers Moore in expressing appreciation of the work done in preparing this Memorandum and Articles of Association. I also fully appreciate Mr. Reeves' remarks regarding the care which has been taken, but the fact still remains that, in common with a large number of members, I have only this evening received a copy of the new Memorandum and Articles of Association and **I think it is wrong in principle, in a Society of the importance of this one, that even in principle one should be asked to approve such a memorandum as this within a few minutes of receiving it,** when it has been a physical impossibility to read 50 per cent. of it, without missing the discussion which has been taking place. I should like, therefore, to move the adjournment of the meeting until such time as the members have had an opportunity of considering these, even in general principle.

The President: A motion of that kind would not be acceptable. The Chairman of any meeting cannot accept a motion which prevents business. You can vote against the resolution or you can move an amendment to it, but you cannot do anything that stops business. The proper meaning of "motion" is to get a move on. Anybody who produces a stoppage is doing the opposite and the Chairman cannot possibly accept such a motion.

Mr. Harris: I thank you for the explanation. Is it possible to word it in the form of an amendment, then?

The President: You can ask for a fuller explanation before voting, but you cannot stop a vote being taken.

Mr. Harris: The matter seems of such seriousness that unless we have some means of expressing ourselves either in words or some other form, there is the danger, which as Mr. Rivers Moore said, has been mentioned in a certain part of the Press, of the matter being rushed through, which I think is dangerous.

The President: What item do you think is being rushed through?

Mr. Harris: We are asked to approve these in general principle, and, in particular, certain items. I object in principle to having to vote on such a matter at such short notice.

The President: Pardon me, the notice is not short. What we ask you to vote upon to-night has been in the Press and in most of the wireless papers repeatedly during the past four months. There is nothing more than that that you are asked to vote for. **You will have to take my word for it that this Memorandum and Articles of Association does not contain anything that has not been well aired, and I hope you will.** There is nothing in them which has not been thoroughly discussed in the public Press and announced on the broadcast repeatedly. If there are no further comments, I will put the motion to the meeting.

* * *

We reiterate our belief in the principle of unity of control, and that such control should be vested in a properly constituted Radio Society of Great Britain, and our criticisms are made in an endeavour to have the Radio Society of Great Britain placed upon a proper footing so that it may become a really strong Society and truly representative of the amateur movement.

So far, the leaders of the Society have failed (or refused) to read the writing on the wall. They have remained placidly content, whilst 100 or more of the best experimenters in the country leave the fold and start a separate Transmitters Society.

They have apparently ignored the wholesale secession of affiliated Societies, who have formed a separate League with a view to accomplishing what they have evidently found the parent Society failed to accomplish.

Steps should be taken at once to check the disintegration. If the responsible individuals consider that we are wrong in our contention, let them take a plebiscite of their members and affiliated Societies, when they will discover that the new constitution should have been produced in time for adequate consideration in detail; apart from this, they will also find that the Society, working on its present programmes, is considered of little or no use to individual members or to affiliated Societies; and, secondly, that a truly representative and energetically managed Society, with an enthusiastic and broad-minded committee, with a progressive programme *would* gain adequate support.

SIX LECTURES ON DUAL AMPLIFICATION

No. V.

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

The first of this series of Lectures began in our issue of December 12th.

SO far we have considered the use of crystal detectors as rectifiers in dual amplification circuits. This form of detector was used in the earliest dual circuits; perhaps this is the reason why the words "dual amplification" nearly always conjure up the picture of a crystal detector which some people seem to find unmanageable.

In this lecture it is proposed to discuss the use of the three-electrode valve as a detector in dual amplification circuits.

A Two-valve Dual.

Fig. 23 shows a two-valve dual circuit in which the first valve acts as a high-frequency amplifier, and also as a low-frequency magnifier; the second valve acts as the detector, the grid circuit L3 C3 being tuned to the incoming wavelength, the inductance L3 being tightly coupled to the inductance L2 which is aperiodic, and which is in the anode circuit of the first valve.

The operation of this circuit is briefly as follows:—

The aerial circuit includes the tuned circuit L1 C1 and the high-frequency oscillations are communicated to the grid of the valve V1 which proceeds to amplify them, the amplified oscillations passing through the inductance coil L2 which is tightly coupled to the inductance coil L3. The telephones T, or the loud-speaker, as the case may be, are

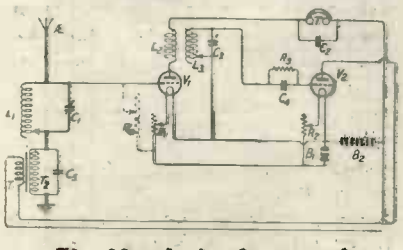


Fig. 23.—A simple two-valve dual circuit.

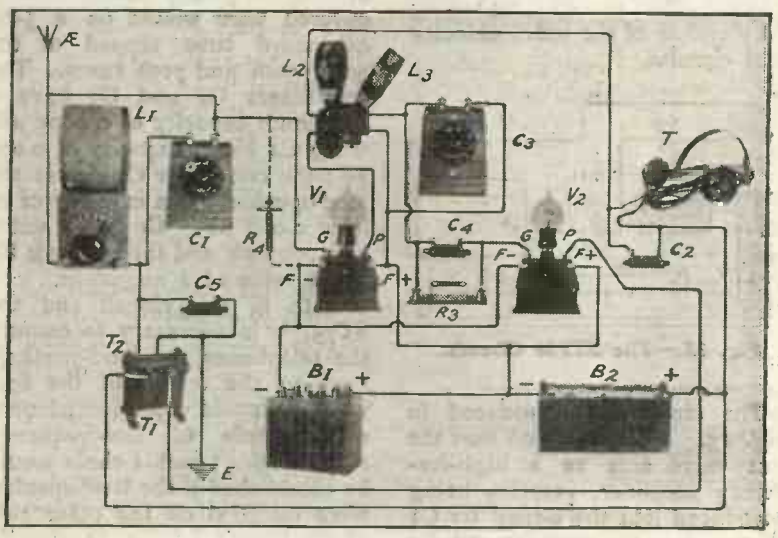


Fig. 24.—Pictorial form of the circuit in Fig. 23.

connected in the anode circuit of the first valve, and are shunted by condenser C2 of, say, 0.002 μF capacity.

The oscillations in L2 are induced into the circuit L3 C3 and are communicated to the grid of the second valve through the grid condenser C4 of 0.0003 μF capacity. This grid condenser is shunted by the usual grid-leak R3 of about 2 megohms resistance. The second valve V2 acts as a detector, and rectified currents appear in the anode circuit of this valve. The rectified currents therefore pass through the primary T1 of the step-up transformer T1 T2, the O.P. terminal of which is connected to the anode of V2, and the I.P. terminal to the positive of the high-tension battery B2.

The secondary T2 is connected in the grid circuit of the valve V1, and the low-frequency potentials are therefore communicated to the grid of the valve which carries out the stage of high-frequency amplification. The low-frequency currents pass through the coil L2 and through the telephones T. There is no undesirable low-frequency reaction chain, owing to the fact that the low-frequency currents passing through L2 are not communicated to the grid of the second valve, because L2 L3 is an air-core transformer which acts as a transformer to the high-frequency currents, but not to the low-frequency currents.

Fig. 24 shows the Fig. 23 arrangement in pictorial form.

Suitable Values.

Suitable values for the Fig. 23 circuit for the broadcast wave-band, are as follows:—

Condensers C1 and C3 are 0.0005 μF variable condensers; C5 has a capacity of 0.001 μF; L1 may be a No. 35 or No. 50 honeycomb coil, or may consist of 50 turns of No. 26 gauge double cotton-covered wire wound on a cardboard tube 3½ in. in diameter, tappings being taken at the 10th, 15th, 20th, 25th, 30th, 35th, 40th and 50th turns; the inductance L3 consists of 70 turns of No. 26 gauge wire wound on a cardboard tube 3 in.

in diameter, tappings being taken at the 30th, 50th and 70th turns. The coil L2 consists of 30 turns of No. 26 gauge double cotton-covered wire wound directly over one end of the other coil.

The ST150 Circuit.

The ST150 circuit has already been fully described in this journal, but for the benefit of the considerable number of new readers, it is proposed to make a few further remarks regarding the simplest of the valve detector dual circuits.

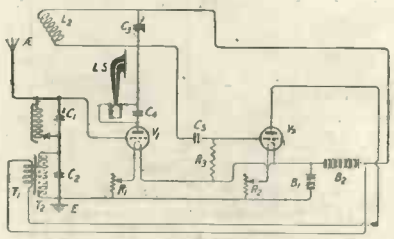


Fig. 25.—The ST150 Circuit.

The circuit is reproduced in Fig. 25. It will be seen that the first valve acts as a high-frequency amplifier, reaction being introduced into the circuit L1 C1 by coupling the reaction coil L2 to L1; the reaction coil L2 is tuned by means of the variable condenser C1 and a connection is taken between the foot of the circuit L2 C2 to the grid of the second valve which acts as a detector. In the anode circuit of the second valve we have the primary T1 of the step-up intervalve transformer T1 T2, the secondary T2 of which is connected both in the aerial circuit and the grid circuit of the first valve. The result is that the low-frequency potentials are applied to the grid of the first valve, the amplified low-frequency currents passing through the loud-speaker L.S. and operating it. Instead of a loud-speaker, telephone receivers might be included, and it is a matter for experiment to see whether the condenser C4 is necessary or not. If telephones are used it is desirable that their insulation should be perfect. A loud-speaker is, in general, greatly to be preferred to telephone receivers with this circuit.

Fig. 26 is a pictorial representation of the ST150 circuit.

As regards values for the ST150 circuit, the following data may prove useful:—

The inductance L1 may be a No. 25, 35 or 50 honeycomb coil, or may consist of 50 turns of No. 26 gauge double cotton-covered wire wound on a cardboard tube 3½ in. in diameter, tappings being taken at the 10th, 15th, 20th, 25th, 30th, 35th, 40th and 50th turns; the inductance L2 may be a No. 50 or No. 75 coil, or may consist of 70 turns of No. 26 gauge double cotton-covered wire wound on a 3-in. cardboard tube tapped at the 30th, 50th and 70th turns. The condensers C1 and C3 have a maximum capacity of 0.0005 μF, while C2 has a capacity of 0.001 μF; the condenser C4 across the loud-speaker has a capacity of at least 0.002 μF. C5 has a value of 0.0003 μF and the gridleak R3 has a value of 2 megohms.

Both in this circuit and the ST75, it is necessary to connect the telephones, or loud-speaker, next to the anode of the first valve to avoid the establishment of a chain of low-frequency amplification; such a chain would be established if the loud-speaker were included on the other side of the circuit L2 C3, because in this case the potential variations across the loud-speaker would be communicated through the condenser C5 to the grid of the second valve, which would proceed to amplify the low-frequency currents. These would be amplified a second time by the valve V1, and so we would have established a chain of amplification which would result in low-frequency self-oscillation. Methods of overcoming the trouble experienced when telephones are connected next to the anode are explained in the next lecture.

The ST75 Circuit.

This circuit somewhat resembles the ST150, but reaction is introduced on to a tuned anode circuit by a coil in the anode circuit of the second valve.

The circuit involves a stage of high-frequency amplification, a stage of low-frequency amplification and a valve detector in between the two stages.

In the circuit given in Fig. 27, which illustrates the ST75 circuit, the first valve V1 acts as a high-frequency amplifier, the amplified currents appearing in the circuit L2 C2, which is the anode circuit of the first valve. A lead is taken, as shown, from the bottom of L2 through the grid condenser C4 to the grid of the second valve V2, which acts as the detector. In the anode circuit of the second valve we have the reaction coil L3, which is for the purpose of introducing reaction into the circuit L2 C2, and also the primary T1 of a step-up intervalve transformer T1 T2, which conveys the low-frequency currents to the grid circuit of the first valve, which thereupon amplifies them.

The amplified low-frequency

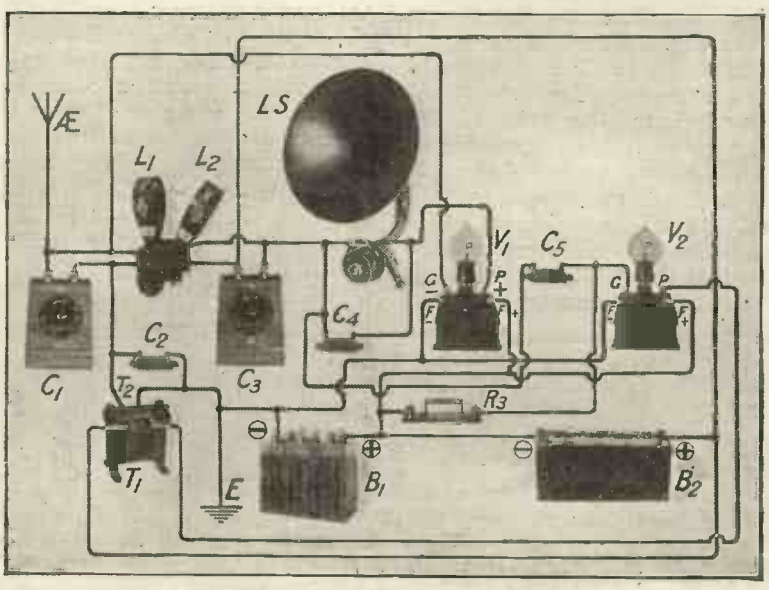


Fig. 26.—The ST150 Circuit in pictorial form.

currents pass through the loud-speaker L.S., which is included between the anode of the first valve and the circuit L2 C2, a condenser C3 being preferably provided. A condenser C5, preferably variable, but of 0.001 μF capacity if fixed, is connected across T2 to allow the high-frequency currents to pass through. The condenser C6 is optional, and experiments will prove if it is necessary with the particular apparatus used. Care should be taken to keep the loud-speaker away from the accumulator and high-tension battery, and it

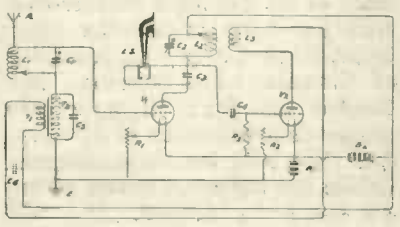


Fig. 27.—The ST75 Circuit.

should be well insulated. When telephones are used instead of the loud-speaker, there is frequently some difficulty in tuning.

Suitable Values.

The following are suitable values for the ST75 circuit. The inductance L1 may consist of a No. 25, 35 or 50 honeycomb coil, or may consist of 50 turns of No. 26 gauge double cotton-covered wire wound on a cardboard tube 3½ in. in diameter and tapped at the 10th, 15th, 20th, 25th, 30th, 35th, 40th and 50th turns; the inductance L2 may consist of a No. 50 or 75 honeycomb coil, or 70 turns of No. 26 gauge double cotton-covered wire wound on a 3-in. cardboard tube and tapped at the 30th, 50th and 70th turns; the inductance L3 may be a No. 75 coil or may consist of 35 turns of No. 26 gauge double cotton-covered wire wound on a cardboard tube 3½ in. in diameter; C5 has a value of 0.0001 μF, while C1 and C2 have a capacity of 0.0005 μF; C3 has a value of 0.002 μF, while C4 has a value of 0.0003 μF. The value for C6 is a matter for trial, and 0.0003 μF may be tried; the gridleak R3 has a value of about 2 megohms.

Special Note.

In all three circuits, Figs. 23, 25 and 27, a 100,000 ohms resistance may be tried across the grid of the first valve and the positive or negative terminal of the filament accumulator, as shown dotted in Fig. 23; this resistance may be variable between 50,000 ohms and 100,000 ohms. It will be found that this resistance will stabilise the circuit in each case.

(The Sixth Lecture on Dual Amplification will appear next week.)

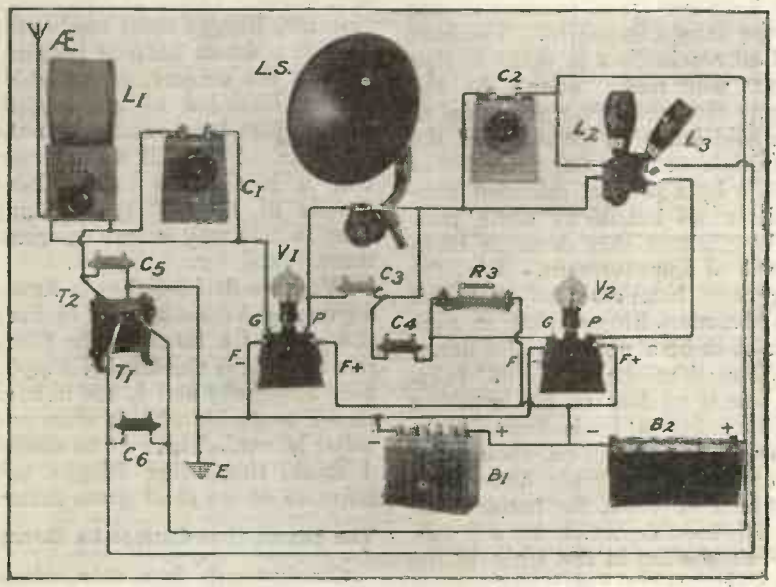


Fig. 28.—Pictorial form of the ST75 Circuit.

REPAIRING LEAKY ACCUMULATOR CONTAINERS

IT occasionally happens that the celluloid case of an accumulator gives way. This may be due either to an accident or to the buckling or bulging of the plates after long use. But whatever the cause the results are extremely unpleasant, on account of the destructive action of the acid. Fortunately, celluloid is a material which is very easy to repair by means of patches.

Should a hole or a crack be discovered in the case of the accumulator, the first step is to empty out the acid and to allow the battery to drain. If there is a deposit of sediment on the bottom of the case use may be made of this opportunity for washing it out. Now take a nail brush and thoroughly clean the celluloid in the neighbourhood of the wound, afterwards scraping it a little with a pocket knife. Cut out a patch of celluloid of suitable size and treat it in the same way. Now apply a very thin coating of either amyl acetate or acetone (aeroplane dope) to both case and patch. Two or three further thin coats should be given, after which the patch should be placed in position and held under considerable pressure until the solution is dry. A little more of the solution should then be painted on round the edges of the patch.

An accumulator treated in this way will be found to be perfectly watertight; in fact, it is stronger than ever at the place where the repair has been made. As prevention is always better than cure, the accumulator which shows any signs of bulging or warping should be strengthened at once by sticking on strips of stout celluloid at the places affected. If this is done its life will be considerably prolonged, and there will be no fear of an unexpected leak.

R. W. H.

The Multiple Good Resolution.

Now that the New Year is with us I hope that you have not begun it badly by leading off with a whole host of noble resolutions, for no one has ever yet been able to keep his good resolutions for more than a fortnight. The best of all resolutions to make is that you will make none. At the same time there is a good deal to be said for what we may call the multiple resolution, which is made by a kind of informal committee on behalf of some poor fellow whom they deem to be in need of improvement. We, for instance, have resolved on behalf of the man Bloggs that in 1924 he shall be a nobler and a better fellow than he was in 1923. There is no fear of his breaking our resolution, for he knows nothing of it; nor will he, though its workings will slowly but surely make him a far, far better man.

The trouble is that he will talk wireless shop in the train in the morning when every reasonable being should be reading his paper and smoking his pipe in peace. The rest of us, Snaggsby, Pippleton, Gubblesby and I, are never guilty of such an offence. Keen as we are, we reserve our discussions for more seemly moments. Of course, if one of us has discovered what may be a really wonderful circuit he may tell the others something of it, and after an all-night sitting one must naturally let one's friends know how WHAZ and WGY came through. Again, should one of our number be contemplating the purchase of, say, valves, could you expect him not to ask the advice of the rest on the point? But this, of course, we do not count as wireless shop.

Intolerable.

Bloggs, on the other hand, is the kind of fellow who is always butting in with queries or even gratuitous information on aerial constants, duplex circuits, reverse reaction and other such technical points. Only the other morning when Pippleton and I were discussing the question of the root-mean-square values of alternating currents, Bloggs must needs chip in with a whole heap of information on the subject, all of which I had intended to air myself, having just been reading up the subject. You will see at once why it is that we cannot have people of Bloggs' type talking shop in this way in our compartment.

We have decided that in future anyone who does so shall be fined the price of a lunch. The Committee, that is Gubblesby, Pippleton, Snaggsby and I, are to have power to decide what is shop and what is not. There is no doubt, I think, that either Bloggs will improve or we shall grow fatter.

The Insult that Cannot be Borne.

Cranksworth is a man whose strength of mind I admire deeply. He is the sort of fellow who always stands up fearlessly for truth and justice, speaking his mind at whatever cost to himself, when lesser men are silent, possibly because they have no minds to speak. If only he would mind his speak as well as he speaks his mind all might be well; but he is not built that way. If he feels strongly about anything, then he must out with it or burst. It was this downrightness that led to his cutting himself off without even a shilling from his wealthiest maiden aunt.

The old lady had driven across in her landau to see him one day in order that for the first time in her life she might sample the joys of wireless. Cranksworth specialises in purity of reception; he is very touchy on the point. When she had heard several items perfectly brought in, she beamed upon him and said, "Why, I call it splendid, my boy. It's almost as good as a gramophone." A tiger deprived forcibly of his dinner, a mother told that her baby is not the most beautiful that ever was, a master of hounds when someone has headed his fox; all these are pretty fair examples of ferocity, but they pale into insignificance beside the radio enthusiast whose set has been insulted. We will draw a veil over the subsequent scene. I only know that the aunt drove straight from Cranksworth's abode to her solicitors, where she promptly made a new will leaving her all to the Society for Providing Papuans with Chest Protectors.

A New Party.

At the next election, which may Heaven defer, I want to see wireless candidates enter the lists, strong, silent men with bulldog chins, who will not bother their heads about such frivolous matters as mere politics, but will stand as champions of the listener-in, the radiaud, the broadcatcher or whatever name you prefer to call him by. "Vote for Muggins, and No More Mush," would be a splendid electioneering slogan. Can you not see the Wireless Party sweeping the country with their cry of Every Man His Own Aerial, in spite of the opposition's feeble threat. "Your Valves Will Cost You More!" Then oscillation will be made a crime of the first water, and ere long we shall see condign punishment faithfully meted out to those who make the evening ether hideous with their squeals. The amateur who insists on using a broadly tuned spark transmitter on broadcast wavelengths during entertainment hours will be publicly shot from a gun. Electric railways, power stations, tramways and

other mere nuisances will be very properly curbed in their activities and we shall know a great and lasting peace in the land.

The Trials of Rupert.

Really I think that those to whom is assigned the task of allotting new wavelengths to the B.B.C. stations might be a little more considerate. They seem to forget that Radiating Rupert and people of his kidney take months to find the correct tuning for any particular wavelength. Ever since the time, some months ago, when 2LO went from 369 to 363 metres, Rupert has been puzzled. Night after night he has sat down to give the problem his serious attention. He starts with his condenser pointer at umpteen degrees. "Not so bad, but just not quite right. Let's try a little more. Slowly up . . . . (SqueAK) No, we must go back again. Ah, that's almost done it. A little lower down . . . . (squeAK). Dear, dear, it's very difficult; but we'll persevere. . . . ."

And persevere he does. As a rule six months suffice for him either to find the right spot or to give it up as a bad job. He was just settling down to the old wavelength to the no small comfort of the rest of us when bang went the whole show, for 2LO came down to 350 metres, then up again to 365. It will take Rupert at least until next Easter to satisfy himself about his adjustments, and by that time another change will have taken place.

Flattery.

I suppose I ought to feel considerably elated if it be true, as the old saw avers it is, that imitation is the sincerest form of flattery. Some time ago I gave you some spoof wireless definitions. Readers apparently liked them, for a good many wrote to ask for more. It seems that they also appealed to one writer, at any rate, for he borrowed some of the ideas and dished them up in but slightly altered form. If he finds himself hard up for original ideas in the future, I hope that he will send me a line, for I shall be charmed to supply him with some.

WIRELESS WAYFARER.

THE SCIENTIFIC NOVELTIES EXHIBITION.

Mr. Arthur Burrows, Director of B.B.C. Programmes, with the wireless apparatus used at the Scientific Novelties Exhibition at King's College, in aid of King Edward's Hospital Fund for London.

An Experimental Crystal Set

By H. BRAMFORD.

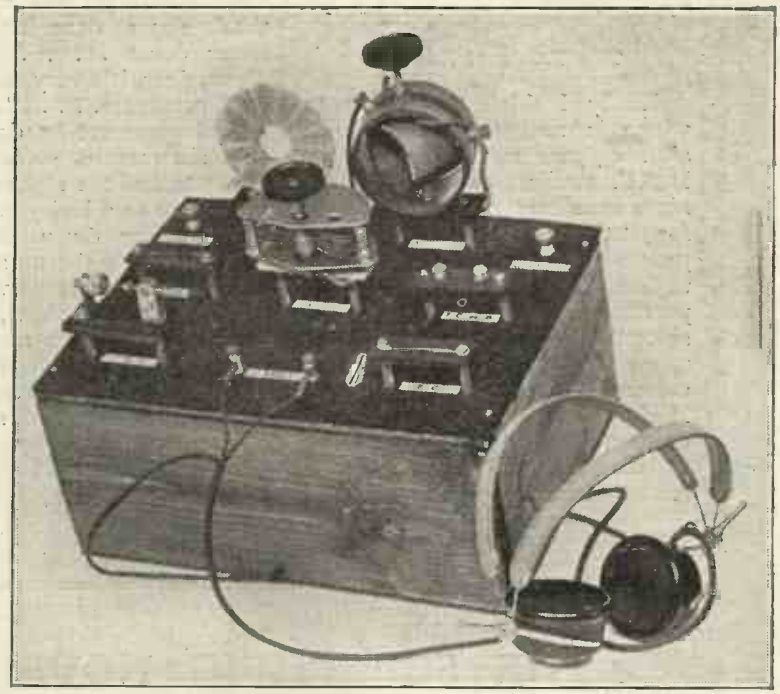


Fig. 1.—A general view of the receiver with components mounted for use.

THE crystal set described herein, apart from being unique in design, will be found to have many points of advantage over the usual arrangement of crystal receiver, and, in addition, from tests made, exceptionally loud signals are obtainable.

Components Necessary.

Practically any make of component, subject to the value being the same, may be incorporated in the set, but all such components must be converted to standard "plug-in" units. The necessary components are as follows:—

1. A variable condenser.
2. A fixed condenser.
3. A variometer.
4. A basket coil.
5. A detector.

With a little ingenuity on the part of the constructor other units such as:—

1. A tapped inductance;
2. A sliding inductance;
3. Spider coils; or
4. Loose couplers

may be used. By making a supply of these units the experimenter affords himself the opportunity of trying several interesting types of circuits. The basic idea is to be able to plug in any component in a series of positions suitable to the circuit, thereby enabling one to obtain a selection of wavelengths. For instance, the variable condenser may be plugged into position in series with the aerial inductance, thereby acting as the aerial tuning unit. On the other hand, one may place the variable condenser across the aerial tuning inductance in conjunction with a fixed condenser of any desired value. For this purpose a fixed condenser of 0.0005 μF and a variable of 0.0005 μF will be found very suitable. These would give a variation of 0.001 μF. If desired, any other values may be used for experimental purposes.

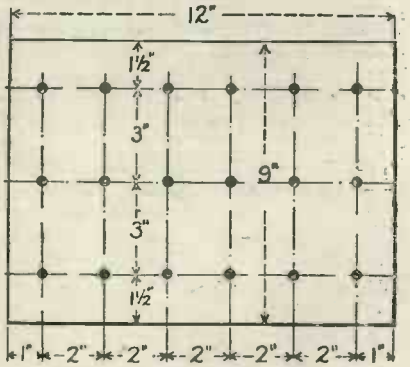


Fig. 3.—Panel Dimensions.

Fig. 1 shows a photograph of the set with all the components plugged into position. In Fig. 2 a photograph is shown with the components lying inside the containing box. When the set is not in use the parts, including headphones, may be packed into the box, keeping them protected and dustproof.

Fig. 3 shows the panel drilling. A piece of ebonite 9 x 12 x ¼ in. should first be procured. For purposes of economy good, dry three-ply wood will be found equally satisfactory if previously well soaked in melted paraffin wax. The holes are drilled as dimensioned in the diagram, and accuracy must be observed in this operation to ensure good fits for the plug-in units. A good method of achieving this accuracy is to first make a brass template having two holes drilled in it, exactly 2 in. apart, and mark off all the drilling centres from it. All these holes are drilled to clear the screws of valve sockets, which are usually 4 B.A.

The Wiring.

Fig. 4 shows the back of the panel wiring, looking from the top face. The positions in which the various components may be placed are shown across the various connections in dotted

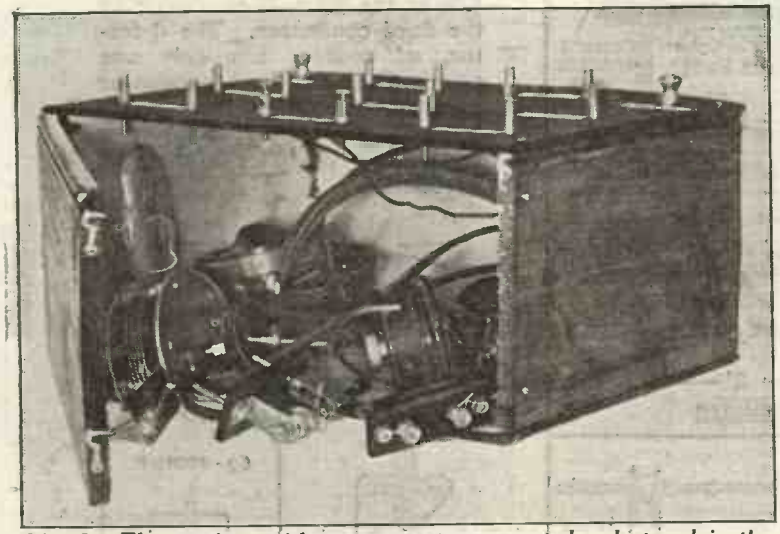


Fig. 2.—The receiver with components unmounted and stored in the containing box.

Many readers who lack a regular experimental bench will appreciate the facilities afforded by this receiver and, in particular, the ease with which everything can be stowed away when the evening's work is done.

lines. The connection which places the telephone condenser across the telephones may be used for a second pair of 'phones, by fixing valve pins to the ends of the telephone leads.

The Plugs.

In Fig. 5 various methods of making the plugs for the units are suggested. "A" shows a bridge, of which three will be required. First procure a piece of ebonite 3 x ¾ by ¼ in. (or, as previously stated, treated three-ply wood), and drill two holes on the centre line, 2 in. apart, for which the template already constructed may be used. These holes should clear the screws of the valve pins, which are usually 5 B.A. Now insert the pins, as shown, and make the connection on the upper side between the two nuts and washers.

"B" shows an arrangement suitable for a variable condenser. First make a bridge, as previously described, the ebonite part being 3 x 1 x ⅛ in., and the pins having 2-in. centres. Now connect the bridge to the bottom plate of the variable condenser, as shown, ebonite spacers being used to act as distance pieces between the bridge and the bottom plate. The connections are then made from one of the spindles of the fixed vanes to one of the pins, and from the spindle of the moving vanes to the other pin of the ebonite bridge.

"C" shows the connections for a fixed condenser. The bridge is made, as before, and of the same dimensions as those described for "B." A fixed condenser having two terminals attached can be procured. Bore two holes in the bridge to correspond with the centres of the two terminals on the condenser. Push the shanks of the condenser terminals through from the under side of the bridge and secure by means of the nuts, then connect

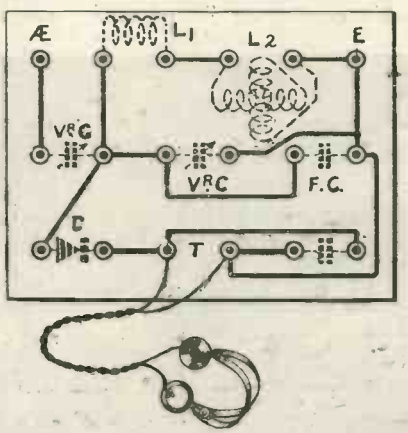


Fig. 4.—The wiring as seen through the panel.

one terminal to one valve pin, and the other to the second pin.

"D" shows the method necessary in the case of a variometer. The bridge is made as described in "B," and the stator spindle, of the fixed type, passed through a hole drilled centrally in the bridge and secured on the under side by means of a nut. One valve pin is connected to the output, flexible wire being used for this purpose.

"E" shows the connections to be made for a basket coil. The bridge is made as previously described, and a valve pin is inserted through a hole in the centre of it and secured on the under side by means of a nut. It will be found that this pin just passes in between the windings of the basket coil, thereby holding it upright and also acting as a pivot. One valve pin is connected to the inner end of the coil, and the other to the outer end. Coils of various sizes may easily be inserted on this bridge, or, if desired, a series of bridges may be made.

"F" shows the arrangement necessary for the detector, ordinary parts for which may be procured. An ebonite base is made of similar dimensions to the bridge described, one valve pin securing the crystal cup standard, and the other valve pin securing the catwhisker standard, the centres of the pins being, of course, 2 ins. apart. This completes the construction of the various units.

The Containing Box.

The construction of the box is shown in Fig. 6. The details in the diagram should be self-explanatory. The wood used may be of any suitable kind to suit the taste of the construc-

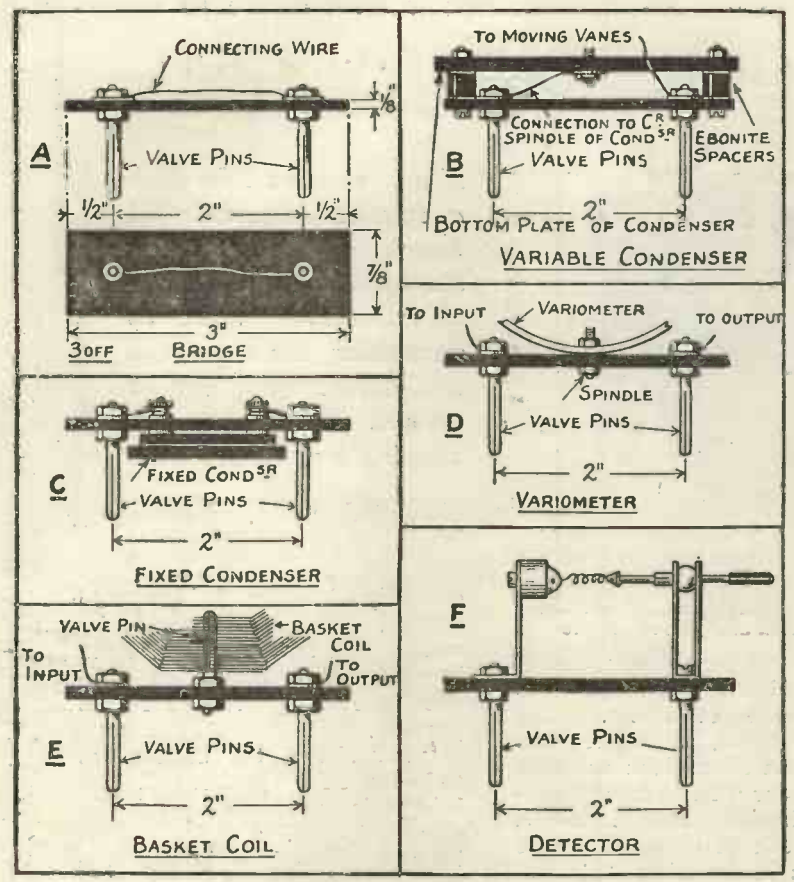


Fig. 5.—Illustrating the different plug-in units.

tor, three-ply being recommended. Clips and hinges are provided for the door.

Fig. 7 shows an example of a circuit which may be used. Any form of inductance may be plugged in to the inductance sockets, whether a variometer and a bridge, or a coil and a variometer, according to the wavelength desired. A variometer is efficient for short waves, and for rough tuning on the longer waves a loading coil is placed in series. The condenser may be inserted in series with the aerial, or it may be removed and a bridge replaced to complete the circuit, enabling one to insert a variable condenser (in parallel with a fixed condenser or alone) across the inductance, or bridges may be placed in either the position of the variable condenser or the fixed condenser. The detector, of course, has only one position. The fixed condenser may also be placed across the 'phones, or by removing it a further set of 'phones may be introduced.

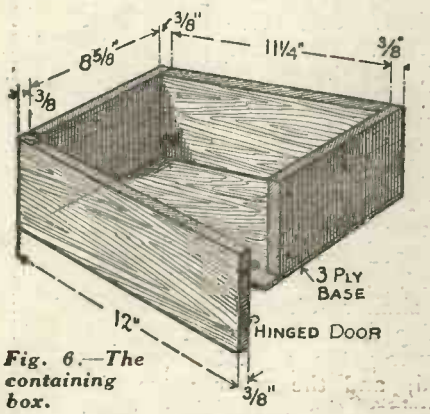


Fig. 6.—The containing box.

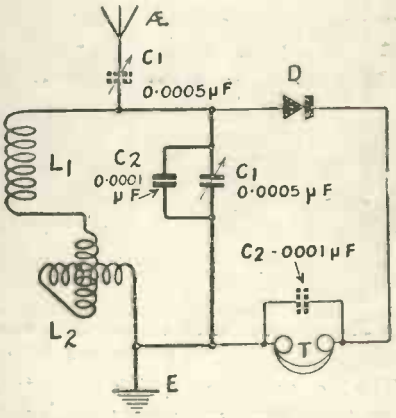


Fig. 7.—An example of a circuit which may be used with this receiver

Fig. 8 shows a photograph of the top of the panel, the names of the components and the positions being marked.

Every satisfaction will be experienced by those who construct this set, which gives considerably more scope for experiment than the average crystal set. It has, moreover, a universal wavelength range.

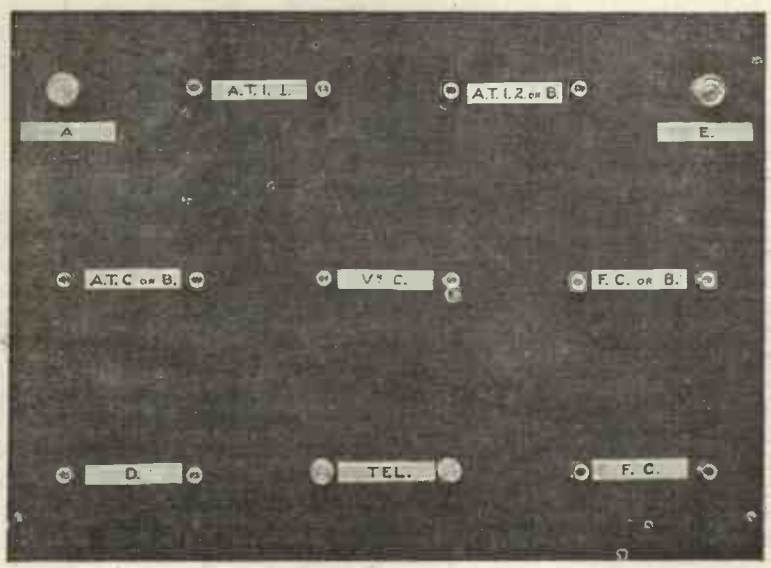


Fig. 8.—The top of the panel, showing the position of the various plug-in components.

OUR GIFT SCHEME.—Will readers kindly send postcards advising us which book they intend to order? We shall then be able to make preparations to execute orders promptly.

HOW TO DESIGN YOUR OWN SET

No. V.

By PERCY W. HARRIS, Assistant Editor.

The fifth article of a series of six which began in Vol. 3, No. 1.

Tuners made with Vario-Couplers.

A VERY useful form of loose-coupled tuner can be made up with what is known as a "vario-coupler." The vario-coupler, which is a device of American origin, is now obtainable in several makes in this country. In appearance it somewhat resembles a ball type of variometer, although the stator or stationary winding is generally wound on the outside of a cylindrical former. The secondary winding is on the ball which rotates within the stator. Units and tens or units and eights tappings are generally taken from the stator coil which forms the aerial tuning inductance. By using a double switch, one on the unit turns and the other on the multiple turns, one can carry out all of the aerial tuning within reasonable limits without the use of a condenser. The secondary winding is generally made of such a size that, with a variable condenser set at minimum, a wavelength of about 250 to 300 metres is obtained, the coil being of a size which, with a suitable condenser (0.0005 μF approximately), will cover the broadcast band. A very useful tuner can therefore be made up by taking a panel and attaching to it the vario-coupler, two switches and the variable condenser for the secondary. Such a tuner will have two dials (one for varying the coupling and the other for varying the secondary tuning), and two switches with, say, eight or ten studs each, according to the way the tappings are taken.

Tuners Utilising Reaction.

When we come to the design of tuners using reaction, we have to take into account several special points. Reaction can take place on to either the aerial coil or on to a secondary coil. If the tuner is to be efficient, the variation of reaction must be gradual, or we shall not be able to control the reaction sufficiently well to prevent self-oscillation when this is not wanted. If we are using a solenoid or single-layer inductance, we can react on to this either with a ball former on which is wound the reaction coil, this former being rotated within the cylindrical former, or we can arrange, say, a basket coil on a swinging arm so that it will come up against one end of the coil, the end being that in which the turns are always in circuit.

Sliding Reaction Coil.

Still another way is to wind the reaction coil on a former which will slide in and out of the primary winding, such as is done with a loose-coupler of the old-fashioned form. If we use plug-in coils, then a two-coil holder will serve, one socket carrying the aerial tuning coil and the other the reaction coil. This is one of the most popular ways of using a reaction coil. Still another way very little used in this country, but of undoubted efficiency on short waves, is to tune the plate circuit of the detector valve with a variometer. When this plate circuit is in tune with the aerial circuit, the set will oscillate readily, unless a large amount of shunting capacity is placed across the aerial tuning coil. We are, of course, referring at the moment to single-circuit tuners with reaction.

Double Circuit Tuners with Reaction.

It is very easy to draw on paper a two-circuit tuner with reaction on the secondary, and at first glance it would appear a very simple matter to design a satisfactory instrument of this type. However, those who have tried will agree with me when I say that it is by no means an easy task. Perhaps the best way to get satisfactory tuning with reaction on a two-circuit tuner is to separate the secondary inductance into two parts, one being used for coupling with the aerial tuning inductance and the other (at right angles to it so as not to be in inductive relation to the other coil), serving as the coil on which reaction is obtained. The three-coil holder which figures in so many circuits is particularly difficult to handle when a primary, a secondary and reaction coil are used. It will be found in loose-coupled tuners that very little reaction is needed to push the whole set into self-oscillation, whereas in single circuit tuning the capacity of the aerial acts as a steadying factor.

Three Coil Problems.

If we arrange a three-coil holder with the first coil as the aerial tuning inductance, the second as the closed circuit inductance and the third as the reaction, we shall find in practice that when the aerial and secondary circuits are exactly in tune, the slightest application of reaction will tend to trigger off the set into oscillation, and much practice will be required before the set can be handled at all efficiently. This is partly due to the fact that there is interaction between all three coils. A far better arrangement is to use a two-coil holder for primary and secondary, and, so far as short waves are concerned, to tune the plate circuits of the detector valve, thus utilising the capacity between the electrodes of the valve as the coupling between the two circuits (secondary and plate).

General Considerations when Designing Tuners.

When preparing your tuner design, keep all leads as short as possible and arrange the disposition of parts with this in view. Particularly see that leads to and from switches are kept very short, or you may introduce the most undesirable additional capacities, which will increase the minimum of your tuning con-

densers and possibly bye-pass energy that should go in other directions. If the tuner is to be a separate unit, see to it that the leads which go from the tuner to the detector are as short as possible. The function of a tuner is first of all to adjust your receiver to resonance with the wanted waves and secondly to impress the maximum voltage across the valves. This cannot possibly be done if there are lengthy parallel leads running backwards and forwards; for this reason it is often advisable to incorporate the tuning apparatus in the whole receiver so that the detector, whether crystal or valve, can be placed in the best position with this in view.

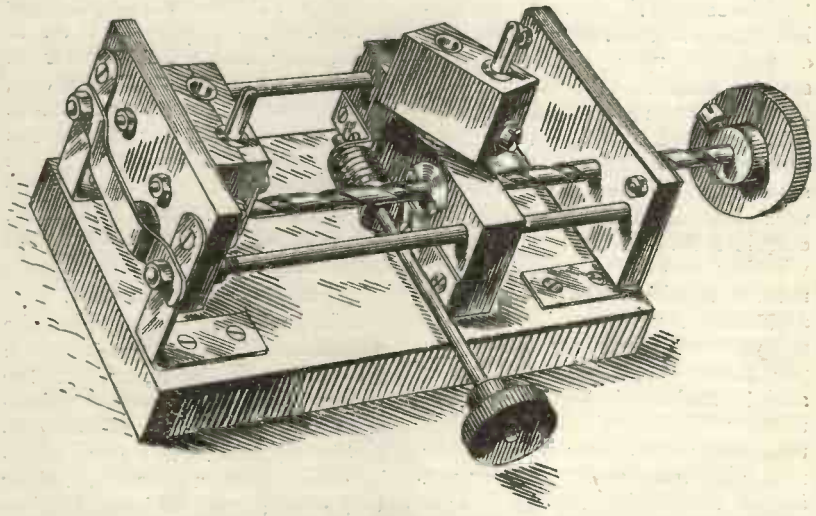
Designing the Detector Section

The detector, as we have previously indicated, may be either a crystal or a valve. Let us consider for a moment some points connected with the design of the detector portion of the circuits shown in the diagrams on page 49 of *Wireless Weekly* for December 19. In the right-hand illustration will be seen a circuit which enables one to place the crystal detector in a position directly connected to the aerial, when the switch is on the right-hand side. In all directly-coupled crystal sets it is essential that the crystal be connected to that side of the inductance which is nearest to the aerial, the telephones being connected to the earth side. When actually wiring-up crystal sets, beginners often make the mistake of thinking the way of this connection is unimportant, but unless the crystal is connected as shown in the illustration, there will be a considerable loss in signal strength. This is because the telephones and the body of the listener will bye-pass a considerable amount of the energy straight to earth through the capacity so formed. With the detector connections shown, the crystal is at a point of high potential, and the rectified currents pass it through the telephones which are now on the earth side and therefore approximately at earth potential. It is also well when designing the set, and before wiring it up, to try which way round the point and the crystal will work the better, for with some crystals one connection is much more sensitive than the other.

Again referring to the diagram, it will be seen that a condenser is shunted across the telephones. The value of this condenser is not critical, and indeed in most cases it can be dispensed with without any loss of signal strength, owing to the fact that the capacity between the two telephone cords is sufficient. Several excellent crystal receivers on the market are arranged without any shunting condensers, and my own experience is that in nine cases out of ten, at least in plain crystal sets, this condenser is not required.

Telephones to be used with Crystal Sets

High-resistance telephones are always recommended for use with crystal sets, and it is generally stated that low-resistance telephones are quite unsuitable. Some experiments I have recently conducted have brought to light the surprising fact that when signals are very strong (*e.g.*, when the receiving set with good aerial is used within 4 or 5 miles of the broadcasting station), louder signals can often be obtained with low-resistance telephones. Those readers who are in the position to try a pair of low-resistance telephones at this short distance from a station are recommended to see whether high- or low-resistance telephones are better in their own case. I have known cases where 50 per cent. increase in signal strength is obtainable in this way. No transformer is needed—the telephones are simply connected as before.



For very fine adjustment of coupling a somewhat elaborate and geared holder is often preferred. In this form both distance and angle are separately adjusted.

Crystal Sets to be used with Note Magnifiers

Where it is intended that the crystal set shall be used with one or more low-frequency magnifiers following it, the shunting condenser should be placed across the telephone terminals. The note-magnifying unit is attached in place of the telephones, which are now transferred to the output side of the magnifier. With magnifiers, however, it will always be found necessary to use high-resistance telephones to get the best results.

RADIO PRESS ENVELOPE No. 1.

It is regretted that a few copies of Radio Press Envelope No. 1 ("How to make a successful Two-Valve receiver") containing a printer's error, have been allowed to go out. In these envelopes the list of components contains the item "2 fixed condensers of 0.002μF." This should read "one fixed condenser of 0.001μF, and one of 0.002μF." The rest of the description is correct, the condenser C_3 being rightly given as 0.001μF capacity.

"WIRELESS WEEKLY" UNIVERSAL VALVE PANEL

Below appear four further circuits of the twenty possible arrangements, using this panel as the main unit. Constructional details were given in Vol. 3, Nos. 1 & 2.

CIRCUIT No. 13.

A MODIFIED REINARTZ RECEIVER.

Connecting Up.

Grid condenser "in." Grid-leak "shunted" (S). A.T.I. (vario-coupler) connected to 0.001 μF variable condenser, the other side of which is connected to terminal P. Short-circuiting strap across terminals P and XHT+. Telephones connected to terminals 2 and 3. Battery strap in position. Free end of vario-coupler connected to AE terminal. Switch arm of vario-coupler to +E terminal and earth.

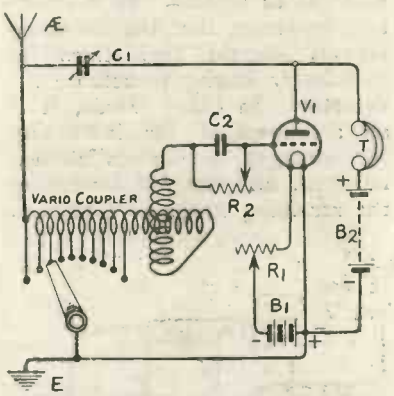


Fig. 13A.—A modified Reinartz Receiver.

Note.

If the vario-coupler is on the small side, a small variable condenser may be included, as shown by the dotted line, in order to reach the higher broadcast wavelengths.

General Notes.

This very interesting circuit has been the subject of many experiments and variations. As a complete article dealing with the subject has already appeared in *Wireless Weekly*, Vol. 2, No. 8 (September 5, 1923), further details will not be given here. It should be noted, however, that a special vario-coupler is necessary. This may consist of a cardboard stator, 4 or 4½ in. in diameter, wound with 30 turns of No. 26 S.W.G.-d.c.c. copper wire, each of the first ten turns being tapped and connected to a stud on a 10-point selector switch. The rotor (3 in. or 3½ in. diameter) should be wound with 30 to 35 turns of the same gauge of wire.

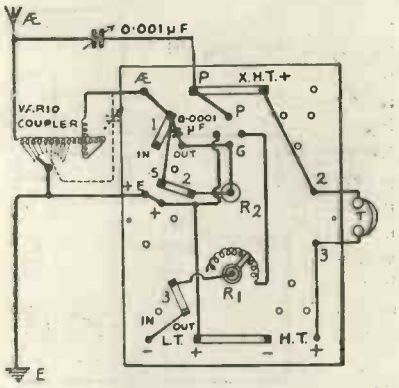


Fig. 13B.—The panel connections of Fig. 13A.

CIRCUIT No. 14.

AN IMPROVED REINARTZ RECEIVER.

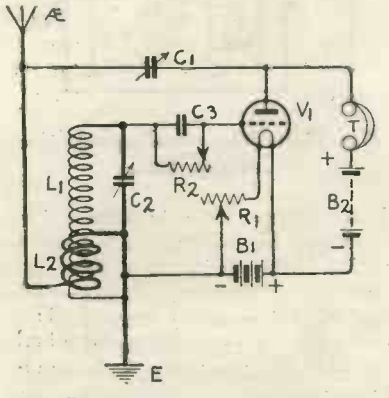


Fig. 14A.—An improved Reinartz Receiver.

Connecting Up.

Grid condenser "in." Grid-leak "shunted" (S). Aerial tuning coil (20 turns) to have its upper end connected to earth and its lower end to the aerial and to one side of 0.0005 μF variable condenser. The opposite side of this condenser to be connected to terminal P. Grid coil (80 turns) connected to AE and −E terminals and shunted by 0.0005 μF variable condenser. Short-circuiting straps across terminals P and XHT+; also across terminals −E and −LT. Battery strap in position. Telephones connected to terminals 2 and 3.

General Notes.

For further information regarding this circuit, together with constructional details of the special type of tuning coils employed, readers are referred to *Wireless Weekly* (Vol. 2, No. 18, November 14, 1923). The results obtainable with this arrangement are very good indeed; the tuning is extremely selective, and an easy adjustment of reaction is obtainable by means of the variable condenser connected between the aerial and terminal P.

This circuit is particularly interesting to operate, and when used in conjunction with a note magnifier gives very satisfactory results on a moderate aerial when carefully tuned, even from the more distant broadcasting stations

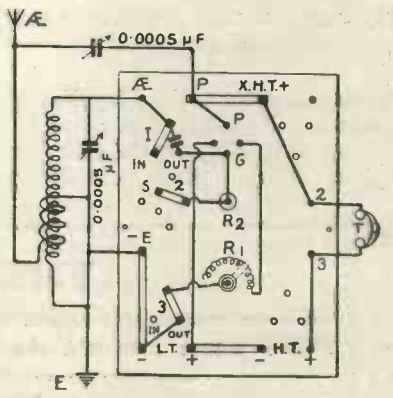


Fig. 14B.—The panel connections of Fig. 14A.

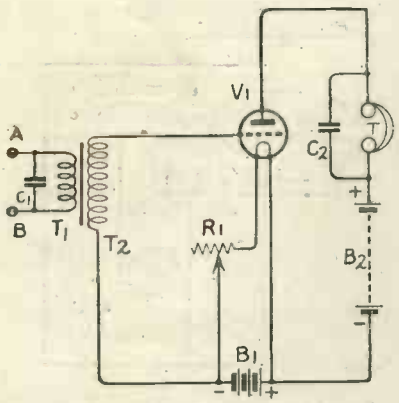


Fig. 15A.—A low frequency amplifier circuit.

Connecting Up.

Grid condenser "out." Grid-leak "out." Short-circuiting straps across terminals P and XHT+, also −E and −LT. Battery strap in position. Telephones connected to terminals 2 and 3. OS of LF transformer connected to AE terminal, and IS to −E. Transformer primary winding, connected to output terminal of detector valve panel or crystal set in the position usually occupied by the telephones. Primary winding shunted by fixed condenser, 0.002 μF.

Note.

With low-resistance telephone receivers, a step-down telephone transformer may be connected to terminals 2 and 3 and the telephones.

General Notes.

The arrangement illustrated may be used in conjunction with any existing crystal- or valve-receiving set, and forms a very useful means of increasing the strength of signals. It is essential, however, that the incoming signals should themselves be sufficiently strong to actuate the detector. In other words, it is an arrangement for increasing the strength of signals already received, and not for increasing the receiving range of a station.

CIRCUIT No. 15.

A LOW-FREQUENCY AMPLIFIER.

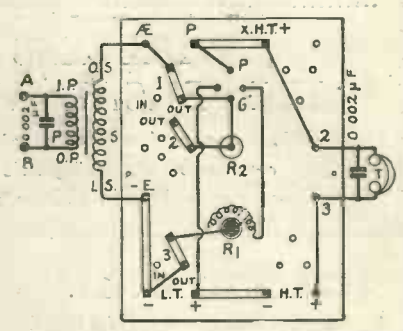


Fig. 15B.—The panel connections of Fig. 15A.

Connecting Up.

Grid condenser "out." Grid-leak "out." Anode coil connected to terminals P and XHT+, and shunted by variable condenser 0.0002 μF. Plug No. 4 into crystal sockets Nos. 1 and 3. *Do not plug in the crystal detector by mistake.* Short-circuiting strap across terminals 2 and 3; also across terminals −E and −LT, and +LT and −HT. From terminal No. 1 a connection is to be taken to the grid of the detector valve, through a fixed condenser (capacity 0.0003 μF). The gridleak of the detector valve should be connected directly between the grid and the positive side of the filament. From +HT terminal, a connection is to be taken *via* the telephone receivers to the plate of the detector valve.

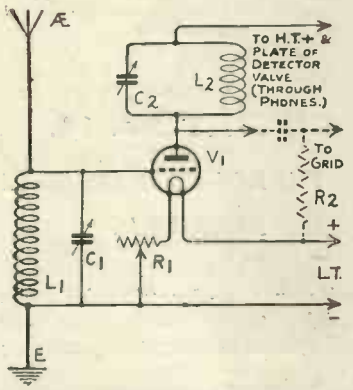


Fig. 16A.—A high-frequency tuned anode amplifier.

General Notes.

This is a popular and an efficient method of amplifying high-frequency currents, particularly useful for increasing the range of a receiving station. In the arrangement, incoming signals which are too feeble to satisfactorily operate a detector valve, undergo high-frequency amplification before being applied to the detector. Readers desiring to use high-frequency amplification preceding a crystal detector, are referred to circuit No. 7, in which high-frequency amplification and crystal rectification are provided on the same panel.

CIRCUIT No. 16.

A HIGH-FREQUENCY AMPLIFIER WITH TUNED ANODE.

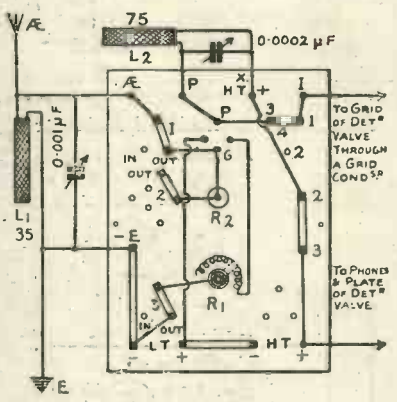


Fig. 16B.—The panel connections of Fig. 16A.

Fig. 1.—The unit in its box.

A COMPACT NOTE MAGNIFYING UNIT

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

An easily-constructed single-valve magnifier which can be used with any existing receiving set.

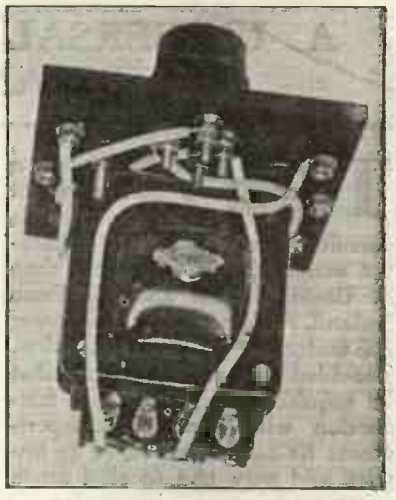


Fig. 2.—The internal arrangement of the unit.

FOR general experimental work a most useful accessory is a self-contained L.F. amplifying unit, such as the one illustrated on this page. With its aid one can add a note-magnifying valve to any given receiver, whether valve or crystal, without modification of the existing set. The telephone terminals of the set are merely connected to the input terminals of the L.F. unit, separate leads are taken to the battery terminals of the latter, and the phones or loud speaker are connected to its output terminals.

The unit shown in the photograph was intended to be added to the "Variometer Crystal Unit" recently described in *Wireless Weekly* (Vol. 2, No. 15). Its compactness and ease of construction, however, should commend it to many readers besides those who made the former unit.

The basis of this unit is a polished wooden box, the inside dimensions of which are 4 by 4 by 4 inches, and which is fitted with a ¼ inch ebonite top panel which carries the components. There is no necessity for the reader to make the box himself, since it is a standard size with many firms, the one photographed having been supplied by Messrs. Scientific Appliances.

Upon the top of the ebonite panel are mounted various terminals, an ebonite valve holder (remember that the easiest way to mark off the holes for the legs of the holder is by means of the paper templates given in *Modern Wireless* (Vol. I, No. 6), and a filament resistance of the type for mounting above the panel.

The latter is of the Igranic shrouded pattern, which is particularly suitable for the purpose. Two, or even three, of these units can be made up and used in cascade, the "screening" of the transformers serving to reduce interaction between the units and diminish the inherent tendency to howling. Although three stages *can* be used with some success it is not recommended, since the additional volume thereby obtained is almost inevitably accompanied by an undue amount of distortion whatever the type of transformer employed.

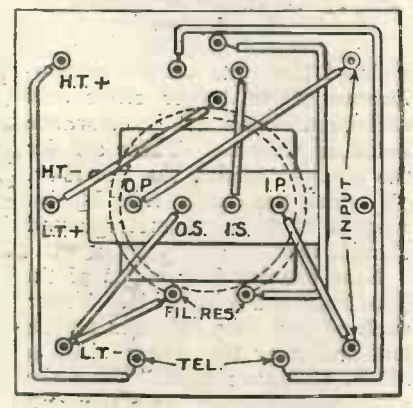


Fig. 3.—Wiring Diagram.

The terminals have been arranged with some care to facilitate the connection of the unit to an existing set, and to simplify the wiring when two of the units are used in cascade. Of the three terminals on the left (Fig. 1) the centre is a blank, simply included for the purpose of preserving the symmetrical appearance of the unit. The other two terminals are the "input" terminals, connected to the primary winding of the transformer.

Of the three terminals on the right, that in front is the L.T. negative, the middle one is L.T. positive and H.T. negative, and that at the back is H.T. positive.

In the front are two valve legs which represent the output or telephone terminals. It is intended that the telephone leads shall terminate in a pair of valve pins, so that they may be inserted in these sockets, and, further, to provide a simple and easy method of switching the unit into circuit.

To provide means of performing this latter operation the telephone terminals upon the receiving set proper should be replaced with another pair of valve sockets, and two short flexible leads terminating in valve pins should be attached to the input terminals of the L.F. unit. When it is required to use the receiving set alone the phones are plugged straight into the sockets which replace the original telephone terminals, whilst to bring the L.F. unit into operation the procedure is as follows: Transfer the phones to the sockets on the note-magnifying unit, insert the pins of the leads from the input terminals into the sockets on the receiving set, and turn on the filament current of the valve.

The actual construction of units like this is exceedingly simple, and further explanation is considered unnecessary.

A UNIVERSAL HOLDER FOR AMERICAN VALVES

THOUGH the holder of a constructor's licence is not allowed by the terms of his permit knowingly to use apparatus manufactured elsewhere than in Great Britain and Northern Ireland, the genuine experimenter is under no such restriction. Provided that he can show that he requires foreign parts in connection with *bona fide* experiments he can obtain leave to import and may use foreign made parts on his set. Many American valves are now in use in this country for experiments, and the general wireless public is becoming familiar with the kind of cap with which they are fitted.

One of the difficulties that faces those who want to use American valves is that there is no holder or adaptor on the market that will take all of them. With one exception (WD11) the caps are of the same general design (Fig. 1). Instead of prongs they are fitted with 4 very short studs. The valves are intended to be pushed into a bayonet holder in which the studs are forced against spring contacts, the valve being held in place by a single pin which engages in an L-shaped slot. The caps, however, are of widely different diameters and the studs

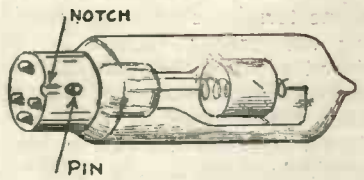


Fig. 1.—The usual arrangement of American Valve.

are differently arranged in different patterns. Thus holders that will take UV201 will not fit UV199 or WD12, each of which requires its own special mounting.

Here is a way of making a holder that will take all American-type valves from the tiny "peanut" to the largest size. Obtain or turn up a disc of ¼ in. ebonite 3 in. in diameter. Scribe out with a common centre two circles one ⅝ in. and the other 2½ in. in diameter. Between these cut slots 5-32 in. wide, as shown in Fig. 2. These can be made with a fretsaw, or if this tool is not available a row of 4B.A. clearance holes should be drilled running into each other, final trimming up being done with a small fine flat file. Midway between the outer

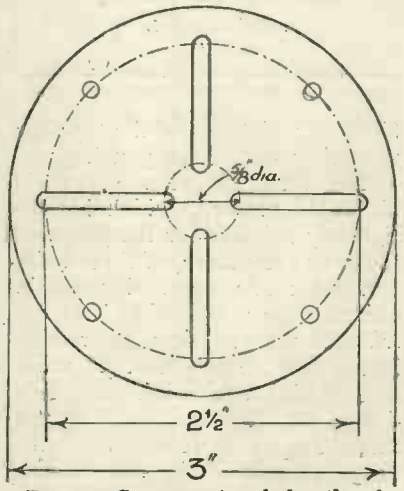


Fig. 2.—Constructional details of the adaptor.

ends of the slots on the circumference of the larger circle drill and countersink 4B.A. clearance holes as shown. These are for the screws securing the feet (Fig. 3), which are made from ½ in. lengths of ½ in. diameter round ebonite rod.

Now cut out four strips of tin ¾ in. long and ¼ in. wide. Taper each off to a rounded point at one end and near the other drill a 4B.A. clearance hole. Turn the valve upside down in its box and solder the narrow end of one of these strips to each of its little studs. This is a very easy job, for there is already a "blob" of solder upon each stud. The valve can now be secured to the stand in a moment by means of four medium sized 4B.A. terminals the shanks of which must not be more than ½ in. long.

If the valve is clear there will be no difficulty in discovering which stud is the plate connection and which belongs to grid and filament. Many valves, however, are pumped with a magnesium "getter" which leaves a metallic

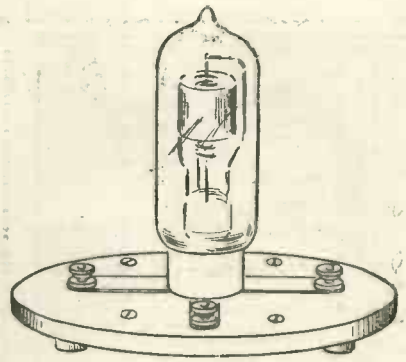


Fig. 3.—The valve mounted in position.

deposit on the inside of the bulb rendering it opaque. In this case proceed as follows.

Take a pocket flashlamp battery, or a single dry cell in the case of the low voltage valve, and touch pairs of terminals in turn with the leads from it until the filament is seen to glow. Take two milled headed terminal nuts one of which has been painted red round its rim and the other white, and screw them on to the terminals that you intend to be F + and F − respectively. Leave the filament glowing. Connect one lead of a pair of telephones to filament positive and with the end of the other lead touch the two remaining terminals in turn. Clicks will be heard when either is touched, but those from the grid terminal will be much louder owing to the grid being a good deal closer to the filament than the anode; the internal resistance therefore being smaller more current is allowed to pass. Place a black painted milled nut on the plate terminal and a green painted one on the grid.

It will be seen that any size of valve cap can be accommodated since the terminals securing the strips fit into slots and not into single holes.

R. W. H.

Californian Broadcasting.

One of our readers has received an enquiry in Esperanto from Oakland, California, asking whether the radio concerts broadcast from the "Tribune Tower" Station (call sign KLX) have been heard in this country.

Any reader who has heard these transmissions is requested to communicate with Mr. H. A. Epton, Chairman of the Hackney and District Radio Society, 17, Chatsworth Road, London, E.5.

A SIMPLE THREE-VALVE RECEIVER

By STANLEY G. RATTEE, Staff Editor.

The following article, which began in our last issue, deals with the construction of a receiver capable of receiving all British and Continental broadcasting.

IN last week's issue the reader was advised to set out his components on a baseboard, connect them up and obtain satisfactory results before the final assembly. Assuming that the constructor has obtained such results and is now familiar with the circuit, the components may now be mounted on the ebonite panel.

The Containing Box.

In view of the fact that the two-coil holder is mounted on the box, this latter must be either purchased or made before the receiver can be completed.

The constructional details of the box are given in Fig. 5, though these dimensions need not be adhered to should the constructor choose to use a box of another design. The two-coil holder is mounted upon the side of the box, as seen in Fig. 1, and at the points where the four leads are brought through the box to the various connections the holes are bushed with ebonite, in order to overcome any leakage there may be as a result of the wood being damp.

Wiring Up.

In order that the leads may be kept as short as possible, the following method of connecting, studied in conjunction with the wiring diagram, Fig. 6, is suggested. From the L.T. negative terminal make connection to one side of the filament resistance controlling the low-frequency valve, then to one side of the resistance controlling the detector, on to one side of the rheostat controlling the first valve, and then to the earth terminal and one side of the variable condenser on the left of the underside of the panel. From the other side of the resistance controlling the low-frequency valve make connection to one of the filament legs of the holder for the same valve. From the second and third resistances make similar connections to one of the filament legs of each of the other valve-holders—that is, the detector and high-frequency valves. The positive of the L.T. terminals is now connected to the remaining filament leg of the low-frequency valve, on to the remaining filament leg of the detector, to one end of the grid leak, and thence to the remaining filament leg of the high-frequency valve. At this point the filament lighting circuit may be tested if desired. From the aerial terminal of the receiver connection is made to one side of the aerial coil socket

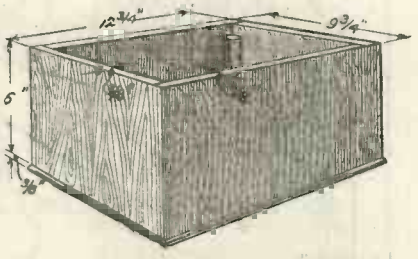


Fig. 5.—Constructional details of the containing box.

(fixed), to the grid of the valve-holder for the first valve and to the remaining side of the condenser on the left-hand of the underside of the panel. From the plate of the first valve connect one side of the 0.0003 μF fixed condenser, one side of the single coil mount, and one side of the variable condenser on the right-hand side of the underneath of panel. From the remaining side of the same variable condenser connection is now made to the remaining side of the single coil mount, on to the I.P. terminal of the low-frequency transformer and then to the H.T. positive.

From the remaining side of the 0.0003 μF fixed condenser connection is now made with the grid of the detector valve. From the plate of the same valve make connection with one side of the reaction coil socket (moving), from the other end of which connect the O.P. of the intervalve transformer. At this point connect across the I.P. and O.P. of the transformer the 0.001 μF fixed condenser. From the O.S. of the low-frequency transformer make connection to the grid of the low-frequency valve, whilst from the I.S. of the transformer connection is made to the L.T. negative supply to the L.F. valve filament resistance winding. From the plate of this last valve connect one of the telephone terminals, whilst from the other connection is made to the H.T. positive.

Operating the Receiver.

Connect the accumulator to the L.T. terminals, making sure before so doing that the filament resistances are in a neutral position and test each valve. Movement of the resistance knobs should vary the brilliancy of the valves they control, and, subject to this test being satisfactory, the H.T. battery may now be connected.

Connect the aerial, the earth and telephones; place suitable coils in their respective sockets (if it is intended to test the set during the hours of broadcasting then coils suitable for wave-lengths above the broadcasting band should be chosen for obvious reasons), with the smallest coil in the aerial circuit.

Before switching on the valves turn the reaction coil away from the aerial coil as far as it will go, then, with the valves lighted, vary the positions of the variable condensers until signals are heard, upon which carefully move the

reaction coil nearer to the aerial coil, when the signals should become louder; again adjust the variable condensers until the loudest results are obtained. Again move the reaction coil towards the fixed or aerial coil, taking every care that the set does not burst into oscillation and thereby cause interference.

In the event of the reaction coil being advanced too far, there should be heard in the telephones a very pronounced "cluck," indicating that the set is oscillating. If the reaction coil is advanced still further, then the set will howl. With the "cluck" once audible, the reaction coil should be turned away from the aerial coil, for, in addition to the fact that in this condition the set is causing interference to other listeners, the actual reception of telephony is hopelessly marred by distortion. The first test of the receiver may possibly fail to produce a "cluck" in the telephones, in which case its absence indicates that the reaction coil is connected the wrong way round, and, to remedy the defect, the leads to the reaction coil socket should be reversed before making further tests.

After some little practice with this receiver it will be found that additional sensitiveness may be obtained by careful adjustment of the filament resistances, and it is for this reason that three separate filament controls are embodied in the set.

In the matter of coils for the reception of British and Continental broadcasting, the reader would do well to consult *Modern Wireless*, No. 6, wherein is given a chart, which, studied in conjunction with the text at the foot of the same page, will show the best possible values of coils for the wavelengths desired.

Valves.

Any type of bright emitter valve may be used with this receiver, subject to the H.T. voltage being adjusted to suit the valves chosen. Mullard Ora, Marconi R, Ediswan A.R. and Cossor P1 valves as detector, and note magnifier and P2 as the H.F. valve have all been tried with satisfactory results. If desired, the last valve, that is, the low-frequency valve, may be of the power type, when, with the same anode voltage, the reception will become not necessarily louder, but sweeter to listen to.

If it is desired to add further H.T. voltage to the plate of the last valve in order to increase the volume of sound, this may be done by placing the extra H.T. battery in series with the loud-speaker, taking especial care that the battery is the right way round. Should signals, after the addition of this battery, be weaker than before, the connection should be reversed, whereupon signals will become considerably louder.

Results obtained.

With the receiver as described, the writer has received all the B.B.C. stations on an indifferent aerial, London, Birmingham, Bournemouth, Cardiff, Newcastle and Aberdeen, being sufficiently loud to operate a loud-speaker. Manchester, though clear, appears relatively weak, but since the author experiences the same poor reception in other receivers, the effect may be due to local screening. The Continental stations are also clearly audible on this receiver, tuning being both easy and selective.

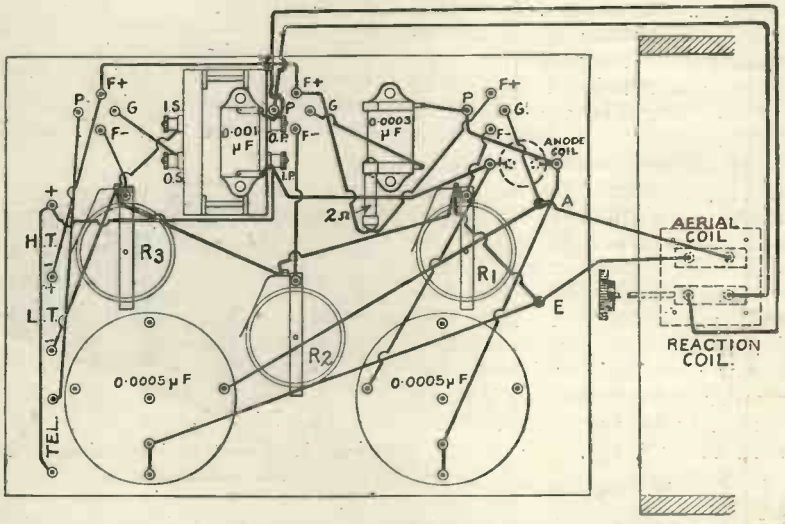


Fig. 6.—Wiring diagram of the receiver. A full-sized Blue-print of this drawing may be obtained from the offices of this journal, price 1/6.

SYDENHAM AND FOREST HILL RADIO SOCIETY

On October 29 last, a Competition of Members' Apparatus was held at the Greyhound Hotel, and three prizes were given by Mr. Leonard Downing, Mr. Cox, Senr., and Captain Huss, respectively.

An excellently-designed Tuner, by Mr. Ivor Cox, was adjudged the first in order of merit, and it was decided that his exhibit would be awarded the honour of being forwarded to the White City as an entry in the Competition organised by the Radio Society of Great Britain.

The next in order of merit was a set constructed by Mr. S. C. Smith, and was awarded the 1st prize; the 2nd went to Mr. H. S. Pace, and the 3rd to Mr. S. J. Anderson.

The Tuner constructed by Mr. Ivor Cox was awarded the 2nd prize in the Competition organised by the Radio Society of Great Britain, although he actually receives the 1st prize, as Mr. Reeves, of the Kensington Society, whose exhibit was placed first, agreed to stand down, as he was serving on the Committee.

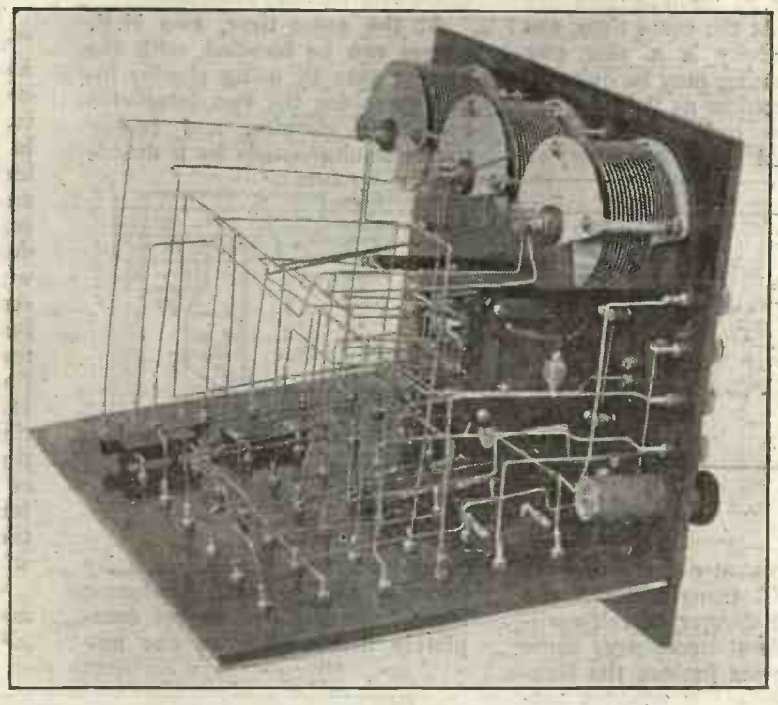
It is, perhaps, with pardonable pride that this Society (perhaps one of the youngest of Wireless Societies) places on record the fact that one of its members succeeded in carrying off one of the chief prizes for amateur-made apparatus exhibited at the White City.

MORE ABOUT THE "WIRELESS WEEKLY" OMNI-CIRCUIT RECEIVER

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

CONSIDERABLE interest appears to have been aroused by the publication last week, and in the current issue of *Modern Wireless*, of details of the omni-circuit receiver which thousands of experimenters will be making in different parts of the country. There will be many who, when they have seen the idea, will at once design and make sets which suit their individual needs, but there will be few who will desire to make a set, either of larger scope or of smaller scope.

It has been suggested that a single valve, or a two-valve set, might have been preferable, but this matter was very carefully considered, and, in fact, I made up a single valve receiver of similar pattern. It was found, however, that if the single valve set were to be capable of use in innumerable circuits, practically as many component parts would be necessary as in the case of a 3-valve set, and therefore it was decided to add enormously to the flexibility of the receiver.



Back view of the Omni-Circuit Receiver, showing components and wiring.

Of course, there will still be some who will discover that certain circuits cannot be employed, but obviously any additional components may be arranged in a similar cabinet which may then be placed next to the other one. I propose placing high-tension batteries and a low-tension dry battery, together with further components, in another cabinet of exactly the same size as the one I have described.

This will stand next to the other, and connecting wires will run from one to the other through grooves in the respective lids. Standing the two cabinets side by side, it will only be necessary to raise the two lids and to run the wires from one side to the other and the connecting links will be practically invisible. Two boxes would provide a self-contained receiving apparatus with an almost infinite number of available circuits, and the whole will present a very neat and attractive appearance.

It has been suggested that the crossing of wires on the terminal board would lead to undesirable capacity effects, but it must be remembered that only a relatively few of the terminals will be employed in many cases. The capacity between the terminals themselves is absolutely negligible, as also is the capacity between the leads connecting the terminals to the components on the back of the panel. These capacities are very much smaller than those existing on the average home-made set, because all the wires, which are bare tin copper, are well spaced. The rubber-covered leads, which join the different terminals together, are the only factors which might result in undesirable capacity effects. This capacity effect would not apply in those cases where only a few of the terminals were employed.

In actual practice I have tried innumerable circuits and have not yet experienced any adverse effect. Where wires do cross, they usually cross more or less at right angles, and the capacity effect is small.

It is very enlightening to discover how many connections there are in a valve receiver. A single valve dual circuit requires 24 connections, whereas a 2-valve ST150 circuit only requires 20 connections, and for a 3-valve ST45 circuit, which uses one high-frequency valve with a tuned anode with reaction, one valve detector and one L.F. amplifier, only 23 connections are necessary. To show the simplicity of a wiring key, which enables the wiring of the set to be accomplished in a matter of 3 minutes at the outside, I give below the connections necessary to wire up the ST45 3-valve circuit.

3-valve ST45 circuit (1 H.F. tuned anode with reaction, 1 valve detector and 1 L.F. amplifier), 23 connections :—

51—10	2—1	2—12	9—52	52—48
4—17	17—18	25—26	26—24	32—40
4—19	27—14	14—5	13—32	6—33
41—22	21—24	21—45	22—46	30—46
29—48	8—23	31—24		

(Concluded on page 160)

THE "C.Q." BROADCAST RECEIVER

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

IN order to receive, with a fair amount of certainty, from every one of the short wavelength telephony stations, British and Continental, two *effective* stages of H.F. amplification are desirable. At the same time, extreme selectivity is a *sine qua non*, as jamming may be quite as serious a problem as "fading."

With the ordinary type of parallel-tuned anode coupling, or with low-resistance and critically-tuned H.F. transformers, the ever-present danger of self-oscillation renders necessary some damping device (unless the Neutrodyne principle is adapted successfully), and any damping device reduces both signal strength and selectivity. The result is that the second H.F. valve is rarely worth the trouble and expense, to say nothing of the complication introduced in the tuning, unless identical transformers and a double tuning condenser be used.

Prominent authorities have gone so far as to state that the most effective equipment for long-distance reception is a plain single valve receiver, with reaction, and one note-magnifier. The records of the Transatlantic broadcast tests seem to support the theory that more than one H.F. valve is generally more trouble than it is worth.

However, with the essentially stable series-tuned anode H.F. coupling described by the writer in *Wireless Weekly*, Vol. 2, No. 19, p. 643, the nightmare of self-oscillation is completely dispelled if reasonable precautions be taken against casual back-couplings in the arrangement of the set; and low-resistance, freely resonant coupling circuits can be used without any but the natural damping. Thus the sharpest tuning, with excellent signal-strength and almost incredible selectivity become possible.

At the same time, two H.F. stages can be handled with the utmost ease by using similar inductances for the two intervalve oscillating circuits, and tuning these simultaneously by a double condenser of very small capacity (0.0001 μF). This condenser must have the two halves completely insulated from one another, and they must be fairly well separated in addition.

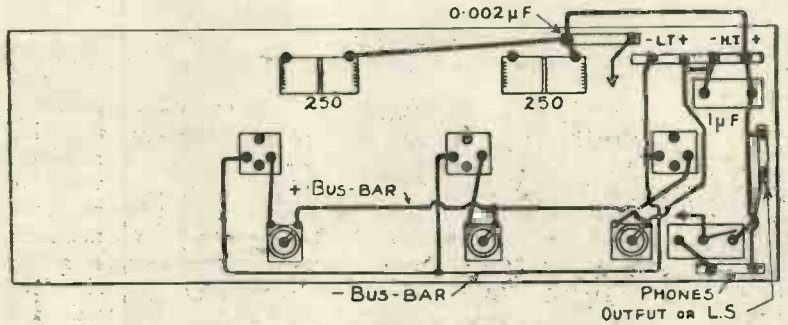
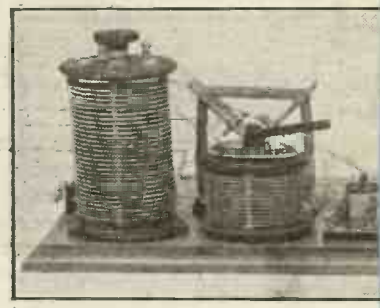


Fig. 3.—The L.T. and H.T. Wiring.



The Circuit Arrangement.

The circuit developed for the "C.Q." receiver is a slight modification of that given in the original article already referred to. Fixed inductances are used in place of the large variometers indicated for the series-tuned anodes; and these are tuned, as suggested, by a double condenser. The coils themselves, which require to be of low H.F. resistance and very low distributed capacity, are wound in the form of miniature frame aerials (introduced by Mr. P. W. Harris), as described several times recently, the frame (of three-ply wood) having a diagonal of 6 in., and six slots each ¾ in. long, in which are wound 72 turns of No. 22 S.W.G. d.c.c. wire, 12 turns per slot.

On the intervalve capacities and with a low-minimum 0.0001 μF parallel condenser, these coils

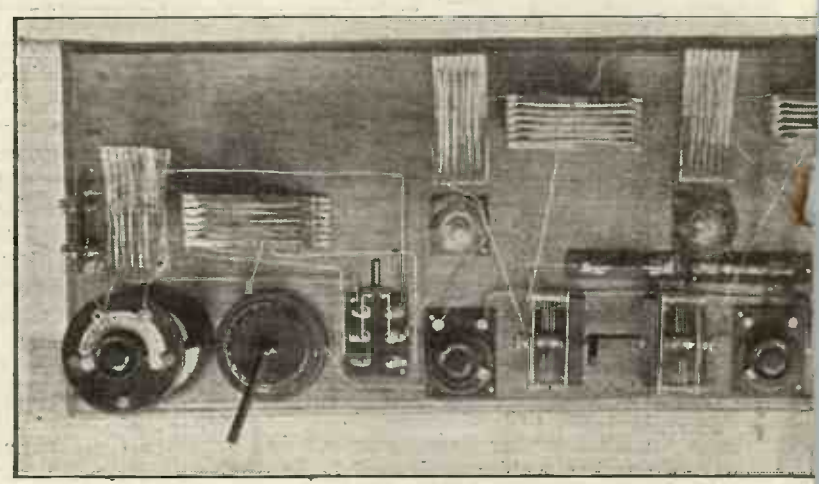


Fig. 2.—A Plan View of the Receiver.

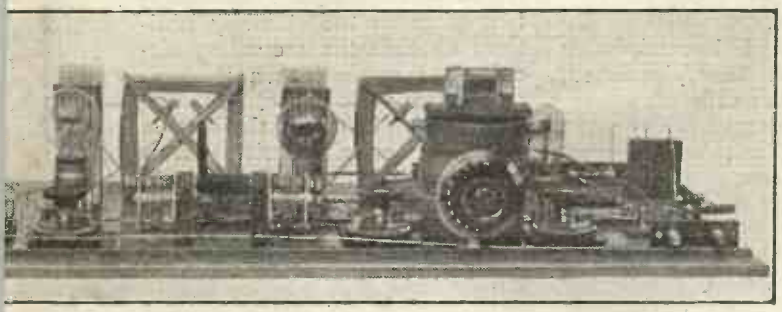


Fig. 1.—The Completed Instrument.

Constructional details of an "All Stations" experimental receiver with two stages of series - tuned - anode H.F. amplification.

tune over a range of from 300 to 500 metres approximately. The two radio-chokes also required in this circuit are wound on similar formers, about ¼ lb. No. 26 S.W.G. d.c.c. wire being used for each. Ordinary plug-in coils of low distributed capacity, of 250 turns or over, can be used here if desired.

The aerial tuning arrangement involves the principle of extremely weak but fixed coupling between a low-resistance, sharply-tuned aerial circuit and a low-resistance, freely-resonating, secondary circuit. This has been described elsewhere by the writer, and is exceedingly selective, showing very little loss of signal-strength compared to direct coupling. Both aerial and secondary inductances are made up as fixed coils, each wound on a frame-aerial former as used for the intervalve coupling coils, and consisting of 24 turns of No. 18 S.W.G. d.c.c. (plus 2 turns No. 20) and 48 turns of No. 20 S.W.G. d.c.c. wire respectively. These are tuned by parallel condensers in the usual way.

The two turns of the secondary circuit which form the only coupling between the two circuits are wound over the other wire at the "earth" end of the A.T.I., the aerial and secondary coils being arranged remote from one another as far as possible, and at right angles, so as to avoid further coupling. A "Stand-by — Tune" switch is incorporated in the design, and will be found useful in searching, on account of the extreme selectivity of the receiver.

Reaction.

Reaction is obtained by a variometer in the anode circuit of the last (detector) valve. That shown has a cardboard tube stator 3¼ in. diameter, and wooden ball rotor about 2¾ in. diameter, 50 turns of No. 22 S.W.G. d.c.c. wire being wound on the stator (two-pile winding), and the rotor wound full of the same wire (about 56 turns). In order to give the sharpest resonance this variometer has a fixed condenser of 0.0001 μF across it. A variometer of any available type having about 100 total turns of not-too-thin wire may be employed.

Method of Assembly.

It is very inadvisable to attempt to enclose a complex experimental circuit of this type in a small cabinet, at least not until considerable experience has been gained with it. High-frequency currents are extremely bad neighbours and it is impossible to retain free resonance in a number of lightly-coupled circuits controlled by the slender

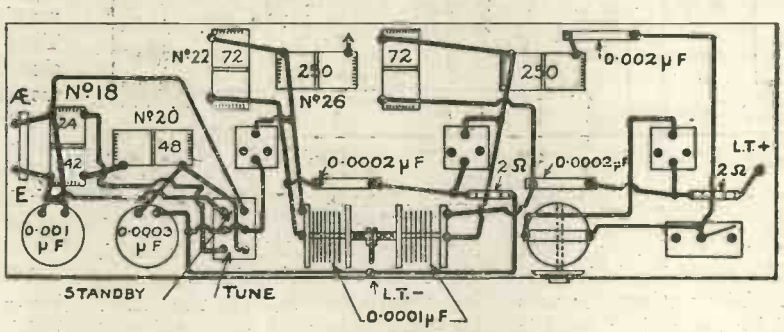


Fig. 4.—The H.F. Wiring.

impulses received from the far-distant station, if these circuits are crowded together in a small box, with incalculable casual magnetic and capacitative couplings between them. Stability and selectivity are bound to suffer. Metallic screens introduce another trouble, namely, wasteful damping just where the freest possible oscillation is wanted.

Accordingly, a convenient base-board mounting, with all wiring visible and accessible, is recommended. Suitable board-mounting components are now available, Messrs. Peto Scott, Grafton Electric Company, Economic Electric Company, Bowyer Lowe Company, and

Marconi Scientific Instrument Company, among others, supplying such components. In the set shown in the photograph the terminal strips, switches, valve sockets and filament resistances are by Messrs. Peto Scott, who also supplied the large base-board; the smaller fixed condensers and one grid-leak are the Grafton Electric Company's make; the 1 μF blocking condenser is by the T.C.C.

The variable condensers are Raymond's, the double 0.0001 μF variable condenser being made up of two separate 7-plate Raymond condensers, coupled by an ebonite sleeve carrying a short handle and mounted edgewise on two ebonite supports, each 3 in. by 2 in. and ½ in. thick, screwed to the base-board from

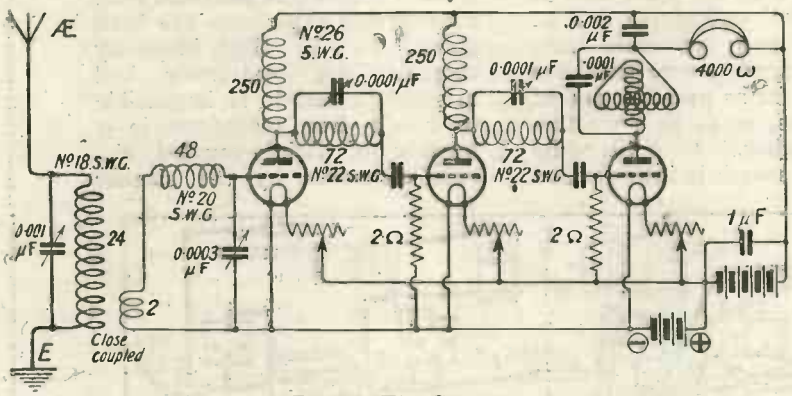


Fig. 5.—The Circuit.

underneath with No. 4 B.A. screws. The second grid-leak is a Dubilier. The variometer was constructed by the writer, and is provided with one of Messrs. Bowyer-Lowe's metal-screened tuning knobs and scales, which is useful here on account of hand-capacities.

Materials and Components Required.

Base-board, 3 ft. by 1 ft.
3 valve sockets.
3 filament resistances.
1 4-terminal strip 1 HT+, HT—, L.T.+, L.T.—.
2 telephone terminal strips.
1 A.E.-earth terminal strip.
1 D.P.D.T. switch on ebonite.
1 S.P.D.T. switch on ebonite.
1 fixed condenser, 1—3 μF.
1 fixed condenser, 0.002 μF.
2 fixed condensers, 0.0002 μF.
1 fixed condenser, 0.0001 μF.
2 grid-leaks (about 2 meg-ohms) and supports.

(For board mounting)

1 — 0.001 μF variable condenser, on base.
1 — 0.0003 — 0.0005 μF condenser on base.
2 — 0.0001 μF low minimum condensers, on base, insulated, but with spindles coupled.
6 coil-formers; 12 strips 3-ply wood, 6 by 1¾ in., half-notched, 6 slots ¾ in. deep.
½ lb. No. 26 S.W.G. d.c.c. for chokes. ½ lb. No. 22 S.W.G. d.c.c. Enough No. 18 S.W.G. and No. 20 S.W.G. d.c.c. for A.T.I. and S.T.I. Variometer former, rotor, etc. Knob-scale for same.
Bare No. 18 or 15 S.W.G. copper wire for connections.
Varnish for coils.

Wiring Up and Operating.

The wiring is done with bare No. 15 or 18 S.W.G. wire, with short pieces of insulating sleeving where necessary, the L.T. bus-bars being of square-tinned wire of large gauge. The H.F. wiring should be well separated. It would have been preferable to have avoided the extra wires around the "Stand-by—Tune" switch, but it is essential to have this in an accessible position.

Some little experience is necessary to get the best results in quick time with this receiver, as with any really selective instrument. A Wavemeter is almost essential for the first calibration of the intermediate circuits (which then act as wavemeters). The effect of the reaction variometer may be found to be somewhat peculiar at times, even in the stand-by position, and there is, of course, an alteration in the tuning of the primary circuit in switching over to "Tune," as the mutual inductance of the two circuits then comes into play.

It will be noted that the earth side of the secondary condenser is so connected that it is inoperative when in the stand-by position, so that the secondary circuit does not act as a "wave-trap" when not in use.

It is best to find the station with direct-coupled aerial, and as much reaction as can be brought to bear, tuning the double condenser as required. Then, leaving the double condenser set, switch over to "Tune," reduce the reaction by detuning the plate variometer, if necessary, and vary the secondary condenser until the desired station is heard faintly; then slowly increase the capacity of the aerial tuning condenser. Finally, carefully adjust each of the variables to give the best and clearest speech.

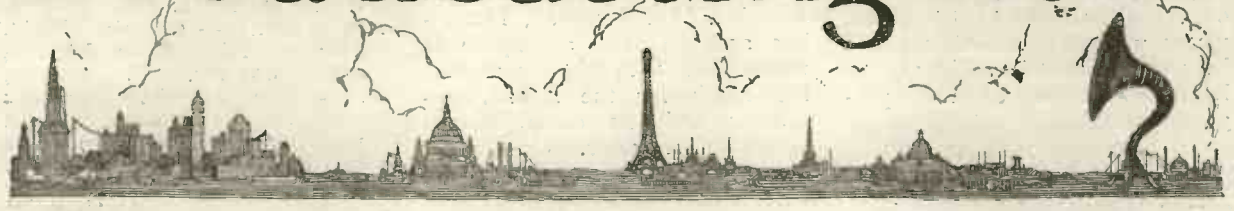
The balancing of the two halves of the double condenser is made on a good signal after the apparatus is wired up, by loosening the connecting sleeve (which should have a lock-nut for this purpose) and slightly rotating each half independently until maximum signals are obtained. Then tighten the connecting sleeve. With reasonably good workmanship, careful winding of the two anode coils, and spacing of wires, etc., this adjustment will be found to hold over the whole scale.

Results.

With a normal type of fairly low-resistance aerial every British broadcasting station (except Manchester, which is always difficult in the London district) comes in at moderate loud-speaker strength on the three valves without any L.F. amplification. Manchester comes in at reasonable strength on telephones. The short-wave Continental stations are also easily received.

At no time, when the loose-coupled arrangement is in use is there the slightest murmur of the local broadcasting station, which on most multi-valve receivers wholly drowns the more distant stations. Amateurs transmitting on what is nominally the same wavelength (440 metres) can be effectively separated, even when heard complaining of jamming and of Northolt's "mush," and many are heard at good loud-speaker strength.

Broadcasting News



LONDON.—Without exaggeration it may be said that the B.B.C. finished the year in good style. The success of the transatlantic experiments was greater than the most sanguine anticipated, and the broadcasting of Big Ben touched the popular imagination in a way that many more important feats have not done.

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Amongst the developments that are to be looked for in the coming year is a much greater use of the portable microphone. The transmissions from the "Old Vic" by this means were very successful, and we may take it for granted that the portable transmitter will be much more in evidence than hitherto has been the case.

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The B.B.C. realise that while interest in the service may be stimulated by means of stunts, it can only be maintained by supplying the best programmes obtainable, and every effort will be made to ensure the achievement of this aim. The Company will develop dramatic resources of its own, and will produce modern plays specially prepared for broadcasting.

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The success of the Paris transmission has given the B.B.C. another bright idea, and in the course of 1924 we may expect to have wireless tours—a little bit of Paris, a little bit of America, a little bit of every continental nation that has a broadcasting station. It would be quite possible, on one night, to have items from half a dozen continental stations.

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The talk by Prof. Cheshire on the "Tuning Fork" (relayed from King's College) was intensely interesting and informative, and we deplored the fact that wireless television is not yet a *fait accompli*, so that we might have enjoyed the Professor's lantern slides. As it was, thanks to his steady and clear delivery, we followed and understood every word of the Professor's lecture and very much enjoyed his aural demonstrations.

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Forthcoming Events

JANUARY.

9th (WED.). — Orchestra. Miss Georgia Drayson, entertainer.

BROADCAST TRANSMISSIONS

	Call-Sign	Wavelength.
LONDON	2LO	365 metres.
ABERDEEN	2BD	495 „
BIRMINGHAM	5IT	475 „
BOURNEMOUTH	6BM	385 „
CARDIFF	5WA	350 „
GLASGOW	5SC	420 „
MANCHESTER	2ZY	460 „
NEWCASTLE	5NO	435 „

TIMES OF WORKING.

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

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

Miss Irene Cryer, soprano. Mr. Stuart Vaughan, singer.

10th (THURS.). — Uncle Humpty Dumpty will entertain the children. Old English Music and General Concert, with items by the Kinsey String Quartette.

11th (FRI.).—General Concert by the Mayfair Singers.

12th (SAT.). — Orchestra. Miss Dorothy Cowper, soprano. Mr. Philip Middlemiss, entertainer. 9.10, Act 1, "Pagliacci," relayed from Covent Garden Opera House.

13th (SUN.).—Organ Recital from Kingsway Hall. Miss Dorothy Robson, soprano. Miss Rita Sharpe, 'cellist. Mr. David Jenkins, bass.

14th (MON.).—Orchestra, including "The Pathetique," by Tchaikovsky. Mr. Maurice Cole, solo piano.

15th (TUES.).—Plays produced by Mr. Nigel Playfair. Dance Music.

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ABERDEEN.—The last week of the old year, apart from successful American and French experiments, produced two innovations at 2BD. The first was the broadcasting of the opening speeches at the Conference—the first time in Scottish broadcasting that a microphone had been used outside the studio. The result bore testimony to excellent organisation.

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The second—even more interesting—was the broadcasting to a meeting of teachers, assembled in the Art Gallery, Aberdeen, of a speech by Sir Robert Blair, Education Officer of the L.C.C., delivered in his own study in London. The message reached 2BD via 2LO. The reception was marked by great clarity, and the experiment has done much to range the teaching profession in Scotland on the side of the B.B.C. A welcome innovation which came into force with the New Year is the inclusion of vocal items in the afternoon programme.

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Forthcoming Events

JANUARY.

9th (WED.).—Dance Night. The Wireless Jazz Orchestra.

10th (THURS.).—Play, "Passing of the Third Floor Back" (Jerome).

11th (FRI.).—S.B. from London.

12th (SAT.).—Popular Night. Popular Airs and Songs.

13th (SUN.).—Address by the Rev. John E. Penman, Bonaccord U.F. Church. Orchestra.

14th (MON.).—The Flashlight Entertainers.

15th (TUES.). — Classical Night. Miss Chrys Barclay, soprano. Mr. W. Fleth, tenor.

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BIRMINGHAM.—Some very interesting events are promised from the Midlands Station

for the remainder of the winter season. Precisely what they are may not be divulged just yet, but with some of the biggest musical events in the district yet to come, we may hope that landlines will be used so as to enable 5IT to broadcast some of the programmes.

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A new fashion in the children's corner is provided by the adventures of "Snookey," who is the creation of a member of the staff, Auntie Phyl. She has written a series of fascinating little stories around him, and while he was still very young "Snookey" achieved a wonderful popularity, with the result that he has had to be "made" in thousands and sent to the toy-shops, where he bids fair to outrival the famous Bonzo pup.

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Forthcoming Events

JANUARY.

9th (WED.).—3.30, Mr. Arthur Wrigglesworth, baritone. 7.30, Operatic Night. Orchestra and Station Repertory Co. Repeat performance of "Cavalleria Rusticana." Morse Practice.
10th (THURS.).—3.30, Pianoforte Recital by Mr. Granville Sliner. Orchestra. Mr. Raymond Green, entertainer.
11th (FRI.).—3.30, Paul Rimmer's Orchestra. Lichfield Cathedral Glee Singers. Orchestra.
12th (SAT.). — Talk on "Sea Chanties and Ancient Sea Songs," with illustrations by Miss Margaret Thomas's Ladies' Choir.
13th (SUN.).—8.30, Talk by Bishop Hamilton Baynes. Orchestra. Elizabethan Trio (songs).
14th (MON.).—7.30, S.B. from London.
15th (TUES.).—7.30, Dramatic Recitals by the Yardley Dramatic Society.

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BOURNEMOUTH.

Forthcoming Events

JANUARY.

9th (WED.).—French Night, all songs with orchestral accompaniment.
10th (THURS.).—Concert by the Post Office Military Band, assisted by Miss Margaret Ellis.
11th (FRI.).—S.B. from London.
12th (SAT.).—Wagner Night. Mr. Bert Kallaway, Miss Nora Read and Mr Arthur J. England.
13th (SUN.).—"Elijah," Part II.
14th (MON.).—S.B. from London.
15th (TUES.).—Irish Night.

CARDIFF.—Great interest was taken by listeners in the Cardiff district in the relaying of music and speech broadcast from America. On Saturday, December 22, the first attempt was made, but atmospherics proved too much for the B.B.C. engineers, and what came through here was very poor. On Friday, December 29, another attempt was made, this meeting with greater success. and on the following night a station at Pittsburgh was picked up and retransmitted, and came through fairly well, but much of it was badly distorted.

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Forthcoming Events

JANUARY.

9th (WED.).—Popular Night. Mr. Horace Jenkins, baritone. Miss Kathleen Jacobs, solo 'cello. Miss Rose Marys, entertainer. Dr. Jas. J. Simpson, M.A., D.Sc.
10th (THURS.). — Welsh Night. Romilly Boys' Choir and Band. Talk by Dr. Llewellyn Williams, M.C., F.R.C.S., Senior Medical Officer of Health.
11th (FRI.). — Choral Night. Vocalist, Miss Annie Johnson, contralto. Mr. D. Llewfer, Magistrate of the Rhondda: Chat on Social Legislation in 1923.
13th (SUN.).—Address by the Rev. J. H. Lewis, B.D. Dvorak Night.
15th (TUES.).—Shakespeare Night. "King John," by the Station Repertory Company.

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GLASGOW.—An interesting event recently was the broadcasting of an address on "The Inventions of Watt and Marconi," by Sir Godfrey Collins, M.P. for Greenock. Simultaneously a well-attended meeting was being held in the Greenock Watt Memorial School

BROADCASTING BIG BEN.

Two B.B.C. engineers fixing up the microphone under the shadow of Big Ben.

(which stands on the site of the birthplace of James Watt), where a Marconi wireless installation was being handed over to the Renfrew Education Authority. Sir Godfrey's speech was heard by the company through the medium of a loud-speaker.

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Very rich and seasonable fare was provided by 5SC during the Christmas and New Year festivities. "The Jolly Beggars," produced by Mr. George Ross, on Hogmanay, was a notable feature of a brilliant Scotch programme, while on the evening of New Year's Day there was another excellent entertainment in the shape of Scotch songs and dance music. The hearts of Scotch listeners must have been gladdened as the haunting airs of the "auld countree" came over.

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Forthcoming Events.

JANUARY.

9th (WED.).—Classical Night with Herold. Solos by Miss Bessie Muirie and Mr. William Gilchrist.
10th (THURS.).—S.B. from London.
11th (FRI.).—Dance Night.
12th (SAT.).—Irish Night.
13th (SUN.).—The Rev. Eric A. Sutton, B.A.
14th (MON.).—S.B. from London.
15th (TUES.).—Classical Night.

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MANCHESTER.—"A Butterfly on the Wheel" was presented by the 2ZY Dramatic Company on December 21; adapted and produced by Mr. Victor Smythe. The studio was divided into three portions and the play produced exactly as it would be on the stage, complete to the minutest details, including the going on and off and an actual meal partaken of in the studio. The artistes never saw the microphone, which was hidden in a bunch of flowers. By these means a true atmosphere was secured, and the performance was an enormous success. About 400 letters and telephone messages were received testifying to the success of the venture, which demonstrated to many that dramatic productions can be made a success.

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A fire mysteriously broke out in the studio at 2ZY on Sunday, December 30. One of the engineers coming on duty for the afternoon transmission observed the studio aglow, called the fire brigade by telephone, detached the microphone and did much to prevent a bigger catastrophe. Mr. Florence, improvising a microphone, sent out an S.O.S. to the Station Director. Altogether only 20 minutes' loss of transmission was sustained during the afternoon programme, and the evening concert proceeded quite up to standard, which reflects a great credit on all concerned.

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Forthcoming Events

JANUARY.

9th (WED.).—3.30, Concert. 6.30, Organ Recital, Piccadilly Picture House. 2ZY Orchestra. Mr. Stephen Williams, baritone. Mr. Foden Williams, entertainer.
10th (THURS.).—11.30, 2ZY Trio. 7.30, St. Hilda Colliery Band from 5NO. Dance Music from 2LO.
11th (FRI.).—3.30, Concert. 7.30, Mr. Barnett Cohen, baritone. Mr. J. Worsley, entertainer. S.B. from London.
12th (SAT.).—3.30, Oxford Picture House Orchestra. 6.30, Organ Recital, Piccadilly Picture House. 7.45, Orchestra. 9.45, S.B. from London.
13th (SUN.).—3, Organ Recital from Kingsway Hall. 8.35, Very Rev. B. Butler, S.J. Mr. Ed. Isaacs, solo piano. Miss Agnes Clarke, soprano. Mr. H. Derbyshire, baritone.
14th (MON.).—3.30, 2ZY Trio. 7.30, S.B. from London.
15th (TUES.).—3.30, Concert. 7.45, 2ZY Orchestra. Miss Olga Telba, soprano. Mr. R. Whitehead, baritone.

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NEWCASTLE.—This Christmas will be remembered as an unfortunate one for the Newcastle station, as a failure to establish communication with London on Sunday evening was followed by a local breakdown on the evening of Boxing Day. We have heard of cases in which inexperienced enthusiasts who were attempting to operate newly-purchased multi-valve sets encountered considerable domestic trouble on the latter evening in consequence of their inability even to get 5NO.

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Forthcoming Events

JANUARY.

9th (WED.).—3.45, Miss Wilkinson and Mr. Beaty, pianoforte duets. Miss Evelyn Beaty, soprano. 7.30, Operatic Evening. Orchestra. Mr. John Olivers, baritone. Mr. Ernest Sharpe, violin. Miss Katherine Duncan, contralto.
10th (THURS.).—3.45, Miss Rosina Wall's Trio. Mme. Maud Greener, soprano. 7.30, St. Hilda Colliery Band. Miss Beatrice Paramor, soprano. Mr. David Macfadzean, baritone. Mme. Maud Jaques, violin.
11th (FRI.).—3.45, Miss Leonie Storn, pianist. Miss Jennie Gardener, soprano. Mr. Martin Henderson, concertina.
12th (SAT.).—3.45, Miss Farrar and Mr. W. A. Crosse, pianoforte duets. Mr. T. Golder, cornet. Miss Hilda Royal, elocutionist. 7.30, Orchestra. Mme. May Grant, contralto. Mr. Vincent Jones, baritone.
13th (SUN.).—8.30, Rev. George Aitken, Address. Mme. Leonora Howe, soprano. Mr. Herman McCleod's String Quintette.
14th (MON.).—3.45, Mr. James F. Rowell, tenor. Mr. Michael Kelley, saxophone.
15th (TUES.).—3.45, Miss Gladys Willis, pianist. Miss Lilian Northorpe, contralto. 7.30, Orchestra. Mr. Hudson Barnsley, baritone. Mr. E. J. Bell, flute.

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Simultaneous Broadcasting Events.

JANUARY.

9th (WED.).—M. Audra (President of the Modern Language Association and Director of L'Institut Français), a French Talk: "Paris." Mr. Archibald Haddon (the B.B.C. Dramatic Critic), "News and Views of the Theatre."
10th (THURS.).—Mr. Percy Scholes (Music Critic) on "The Week's Music." Talk by the Radio Association.
11th (FRI.).—Mr. G. A. Atkinson: "Seen on the Screen." Mr. J. Kewley on "Petroleum in Everyday Life," S.B. from Newcastle, Bournemouth and Aberdeen. "Alcestis," Act 2, from Covent Garden.
12th (SAT.).—"Pagliacci," Acts 1 and 2 (Leoncavallo), from Covent Garden.
13th (SUN.).—3, Organ Recital from Kingsway Hall. 5, Children's Corner, S.B. from Bournemouth.
14th (MON.).—7, The B.B.C. Literary Critic. Symphony Programme of Augmented Orchestra.
15th (TUES.).—"The Blacksmith's Serenade," S.B. from Glasgow. The Right Hon. Stanley M. Bruce, M.C., Prime Minister of Australia.

Dull Emitters and the ST100 Circuit.

I HAVE had many enquiries as to whether the dull emitters will give good results on the ST100 circuit; I can assure my readers that the 0.06 valves are very effective on this circuit and give just as good results as ordinary valves. Moreover, they have this advantage, that a lower high-tension voltage is needed; whereas the full 100 volts is essential when using the ordinary R-type valves, or Cossor or Ora valves, only 70 to 75 volts are necessary in the case of Marconi DE3 or B.T.H. B5 valves. I find that no grid bias is necessary. A higher voltage than 75 will give poorer results and cause distortion, and in this case the obvious remedy is to have a negative grid bias in the case of both valves.

As regards peanut valves, opinions seem to vary. Some say that the full power of the ST100 circuit is not obtainable with these valves. I myself am inclined to prefer a dull emitter valve which takes a minimum of current. Those who desire to use dry cells will, I think, prefer the 0.06 valve, because a dry battery will readily give this current.

Those who propose to continue using their accumulators may be inclined to connect their three cells in parallel and use dull emitters which take a heavier current. There is no doubt that the peanut valve has a very long life, and I am waiting to see which lasts the longer, the 0.06 valve or the peanut valve.

Rheostats for Dull Emitters.

Wireless manufacturers seem to be extraordinarily slow in appreciating the fact that dull emitters are now being used. As far as I am aware, there is only one manufacturer turning out a rheostat suitable for the 0.06 valves, and his advertisement is only rarely seen. Probably there are others hiding their light under a bushel.

I am pleased to see a new carbon rheostat on the market at a reasonable price. Carbon rheostats which work on the principle of carbon discs, or their equivalent, pressing together with varying pressure, have been on the American market in the form of what have been called Bradleystats for several years, but we have been very slow to follow the lead. A similar principle has been adopted in the case of variable gridleaks and anode resistances. Why do not more manufacturers produce this class of instrument?

The carbon rheostat is, as far as I am aware, the only one on the market which may be used both for ordinary valves and dull emitter valves. There is, therefore, likely to be a large demand for them.

This, however, is not the only direction in which a suitable rheostat for all kinds of valves is to be found. A rotary rheostat of the usual type might be made in which the first half is suitable for ordinary valves and the second half suitable for dull emitter valves, the second half being wound with finer wire. The two halves would be connected together and the whole rheostat would look no different from one of the usual type.

Another suitable solution would be to have a thick and a thin winding on the type of rheostats that require several revolutions of the adjusting knob to obtain the variation of resistance.

There is no doubt that a rheostat suitable for all kinds of valves is now a necessary piece of apparatus, and I hope manufacturers will take this hint.

MORE ABOUT THE OMNI-CIRCUIT RECEIVER.

(Concluded from page 153.)

Commencing with the February 6 issue of *Wireless Weekly* we propose to give a series of detailed instructions for making the complete Omni-Circuit Receiver. Shortly, readers will be able to obtain the engraved panels in accordance with the terminal board diagram published last week. Alternatively, they will be able to obtain a full-sized paper sheet with the component signs printed on them. These may then be pasted on the ebonite panel and varnished.

When a sufficient number of readers have constructed the set in accordance with the particulars to be published as mentioned above, it is proposed to give regularly in *Wireless Weekly*, circuits specially for use with the receiver, together with full notes regarding them and a key of connections.

A Variable Anode Resistance

FOR resistance - capacity coupling, whether it is used on the high- or the low-frequency side of the set, the experimenter often feels the need of a variable anode resistance. Fixed resistances are expensive to buy; in fact, a set ranging from 20,000 to 150,000 ohms would be quite a heavy item in one's experimental outfit. Still, to obtain the best results with any particular valve it is necessary to have some means of trying different values of resistance. This want is still more felt when one comes to experiment with some of the newest circuits in which a variable resistance is often essential if good working is to be obtained.

Here is a simple and perfectly satisfactory device which is quite easy to make and will not cost more than a few shillings, the ebonite panel being the most expensive of the items required. The component consists of an ebonite-covered box provided with a 7-stud selector switch and two terminals. Beneath the panel are seven small resistances, wired as shown in Fig. 1, so that any number of them from one to the whole seven can be

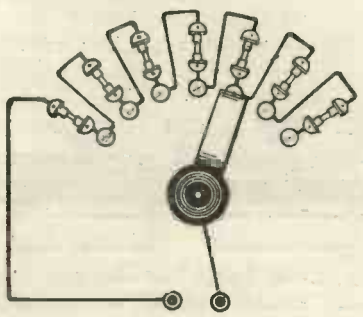


Fig. 1.—How the variation of resistance is obtained.

placed in series merely by moving the knob of the switch. Fig. 2 shows the way in which the resistance units are made. Two used .22 bore copper cartridge cases are cut down to a length of $\frac{1}{4}$ in. They are then thoroughly cleaned, and to the base of each is soldered a clip similar to those commonly used for mounting gridleaks. A 4B.A. clearance hole is drilled in the free end of each clip to take the screw which will secure it to the panel. A small piece of wood is whittled down until it is cylindrical in shape and rather less than $\frac{1}{8}$ in. in diameter. Its total length should be about $\frac{3}{4}$ in. Its ends are inserted into the cartridge cases, which are squeezed tightly with the pliers until it is firmly held.

Now take some Indian ink, and with a brush give the wood a thin, even coating, working the ink well in at the junction between wood and copper. It is impossible to give the value which will result for the resist-

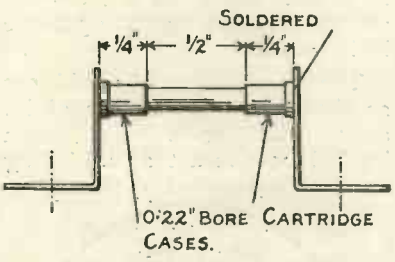


Fig. 2.—Dimensions and details of the resistances.

ance so made, for this depends very largely upon the thickness of the ink and the amount soaked in by the wood; but if the ink is put on not too thickly each unit should have a resistance in the neighbourhood of 20,000 ohms. We shall see presently how this can be determined exactly. Seven of these units are required; care must be taken to make them all of the same size and to apply as nearly as possible the same amount of ink in each case.

Fig. 3 shows the way in which the panel, 6 in. by 4 in. by $\frac{1}{4}$ in. ebonite, is laid out for drilling. An easy way of doing this is to make a full-sized drawing on paper, which is afterwards pasted on to the ebonite. When all the centres have been punched the paper can be removed. From a common centre three segments of circles are drawn with radii of $1\frac{1}{4}$ in., $1\frac{5}{8}$ in. and $2\frac{3}{4}$ in. respectively. The first denotes the line that will be occupied by the studs of the switch. The centres for their holes will be $\frac{3}{8}$ in. apart on the circumference, which distances should be marked off with dividers.

The two large segments mark the position of the holes which take the screws fixing the clips

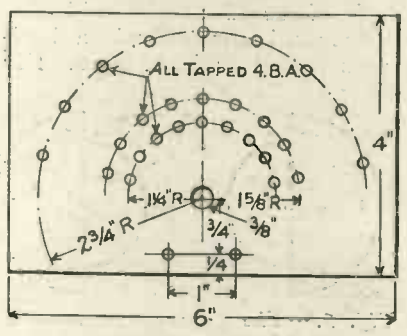


Fig. 3.—Drilling plan of the switch.

of the resistance units in place. With the exception of that for the bush of the switch spindle, which is $\frac{3}{8}$ in. in diameter, all holes may be 4B.A. tapped, though, if desired, the studs and the two terminals may be passed through clearance holes and secured with nuts. All connections should be soldered, stiff bare wire being used for preference. When finished, the panel with its fittings should be mounted on a polished wood box about $1\frac{1}{2}$ in. in depth.

Few amateurs probably are fortunate enough to possess a small "megger," or some similar instrument, for measuring resistance. Most good electricians, however, have these for testing the insulation of indoor wiring circuits. It should not therefore be difficult to have the finished instrument tested, when the value thrown into circuit by each stud can be marked upon the panel. Calibrated in this way the variable resistance becomes a most useful piece of apparatus, for it enables one to discover the resistance required in any circuit before purchasing a suitable component to use in it. But even if it is impossible to have the values measured, it will be found very handy, since with its aid one can accommodate the anode resistance to suit both the valves and high-tension batteries that are in use.

R. W. H.

Adjusting Two Condensers Simultaneously

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

ANYONE who has worked with either two tuned high-frequency transformers or a pair of tuned anodes will have discovered how difficult a business tuning can be at times. For

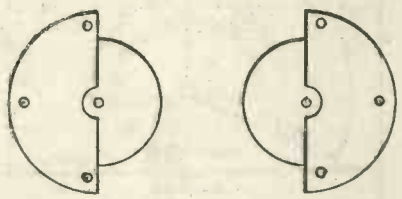


Fig. 1.—The necessary relative position of two panel-mounted condensers which are to be yoked.

the quick picking-up of signals it is essential that the two variable condensers which tune the transformers or the anode inductances should be moved practically simultaneously. This is an impossible feat if one hand is already employed with the aerial tuning condenser, unless some means of coupling the other two condensers can be devised so that one movement alters the setting of both in exactly the same way.

There are several ways of yoking a pair of condensers so that

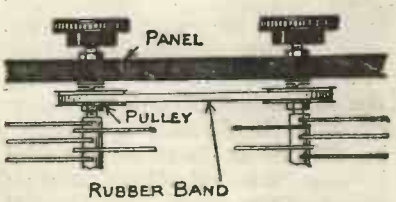


Fig. 2.—A simple and easy method of yoking condensers with two pulleys and a rubber band.

they can be adjusted simultaneously by the turning of one knob. When rotary-vane condensers are in use, which can be adjusted so that they turn very easily, a simple method is as follows.

Mount the pair on the panel so that they are placed as shown in Fig. 1. Turn up two pulleys of ebonite, fibre or hard wood 1 in. in diameter and ½ in. thick, making pronounced flanges on each. Mount these on the spindles below the panel (Fig. 2) and stretch round them a stout rubber band.

If either knob is turned, both condensers will respond in precisely the same way, so long as the band is tight enough to prevent slipping and the action of the condensers is easy.

With mica dielectric condensers and certain types of those provided with moving vanes, the movement of the spindle is always rather on the stiff side. Here the rubber band coupling will not do. A pinion gear must be made, which has the decided advantage of being quite positive in its action.

The panel should be laid out so that the spindles are 3½ in. apart from centre to centre, a bushed hole to act as a bearing

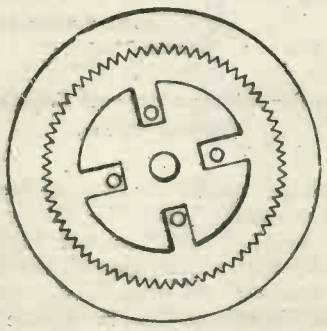


Fig. 3.—Showing how to attach a gear wheel to the underside of a condenser dial.

for a toothed wheel being made exactly midway between them. Three gear-wheels will be needed, two of equal size and the third a good deal smaller. The diameters of *one* large wheel and the small one must come together to 3½ in. Flat stamped toothed wheels can usually be obtained from a clock repairer's scrap-box. Two 2½-in. wheels and one 1-in. make an excellent combination.

If fixed dials are already in use moving bevelled dials should be substituted for them. Cut away the centre and part of the spokes of each large wheel, and fix it by 6B.A. screws to the underside of the dial, as seen in Fig. 3.

The way in which the small wheel is mounted between the dials is seen in Figs. 4 and 5. The lower end of its spindle is tapered off so that it fits into a brass bush, as shown in Fig. 4. The upper end is supported by a bracket made from stoutish sheet brass screwed to the panel.

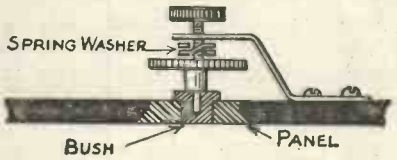


Fig. 4.—Details of the operating knob and gear wheel for the scheme shown in fig. 5.

A spring washer placed below the bracket keeps the spindle in place.

It will be seen that, if the middle knob is turned, both condensers are actuated to exactly the same extent. It should be noted that the movement of one of the condenser spindles will be in the opposite direction to that of the knob. Fine adjustments are readily made, since there is a 2½ to 1 reduction in the gearing. But when the preliminary searching and rough tuning are being done, one of the condenser knobs should be used. Both move simultaneously, but as there is now no gearing down, more rapid movements can be made.

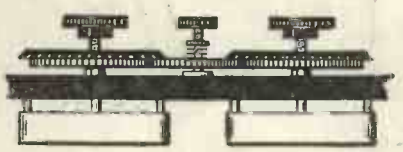


Fig. 5.—A method of coupling with gear wheels which is specially suited to mica condensers.

The question of the exact matching of the capacities of the two condensers at any given reading on the scale is by no means so difficult a problem as might be anticipated. A little experimenting to adjust the relative positions of their moving plates will usually suffice to give a match of quite adequate accuracy.

Apparatus we have tested

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

A Covered Crystal Detector.

A neat form of enclosed horizontal type of crystal detector, fitted with a new form of crystal cup, which obviates the necessity for fixing screws, Wood's metal, etc., has been submitted by Messrs. J. Macdonald & Co. for our inspection.

This is a nicely-finished little device, mounted on a small ebonite base, with terminals. The usual type of cat's whisker with universal joint is provided. The interesting feature of the instrument is the great ease with which the crystal can be replaced. By loosening a milled-head nut, the end of the detector can be slipped out of place. As the crystal is held in the small cup simply by the pressure of a collar on a sleeve (also milled), which screws on to the cup, the former can be then removed and replaced or adjusted in a moment. When in place, a glass tube protects the crystal from dust.

We understand that in future patterns the detector will have higher brackets than those in the sample submitted. We would suggest that greater convenience in operation would also result if these were held by separate screws instead of the terminals.

A Power-amplifier B.B.C. Four-valve Set.

When a firm of scientific instrument makers whose name is a household word in electrical and research laboratories puts forward an ambitious four-valve cabinet receiver, we expect to see something out of the ordinary, and in the power-amplifier set incorporated in a four-valve B.B.C. receiver, made by Messrs. W. G. Pye & Co., we are not disappointed. This is designed for the use of two-power valves on the low-frequency side, with up

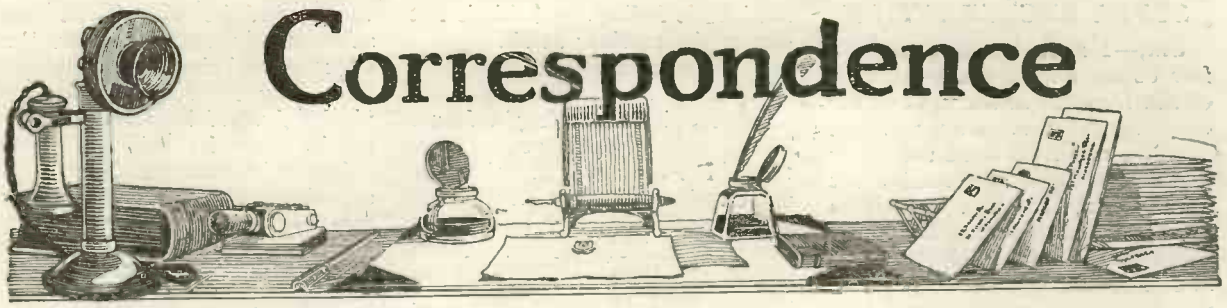
to 300 volts H.T. and the proper grid bias up to 12 volts negative. The set submitted for trial was mounted in a large, flat cabinet with horizontal panel and a hinged cover supported at an angle by a folding arm when in use. The leads to the batteries, etc., are brought in through slots in the rear, allowing the lid to be closed after removing the telephones or loud-speaker connections only.

The usual one H.F. and detector circuit is used, with tuned anode coupling, and adjustable reaction on the tuned anode, the latter by means of a fixed reaction coil controlled by a movable brass damping-cup. Two four-way rotary switches give ranges from 300 to 3,400 metres wavelength. A very good point is the "vernier" or fine-adjustment provided on the A.T.I. and anode tuning by smaller knobs above and co-axial with the main knobs. Filament resistances, which are partly imbedded in the panel, are provided for each of the four valves, whilst three two-way switches control current supply, second note-Mag., and output to H.R. 'phones or Magnavox respectively. In all there are fourteen controls, which, together with the fourteen terminals for aerial, earth, 'phones, L.T., and three H.T. battery connections, give a most imposing appearance to the receiver, and afford ample scope for the skilful operator to display his art. An earthed screening-plate behind the tuning-knobs is provided, and hand-capacity effects were noticeable only in critical adjustment of reaction. A very commendable point is the use of choke-capacity coupling to the telephones or loud-speaker, which eliminates the strain the extra H.T. current from the power-valve throws on the insulation and windings of the latter. A somewhat unique type of L.F. transformer of their own make is used, and we hope to have an opportunity of submitting this to a separate test.

On trial, on a fair suburban aerial in London, it gave as fine an exhibition of real loud-speaking, without distortion or "gramophone effect," as we have ever had the pleasure of listening to, using three valves and 200 volts on the power-amplifier valve. Four valves overloaded the loud-speaker, but with less resulting distortion than usual with one stage. The illusion of actual proximity of the performers was nearly perfect with three valves. In the intervals of 2LO the other stations could be got nicely on the loud-speaker with four valves and on the longer waves Radiola came in on three valves on the head-phones, and very well on four valves, whilst innumerable Morse stations were overpowering.

The makers would do well to take up the matter of greater selectivity in long-distance work, as the local "big noise," together with atmospherics and the customary contribution of Northolt, jammed all other stations up to 500 metres or more, and in the lower portion of each of the higher ranges. A switch to cut out the powerful note magnifier whilst searching would also facilitate this operation.

For open-air demonstrations before critical audiences, or to fill a large hall with dance music from the local station, it would indeed be difficult to improve on this apparatus.



BROADCAST RECEPTION IN INDIA.

SIR,—With reference to the double reaction circuit using a three-coil holder, which arrangement is described by Mr. J. F. Johnson on page 207 of No. 3 *Modern Wireless*. This circuit, which calls for very careful handling, gives, when perfectly tuned some most remarkable results in long-distance, short-wave reception. For the past week I have been receiving 6 BM and 2 LO in the above port between the hours of 3 and 4 a.m., corresponding to 9.30-10.30 p.m. English time. Very fine reception of the former station has been effected, using only the detector valve. The only difference between the above circuit and my own is a variable grid leak and a series-parallel switch (A.T.C.).

With all good wishes to the premier of wireless literature.—I am, etc.,

T. DAVIES.

Bombay.

TYPE "B" WAVETRAP.

SIR,—On Monday, December 3, WGY was received on 380 metres, at 11 p.m., using four valves. The 'phones could be held at arm's length, and yet the announcer could be heard with distinction. It was a sharp, frosty night, and this condition seems to be the best for good reception. Nothing could be heard at all Tuesday and Wednesday.

Seeing the wavelength of 410 metres given in *Wireless Weekly* for the new Belgian station, I tried for this with the type "B" wavetrap. I am only 7 miles from Birmingham, but it came in splendidly, as also did Glasgow, both of them being tuned in while Birmingham was working, so that this little gadget is well worth making. It is such useful tips which make your papers so interesting and well worth the money.—I am, etc.,

H. J. VALE.

Staffs.

SUPER REGENERATION.

SIR,—I should like to make a few comments on the experience of Six Dee Bee in the light of my own experiments. I am using at present, and have been using for some months, a single-valve set with aerial reaction which is practically of the orthodox form. With this circuit 2LO comes in at fair loud-speaker strength, but we always use quiet 'phones and a minimum of reaction in actual practice. With regard to other stations, Glasgow and Newcastle come in much stronger than any of the others, and much above crystal reception at 10 miles. I can get all the B.B.C. stations and the L'Ecole Superieure; Bournemouth is quite strong, but cannot be tuned in whilst London is working. The tuning on distant stations is rather critical, but only uncomfortably so in the case of the Paris station. Hand capacity effects are marked, but not serious, and can be quite overcome by careful arrangement of components and use of extension handles. The only real deterrent to listening to distant stations is fading, and this is not due to the receiver at all.

I have tried all the so-called "supers" and, whilst I have obtained signals, using a frame aerial, which were as loud as those I normally get with the more orthodox circuit on the outside aerial, I have never got them appreciably louder. Then, again, the "super" signals are always to a certain extent distorted, interfered with by C.W. and that annoying whistle, and the adjustment is so sensitive to capacity effects to make listening-in a veritable penance instead of a pleasure.

To sum up, it appears to me that the "super," at its best, only has the advantage of working with a frame or small indoor aerial, and this, to my mind, is a theoretical advantage only. My set will work very well on an inefficient aerial, even on the bell circuit, as a matter of fact, and it is from all points of view superior to any "super" I have yet tried.

My advice to Six Dee Bee is to try the arrangement which I am using, and he will, I am sure, subsequently regard "supers" as experimental circuits to be played with from the scientific point of view only. If he already so regards them he will still gain valuable information from a few experiments with my arrangement.—I am, etc.,

D. IRVINE WATSON,
B.Sc., Lond.

Surbiton.

A NEW STATION (?)

A reader residing near Edinburgh enquires regarding a morse message received by him on Saturday night (December 29) between 6.15 and 6.18 p.m.:—"Between 6.30 and 7 p.m. G.M.T. we are broadcasting latest news and some music on 700 metres. Listen simultaneously for calls on —— metres." At 6.35 p.m. on the same night he tuned in the station and heard music, quite clearly, though very faintly. No call sign was received with certainty. Can any reader identify the transmitting station?

Information Department

R. C. (HAMMERSMITH) asks whether it will be possible to work a loud-speaker from all the British broadcasting stations by means of the "All Concert Receiver" (see "MODERN WIRELESS," No. 8).

A straightforward three-valve receiver, such as the "All Concert" which contains one high-frequency valve, detector and one low-frequency cannot be expected to work a loud-speaker at distances greatly exceeding about 50 miles, when used with an outdoor aerial of average size. With a Reflex receiver, in which one or more of the valves performs a dual function, it may be possible to receive all the broadcasting stations at loud-speaker strength with only three or even two valves under favourable conditions. To obtain reliable loud-speaker results, however, with a straightforward circuit it is usually necessary to allow four valves. A suitable combination of valves for the purpose is one high frequency, detector and two low-frequency.

C. F. L. (STREATHAM) asks for suitabl dimensions for a single-layer coil with tappings to cover the broadcast and ship wavelengths.

An efficient coil to cover these wavelengths can be made by winding a single layer of No. 22 S.W.G.-d.c.c. wire upon a cardboard tube 3½ ins. in diameter and 5 ins. long. The winding will occupy a length of 4 ins., and 8 tappings should be taken at roughly equal intervals. This coil will give the desired variation of wavelength when used with a variable condenser of 0.0005 μF. The finished coil should be impregnated with extremely dilute shellac varnish and well baked. Although such impregnation with a dielectric material like shellac undoubtedly increases the self-capacity of the coil to a noticeable extent, it is better than leaving the coil "dry" with the risk of moisture absorption. A possible alternative is to use wire which is both enamelled and double cotton covered, since in this case if the

covering does absorb moisture it does not impair the insulation between turns. The presence of the moisture in the cotton does, however, raise the self-capacity of the coil in a precisely similar manner to the shellac varnish.

M. S. C. (PETERBOROUGH) asks for the approximate receiving range for broadcasting of the single valve Reflex receiver described in Vol. 2—No. 9, of "WIRELESS WEEKLY."

This receiver is not essentially a long-distance set, although many readers have reported receiving all the broadcasting stations in certain favourable localities. Since no reaction is provided it should not be expected to give good signals at greater distances than about 50 miles from a broadcasting station, although much greater distances will easily be covered if a really good aerial can be erected. Up to distances of about 15 miles it may be expected to work a loud-speaker with sufficient volume for a small room when an outdoor aerial is used.

C. H. E. (ROMFORD) asks how can one estimate the correct brilliancy for the filament of a valve when working with a 6-volt accumulator.

The best way for a novice is probably to proceed as follows:—First tap off 4 volts from the accumulator and turn the valves on nearly to their greatest brilliancy. Note the visible brightness of the valve, then apply 6 volts (first turning off the filament resistances) and note in what position the filament resistance has to be adjusted to give the same brightness.

H. T. M. (LEEDS) asks how many valves should be used to secure reliable reception under all conditions of the American broadcasting stations.

Remembering the important part played by atmospheric conditions in such long distance reception of comparatively low power stations it will be seen that it is not possible to lay down a definite rule as to how many valves are necessary. There are undoubtedly numerous occasions when even the most sensitive receivers will fail to give any signals at all, whereas at other times, even a single-valve set, when used with a good aerial, is capable of picking up one of the American stations. We think that to give the experimenter a reasonable chance of receiving American stations on numerous occasions as distinct from freak reception, it is necessary to specify two high-frequency valves, preferably with some form of tuned intervalve coupling. Such receivers must obviously be very carefully designed to secure efficiency and controllability, a good example of a receiver of this type being that described in the November and December Nos. of *Modern Wireless* under the title of "The Transatlantic Receiver." Note magnifiers may be added to enable loud-speaker strength to be obtained when conditions are good.

Reduction in Price

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Valves

are now reduced in price, as from January 1, 1924,

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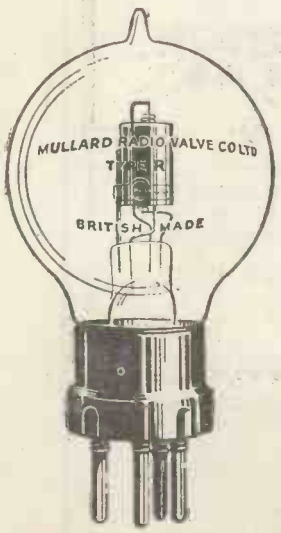

Mullard

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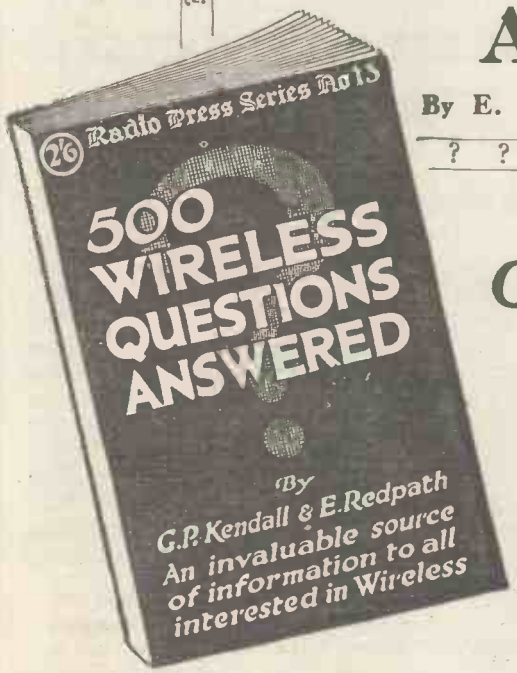
Keep on Keeping on Advertising in WIRELESS WEEKLY.

Published November 8th.

500 Wireless Questions Answered

By E. REDPATH and G. P. KENDALL, B.Sc.



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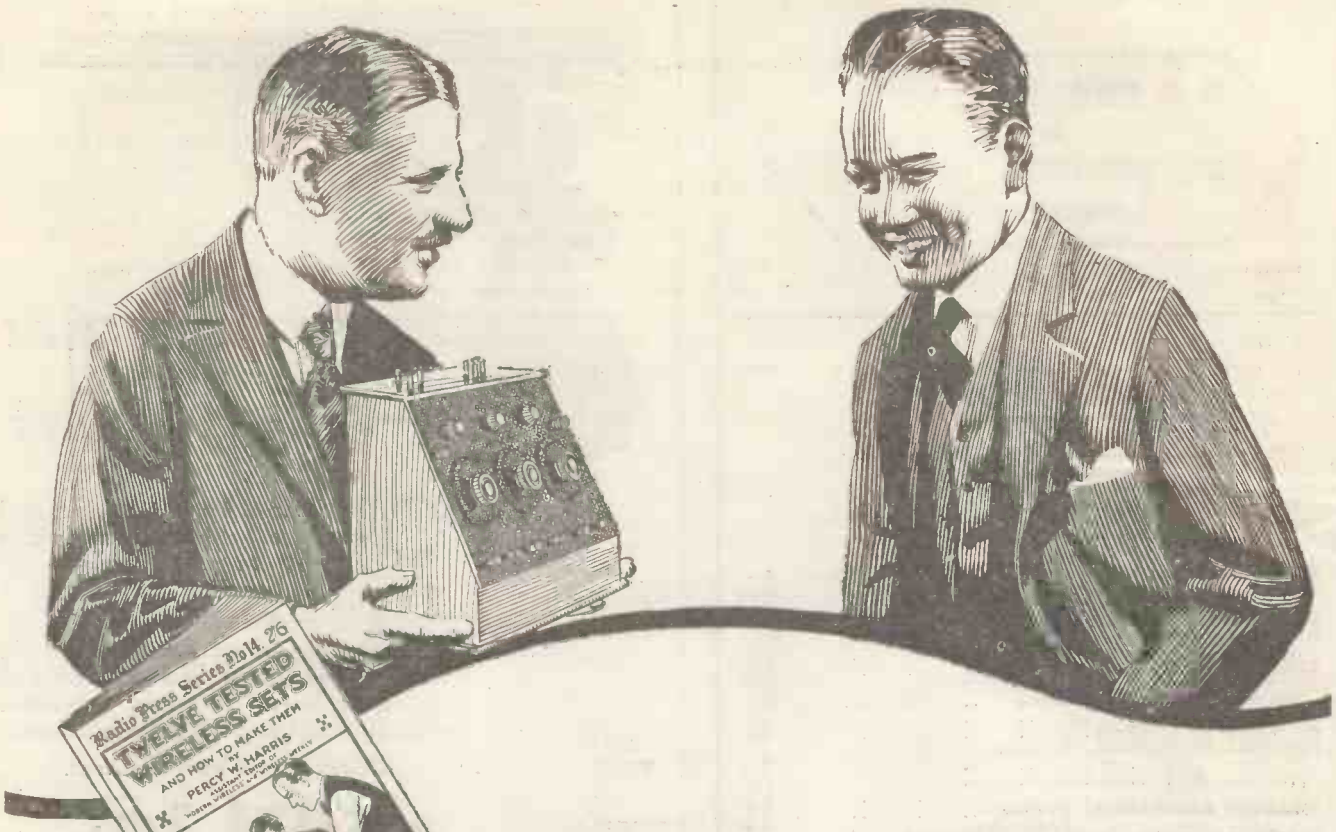

That's pretty smart of you, Williams!

"WELL, I must admit it's not too bad for a first attempt. I'm getting excellent results from it, too."

"Tell me, how did you obtain your knowledge and skill? I suppose you have had some sort of engineering training?"

"Oh, no. My job is in the insurance line—I've never been in any works in my life. As a matter of fact, it was Garnett who put me up to it. He told me how simple it was to build up a really good Set from ready-made components."

"It is a very creditable piece of work—I must congratulate you. I suppose Garnett showed you how to make it?"

"Not a bit of it. He merely advised me to get a copy of a book called *Twelve Tested Wireless Sets* and to follow the instructions. By the way, your boy is coming home from school next week, why not spend a couple of evenings or so with him making up a good Set?"

"That's not a bad idea. He'll sure to be at a bit of a loose end. Let me make a note of the book and I'll call in at the bookshop on the way home for a copy."

Twelve Tested Wireless Sets.

By Percy W. Harris.

Assistant Editor of "Modern Wireless" and "Wireless Weekly."

One of the most practicable constructional books yet published. Mr. Harris' reputation as a bright and informative writer of constructional books is well known and his latest book is easily the best he has written.

Every Set described in this book is well within the capabilities of any enthusiast and provided the very clear instructions are followed perfect results will be obtained at the first attempt.

The following instruments are fully described.

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5 A Simple 2-Valve Receiver.
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GILBERT AD.

Cossor

3 a.m!

—WJZ, WHAZ, WGY, and many other U.S.A. Broadcasting Stations are within easy reach of Cossor P.2 (red top) users.

WIRELESS enthusiasts sufficiently keen to forsake the comfort of their beds at 3 a.m. should first make quite certain that they are using the right type of apparatus.

The aerial should be high, though not necessarily long and its insulation should be above suspicion. Accumulations of soot and fog are certainly not conducive to long distance reception—and a Saturday afternoon spent overhauling the aerial equipment will be time well spent.

The Receiving Set should contain at least one high-frequency Valve, and this should certainly be a **Cossor P.2** (with red top)—the only Valve designed specifically for long-distance work. The other Valves should be of the P.1 type—recognised by all wireless experts as ideal for rectifying and amplifying the weak currents received over distances of several thousands of miles.

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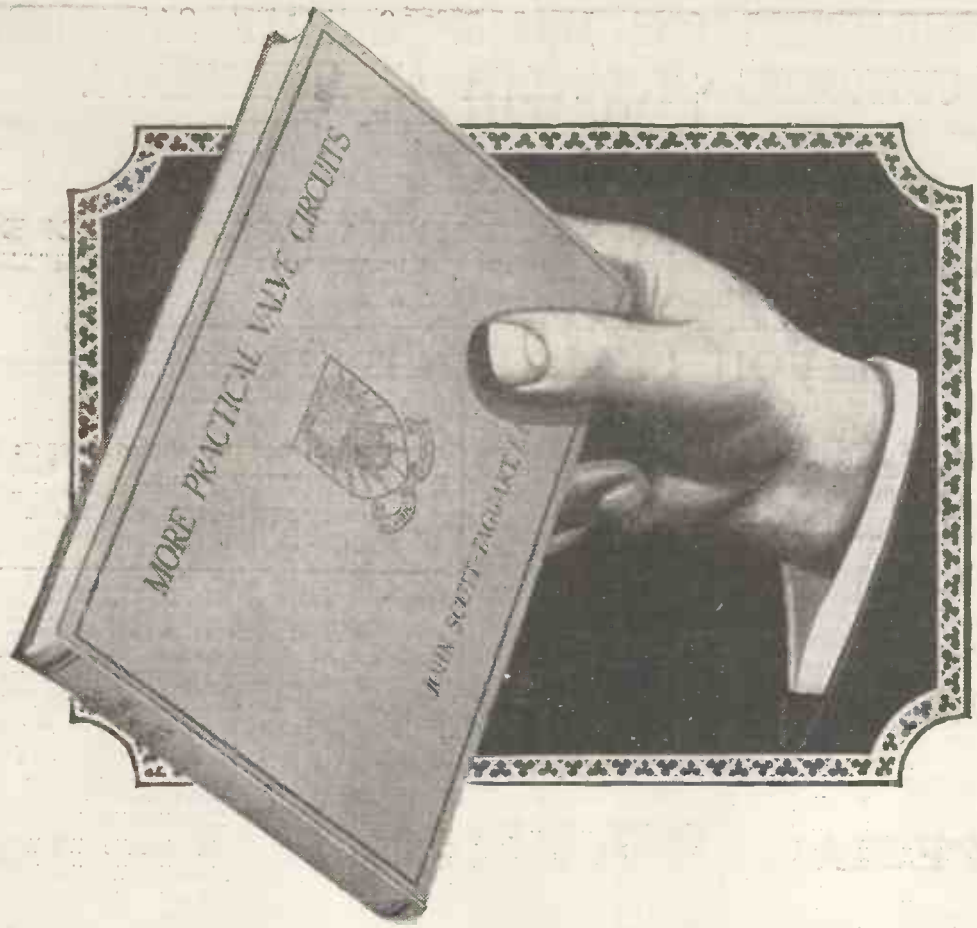

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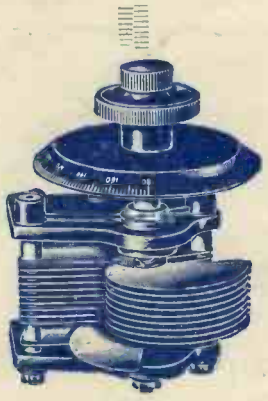

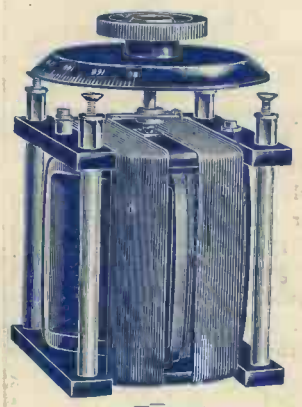

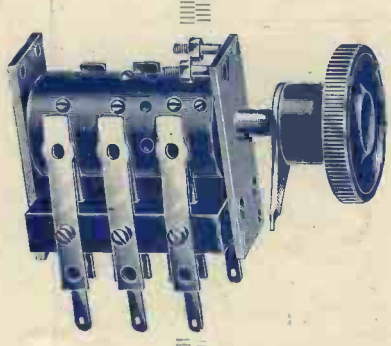

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No. 6.

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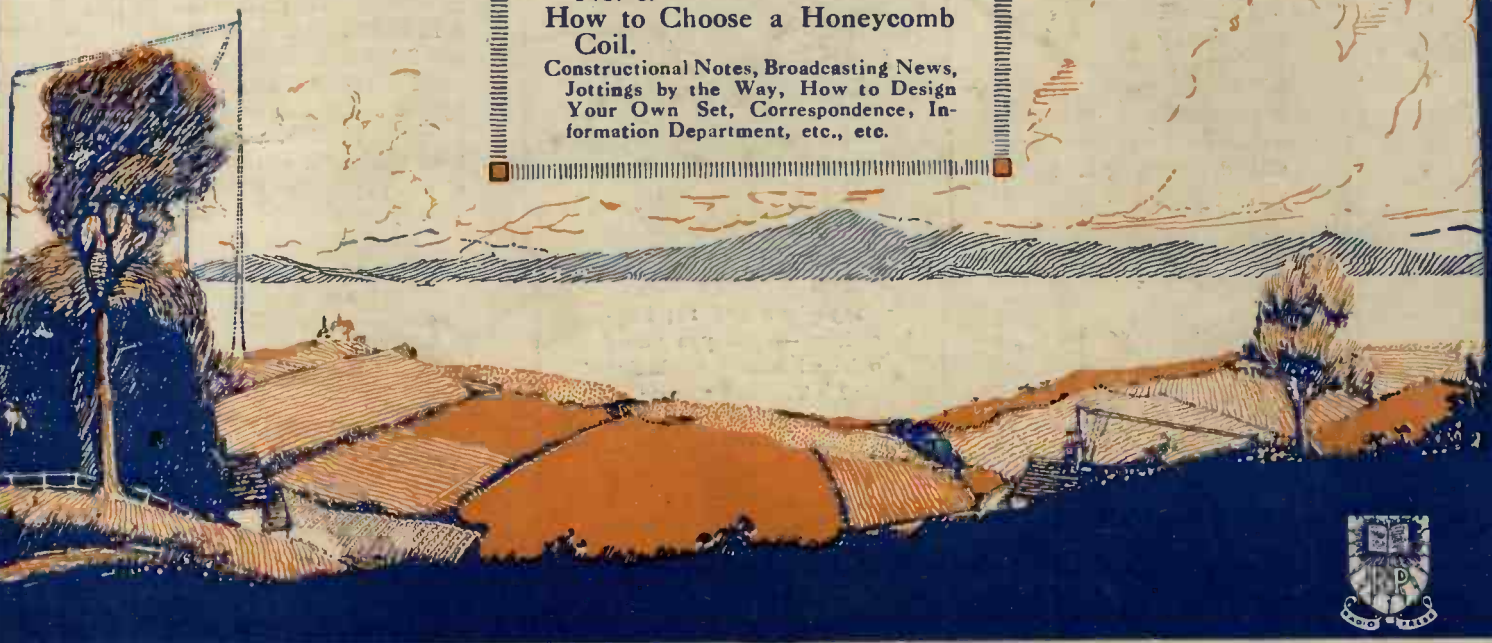

A Selective Broadcast "Peanut" Receiver.

By A. D. COWPER, M.S

Wireless Weekly

Vol. 3, No. 6
Jan. 16, 1924.

CONTENTS

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

Editorial

Some Personal Remarks to Our New Readers.

A LARGE number of new readers have joined us in the past few weeks, and to these I would like to give a very hearty welcome.

The prestige of this journal has steadily increased, and although it is impossible to satisfy everyone, yet, judging by our sales, we are pleasing a very large number, and while the result is gratifying to ourselves, we are ever anxious to keep in the closest touch with the desires and feelings of our readers.

Those who have recently joined us will already have some indication of the lines on which our journal is conducted. Our policy is a progressive one, and many important developments have been published for the first time in our pages, and in many cases by members of our staff. This progressive policy has been steadily building up a high reputation, and it is my intention to see that this reputation is maintained.

Many sound ideas, suggestions and developments have emanated from *Wireless Weekly*, and although in the passage of time and the transference of information the original source becomes obscured, yet our "constant readers" have the satisfaction of knowing that we will never let them down. If there is anything worth hearing about, they shall not only hear about it, but be the *first* to hear about it.

I have surrounded myself by a very capable, original, and experienced staff, and equally capable contributors. We are all wireless people, and we take the greatest care to ensure that everything we publish is accurate and absolutely technically correct.

It has been suggested that a decrease in the price of *Wireless Weekly* would result in an increase even beyond our present number of readers. No such reduction could be possible without changing the whole nature of the journal, and we are following an ideal. The success of the journal is ample proof that there is a large public to which this class of journal appeals, and we intend to go forward and try and improve it in the pursuit of our ideal. Suggestions from readers are always most acceptable; criticisms are treated with the greatest consideration and sympathy.

We want every reader to feel a certain natural pride when he replies to the question "What paper do you buy?" The fact that an experimenter buys *Wireless Weekly* is ample proof that he has passed the initial stages, that he is keen, that his interest is a real technical one, and that he is essentially a progressive experimenter.

To those who have so loyally supported us in the past, I wish to give my assurance that I intend to do everything possible to maintain and improve the quality and usefulness of this journal.

If you have any criticism, please write me a personal letter. If such a thing is possible, I take a greater interest in *Wireless Weekly* than in any other of the publications of Radio Press, Limited. Whether it is because of the fine type of experimenter to whom the paper goes, whether it is the closer sympathy of ideas, or whether it is because we meet oftener, I do not know, but the fact remains that my greatest interest is in the continued satisfaction of the readers of this journal.

In concluding these personal remarks, I wish both old and new readers a very successful New Year, both in wireless and all other matters.

JOHN SCOTT-TAGGART.

We have received a Korland valve for test and do not recommend this product to our readers.

SIX LECTURES ON DUAL AMPLIFICATION

No. VI.

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

The concluding lecture of a series of six which began in Vol 3, No. 1.

A Two-Valve Dual Circuit.

IN Fig. 23 it was explained how, by using a transformer with a tuned secondary, it was possible to use a two-valve circuit involving a stage of high-frequency amplification, the use of the second valve as a detector, and the use of the first valve as a low-frequency amplifier on the reflex principle.

Another neat method which has been suggested by Mr. Cowper is embodied in a circuit which I have arranged in Fig. 29.

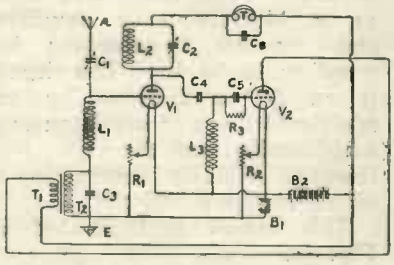


Fig. 29.—A special dual circuit.

It will be seen that the first valve V1 acts as a high-frequency amplifier, and that the second valve acts as the detector, a leaky grid condenser C5 being provided. The rectified currents pass through the primary T1 of the step-up intervalve transformer T1 T2, the secondary of which is included both in the aerial and grid circuit of the first valve. It will be seen that in this circuit telephones T are connected in the anode circuit of the first valve, after the circuit L2 C2; that is to say, the telephones come next to the high-tension battery B2, whereas in the ST150 and the ST75 circuits, the telephones come next to the anode of the valve, and between the anode and the tuned-anode circuit; this latter connection renders the circuit a little difficult to operate, particularly when fine adjustment of reaction is being made, although when a loud-speaker is employed there should be no trouble.

If, on the other hand, we connect the telephones next to the high-tension battery, in a circuit of the ST150 or ST75 type, the low-frequency potential differences across the telephones will be communicated through the grid condenser to the grid of the second valve, where the potentials will be amplified. Both valves, in this case, would act as low-frequency amplifiers, and there would be a chain of low-frequency reaction, which has already been explained. You must either have a chain of low-frequency amplification, in which case low-frequency self-oscillation is almost inevitable or else you must try and get a reverse reaction effect, which would merely tend to weaken the signals.

As a matter of fact, low-frequency buzzing, due to self-oscillation at low-frequency, is usually obtained in any case whenever there is a chain of low-frequency amplification. In order to break the chain, the telephones, or loud-speaker, are placed next to the anode of the first valve in the ST150 and ST75 and other circuits which are derivatives of these.

Preventing Low-Frequency Oscillation.

In Fig. 29 is an interesting method of preventing the chain of low-frequency amplification. This method consists of short-circuiting the low-frequency potentials, which, in the ordinary way, would tend to be applied to the grid of the second valve. This short-circuiting is accomplished by the use of a high-frequency choke coil L3, which is connected in the position shown.

The high-frequency potentials across L2 C2 are communicated to the grid of the second valve, through the condenser C4, and then through the condenser C5. The leak is provided by R3, and any excess of electrons will flow from the grid, through R3, and down through the high-frequency choke L3, back to the filament.

The high-frequency choke L3, which, on the broadcast wave-band, may be a No. 200 honeycomb coil, does not act as a short-circuit for the high-frequency currents, but it does prevent any

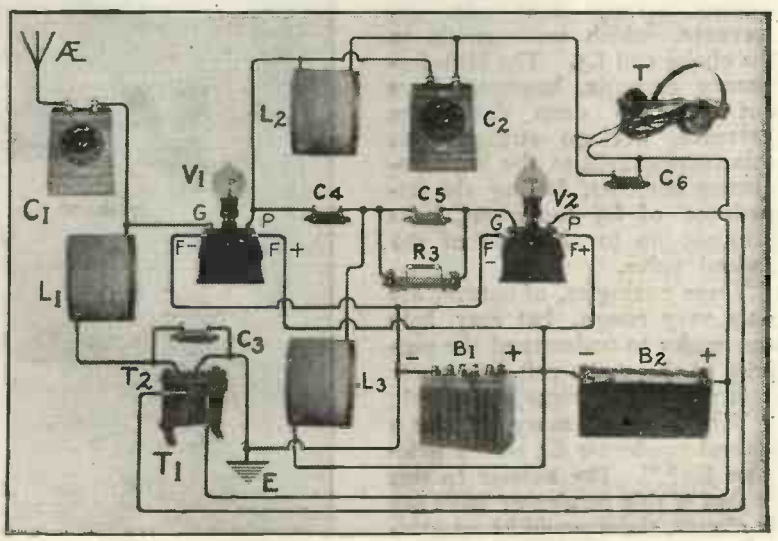


Fig. 30.—Pictorial form of Fig. 29.

low-frequency potentials established across the telephones T from being communicated through C4 and C5 to the grid of the second valve.

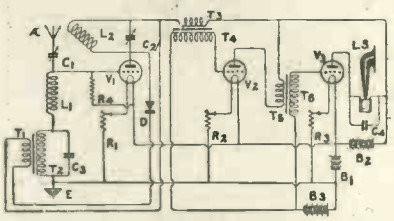


Fig. 31.—The ST118 Circuit.

The low-frequency potentials across the telephones T are communicated through the inductance coil L2, just as if the latter were an ordinary wire connection. They then go happily through the condenser C4, optimistically hoping that they will be impressed through C5 to the grid of the second valve. When, however, they get to the top of L3 they are short-circuited, because L3, having practically no resistance, may be treated as an ordinary connecting wire in so far as the low-frequency currents are concerned. There will therefore be no potential difference across L3 due to the low-frequency currents.

This, of course, is all very colloquial, but the reader will understand what is meant. We may consider the analogy of a rushing torrent which travels down a mountain and which goes along happily until suddenly it comes up against a large crevasse, which, to the ordinary eye, might be invisible. Instead of jumping across the crevasse and proceeding on its way, the torrent merely falls into the crevasse, which corresponds to the choke coil L3. The high-frequency currents, however, have not time to drop down the crevasse, but go straight on; this corresponds to the high-frequency currents, finding the impedance of L3 too great, pass straight on to the grid of the second valve.

These analogies, of course, are only very rough, but may help the reader to understand the purpose of the choke coil L3.

It might, of course, be asked: "Why is it necessary to have a second condenser C5 with a grid-leak R3?" The answer to this is that if this condenser were not in circuit, there would be no grid-leak, or at any rate the gridleak, which would be provided by L3, would have negligible resistance, and therefore there would be no accumulative rectification effect which is so essential. The condenser C4, of course, is necessary, because otherwise the high-tension battery B2 would simply short-circuit through T, L2 and L3. The condenser C4 has no other purpose whatever.

Fig. 30 is a pictorial representation of the Fig. 29 circuit.

Suitable Values for Components.

The inductance L1 may consist of 100 turns of No. 26 gauge double cotton covered wire, wound on a cardboard tube 3½ ins. diameter, tappings being taken at the 30th, 45th, 60th, 75th and 100th turns. Alternatively, a No. 50 or No. 75 honeycomb coil will be suitable. The condensers C1 and C2 are variable and have a maximum capacity of 0.0005 μF. The condenser C3 has a value of 0.001 μF, while C6 has a value of 0.002 μF; the condenser C4 has any value from 0.0003 μF upwards, for example 0.002 μF. The condenser C5 is the usual grid condenser of 0.0003 μF capacity, while R3 has a value of 2 megohms, or is variable. The inductance L3 is a No. 200 honeycomb coil; the inductance L2 consists of 70 turns of No. 26 gauge double cotton-covered wire wound on a cardboard tube 3 in. in diameter, tappings being taken at the 30th, 50th and 70th turns; alternatively, a No. 50 or 75 honeycomb coil might be employed.

Three-Valve Dual Circuits.

Three-valve dual circuits may be of two distinct types; the first type involves the addition of one stage of low-frequency amplification to a two-valve dual circuit, and the other type involves two stages of high-frequency amplification. It is not possible, in the scope of the lectures here given, to go deeply into the question of three-valve dual circuits. It is, however, proposed to describe two successful circuits of special interest. One of these is the ST118, which is the latest ST100 followed by a stage of low-frequency amplification, and the other is the ST151, which is a stage of low-frequency amplification added to the ST150.

The ST118 Circuit.

This circuit will give very loud signals. Three stages of low-frequency amplification follow the rectification by means of a crystal detector. The first valve acts as a high-frequency amplifier and reaction is obtained by coupling L2 to L1. The circuit is an ST100 followed by an additional stage of low-frequency amplification, and the writer has found no difficulty in managing a circuit of this description.

This circuit is illustrated in Fig. 31.

Values of Components.

The condenser C3 might be a variable condenser of 0.001 μF

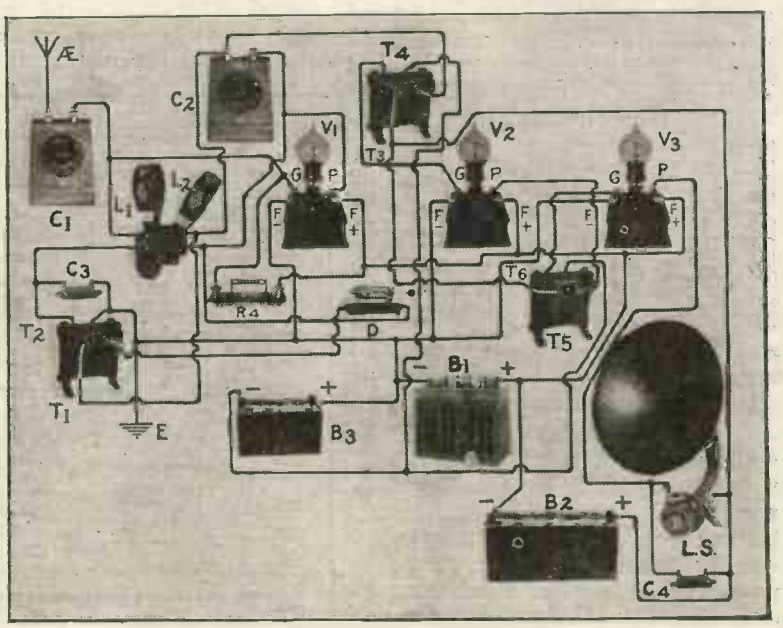


Fig. 32.—Pictorial form of Fig. 31.

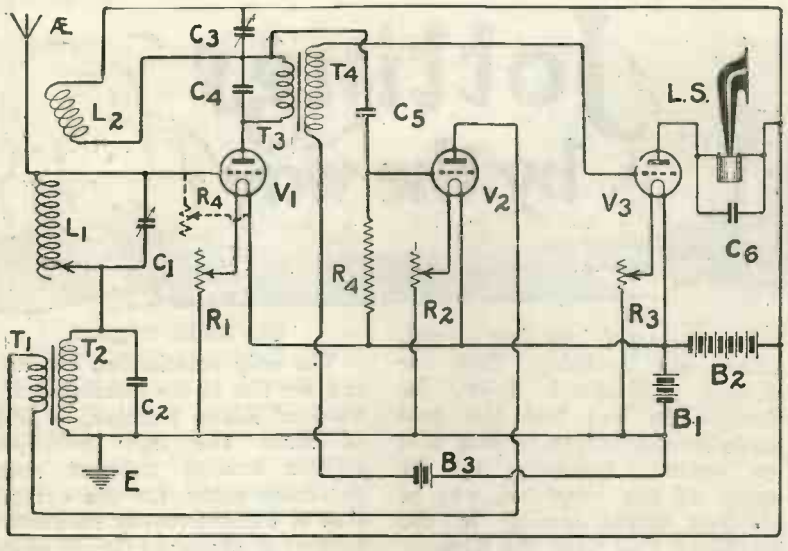


Fig. 33.—ST151 Circuit

capacity, whilst fixed condensers of different values might be tried across T1 and T3. A 100,000 ohms resistance is connected across the grid of the first valve and the positive terminal of the filament accumulator. Another 100,000 ohms resistance might be connected across T4 and still another across T6. This, however, should not prove necessary.

An important point is the provision of the battery B3 of about 4 to 9 volts. This battery is for the purpose of giving the grids of the last two valves a negative potential to prevent distortion due to grid currents.

The inductance L1 may consist of 100 turns of No. 26 gauge double cotton-covered wire, wound on a cardboard tube 3½ in. in diameter, tappings being taken at the 30th, 45th, 60th, 75th and 100th turns. Alternatively, a No. 50 or 75 honeycomb coil may be used. The inductance L2 consists of 70 turns of No. 26 gauge double cotton-covered wire, wound on a cardboard tube 3 in. in diameter, tapped at the 30th, 50th and 70th turns, or alternatively this may be a No. 50 or 75 honeycomb coil. The condensers C1 and C2 have a capacity of 0.0005 μF, and C4 a capacity of 0.05 μF.

The ST151 Circuit

Another useful three-valve circuit is illustrated in Fig. 33, the pictorial form of which is given in Fig. 34.

The ST151 circuit is the three-valve form of the ST150. Instead of connecting the loud-speaker, or telephone receivers, in the anode circuit of the valve, we have the primary T3 of the step-up intervalve transformer T3 T4. The primary T3 is shunted by a condenser C4 of 0.002 μF capacity. The secondary T4 is connected in the grid circuit of the third valve, which acts as an ordinary low-frequency amplifier.

In the grid circuit of the third valve, a grid battery B3, which may have any value from 3 volts to 9 volts, is so arranged as to give the grid a negative potential. The loud-speaker LS is included in the anode circuit of this valve, and a fixed condenser is connected across the loud-speaker.

As in the ST150, the condenser C2 may be variable, in which case a value of 0.001 μF will be found suitable.

In both this and the ST150 circuit, the variable condenser for tuning the aerial circuit may be in series with the aerial. A 100,000 ohms resistance may be connected across the grid and filament of the first valve if there is any tendency to self-oscillation.

Values of Components

The inductance L1 may consist of 50 turns of No. 26 gauge double cotton-covered wire, wound on a cardboard tube 3½ in. in diameter, tappings being taken at the 10th, 15th, 20th, 25th, 30th, 35th, 40th and 50th turns, or alternatively it may be a No. 25, 35 or 50 honeycomb coil. L2 may consist of 70 turns of No. 26 gauge double cotton-covered wire wound on a cardboard tube 3 ins. in diameter and tapped at the 30th, 50th and 70th turns, or may be a No. 50 or 75 honeycomb coil. C1 and C3 may have a capacity of 0.0005 μF; C2 a capacity of 0.001 μF; C5 a capacity of 0.0003 μF; C6 a capacity of 0.05 μF; and R4 a value of 2 megohms.

Conclusion

The reader of these notes on dual amplification will realise that it is not possible in the short space available to give more than an outline of dual amplification circuits. It is, however, the author's intention to write a further series of articles dealing with the matter in much greater detail, and these articles will appear very shortly in *Wireless Weekly*.

The articles which have already appeared will shortly be published in book form.

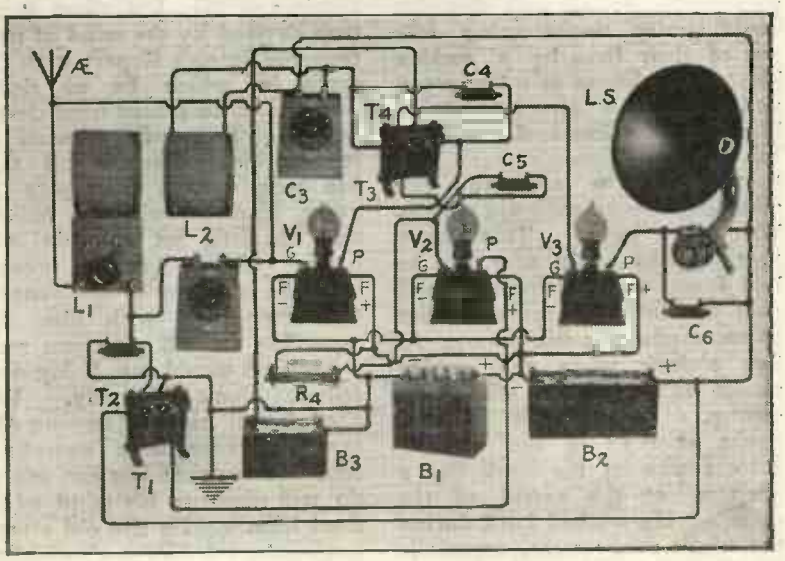
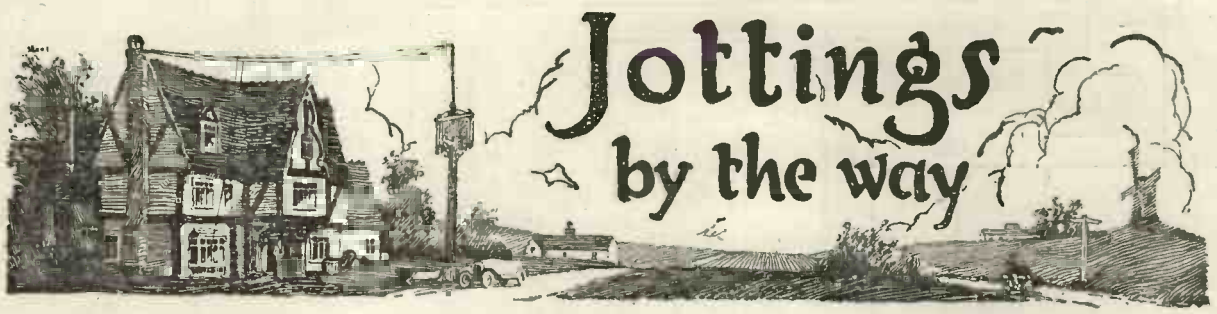


Fig. 34.—Pictorial form of ST151.



Oh, Those Wavelengths!

SOME short time back I said that I anticipated they would not long be content to let the new wavelengths remain unchanged, and, behold, they have been and gone and done it. Radiating Rupert, poor fellow, has had a very bad time of it. So have we. On the Sunday afternoon after they had come into force he set out to search for 2LO. One imagines him sitting, his coat off and his sleeves rolled up, with a fixed look of grim determination upon what he is pleased to call his face. When I switched on at five minutes past three in the afternoon the task had begun. He was still in the stage of a great majestic sweeps with his condenser. He always begins like that; it is his method of searching. The resulting howls take one back to boyhood's days when a wonderful whistle called the "Devilene" could be bought for a modest sixpence. Incorporated in its interior was a kind of screw propeller which revolved as one blew. The harder you blew the faster it went and the higher was the note that it produced. Armed with this you could terrify unsuspecting folk out of their lives by a sudden blast which began as a low croon and ended as a piercing shriek like that of a lost soul. Do you remember it?

Later in the afternoon the sweeping movement gave way to little short jerks. This meant that he was really sure that he had found the transmission, and that nothing now remained but to accomplish his fine tuning. At five o'clock when the station closed down he was still going strong. Directly it opened again at 8.30 in the evening Rupert was off his mark like a sprinter at the sound of the pistol. He worked hard during the whole programme, especially in the five minutes' interval before the 10 o'clock time signal, when, not realising that the station had closed down, he thought he had lost him and made frantic efforts to pick him up again. Manfully did he strive till the very end, one of his best howls coming in the middle of God Save the King.

The Psychology of Rupert.

Rupert, I am afraid, is typical of a very large class of disturbers of the ether—the people who are never content to let well alone. No matter how good their tuning may be they are always thinking that it might be improved. This is a very laudable spirit, a fine manifestation of the divine discontent, but it is pretty rough on peaceful citizens in the neighbourhood who, feeling sure that their own sets are blameless, have to grin and bear the ghastly obligato to the best tunes provided by the local Ruperts.

The worst of it is that you are completely helpless so far as counteracting their efforts goes. Wave traps will deliver you from the attentions of even nearby spark stations, but there is no trap devised by the mind of man that will furnish Rupert with the drain in which he so richly deserves to be placed head downwards. The man himself is incorrigible. Despite all that has been written in papers of every kind he will not believe that his little set can do any harm. Should you be present when he is tuning in and venture to remonstrate with him for squealing he will give you such a smile as would say, "My dear fellow, don't be silly. You needn't tell me that anyone else can hear *those* little squeaks." And nothing that you can say or do will disabuse his mind of its fixed idea. 'Tis the old story: one's own set, like one's children and one's dog, can do no wrong.

The Radio Fascisti.

The only solution so far as I can see lies in the formation of a kind of Radio Fascisti, a body of stout and high principled fellows banded together under fearsome oaths for the extirpation of oscillation—or oscillators. Garbed in strange robes of white, to typify their own innocence, they would repair once a week to their place of meeting, passing the doorkeeper only if they could remember the secret motto "every reaction provokes an equal and opposite action." At the meeting place would be displayed the banner of the order, St. George armed with a potentiometer staying the dragon of radiation. The secret hand clasp of the order might take the form of a grip accompanied by slight movements of the wrist from side to side like those of a confirmed condenser wangler. On receiving this sign from one not known to belong to the brotherhood you would query "Pip," whereupon if he were really an initiate he would reply "Squeak." Recognition would then be complete.

At their meetings the members would settle down to the operation of direction finders. Then having marked down their quarry, they would repair to his house, haul him forth gagged and bound into a fast motor car, and drive him to some lonely spot miles from anywhere. He would be slowly roasted at the stake to the accompaniment of the howls and wails of the assembled throng. It is only by some such drastic means that the freedom of the English ether can be assured. Whoever organises the Radio Fascisti can put me down as the first and most bloodthirsty of its members. Rupert, I think, will roast very nicely.

This Terrible Wireless.

I have just read in a perfectly

good daily paper a sad little announcement. An American citizen has been sent to an asylum upon the complaint of his wife that wireless has unhinged his mind. A terrible thing, this wireless.

This unfortunate American gentleman began by being harassed by his neighbour's loud-speaker (I mean his *wireless* loud-speaker, of course not . . .) He got him to whatever they call a police court over there, and sought an injunction. The magistrate told him to run away and not be silly. Enraged, he repaired to the nearest wireless shop, where he ordered the biggest receiving set that could be bought. If he could not injunct the harassing neighbour he could at all events drown him. But that is a game at which two can play. The rivalry grew apace, each striving to outdo the other. If the harasser went forth and purchased a mighty high-tension battery wherewith to ginger up his note-mags the harassed bought one yet bigger. Ordinary valves gave place to the power variety and these again to transmitting valves of greater and greater size. Volt capped volt, amp. was answered by amp. But the pace was too hot to last. One of the combatants was bound to crack under the strain. Eventually the harassed went silly and the harasser, the victory won, was able to tone down his set so that once again he could hear himself think. Verily America is the land of big things. It is a terrible affair when superman meets superman!

Never Satisfied.

Do you suffer, as most of us wireless folk do, from what I may call constructitis? You know what I mean. You make up the most beautiful set that ever was, embodying in it every possible improvement of the latest type. It is a lovely thing, a joy to look upon, a pleasure to work with, a source of just pride when your friends come round. But somehow it won't do. Little things that might have been done rather better begin to suggest themselves quite early. You make alterations here, additions there. At the end of a month the thing, once neat and shipshape, is a medley of excrescences. There are holes in the ebonite with nothing fitting into them. The symmetry of the terminals is broken up by newcomers. Wires straggle forlornly all over its once tidy panels.

"This," you say, "will never do." You fare forth to purchase yet more ebonite. You rebuild the set embodying all the gadgets that have been added. Once more it is a thing of beauty. . . . . But what happens at the end of another month? Has it not become as unsightly as ever? Are there not bits and pieces everywhere? Do you not contemplate rebuilding? It has; there are; you do. What I want to find is an ebonite maker who requires a partner. It must be great fun!

WIRELESS WAYFARER.

Lettering Panels

IT always improves the look of home-constructed apparatus if one letters the terminals, so as to show clearly the connections which belong to them. On the large boxed-in set containing a considerable number of terminals and switches it is as well to do so, for even the best of us may have moments of mental aberration in which a wrong connection may be made if there is nothing to guide the eye.

Engraving is not a thing that the average man can do neatly for himself, and it is rather an expensive business to have panels lettered in this way. What, however, he can do, is to provide himself with a set of small letter punches, which can be purchased at no great cost from any tool maker. The whole alphabet will not be required, for there are many letters which have no place on the wireless set. Those actually needed are :—A C D E G H I L O P R S T, thirteen in all. To these may be added a set of numerals from 1 to 0 to enable wavelengths, approximate or calibrated, to be stamped upon the holders of inductance coils. It will also be necessary to have a punch which makes a single stroke. This is used to make the minus sign and for the hyphen which separates the maximum and the minimum wavelengths of coils. It will also make the plus sign quite easily; one simply makes a horizontal mark and then a vertical one, bisecting it at right angles.

With ebonite of good quality these punches are quite simple to use. Lay the panel to be marked upon a level piece of hard wood, place the punch in its proper position, taking care to see that it is upright, and tap it sharply with a light hammer. In order to be able to use automatically exactly the right amount of force with the hammer it is as well before starting upon the panels themselves to have a little practice upon a few pieces of scrap ebonite.

Once the letters have been punched they can be filled neatly with white lead. A panel lettered in this way will make an extremely neat job.

If it is not desired to go either to the expense of purchasing punches or to the trouble of using them, certain important terminals can be marked quite plainly in a simple way. Take a 2 or 3B.A. drill and make shallow hollows in the panel close to the terminals to be marked. These can then be filled in with enamel, distinctive colours being used for the various classes. Red should always be reserved for positive and blue for negative. Grid terminals may be white and those connected to plates green. If one uses yellow to denote low-tension and brown for high-tension, battery terminals can be plainly marked by means of a pair of spots placed on each. Thus, L.T. – would be denoted by a yellow spot and a blue spot together, whilst a red spot, accompanied by a brown, would be the distinguishing mark of H.T. positive.

R. W. H.

An All-Wave Crystal Receiver

By A. S. CLARK.

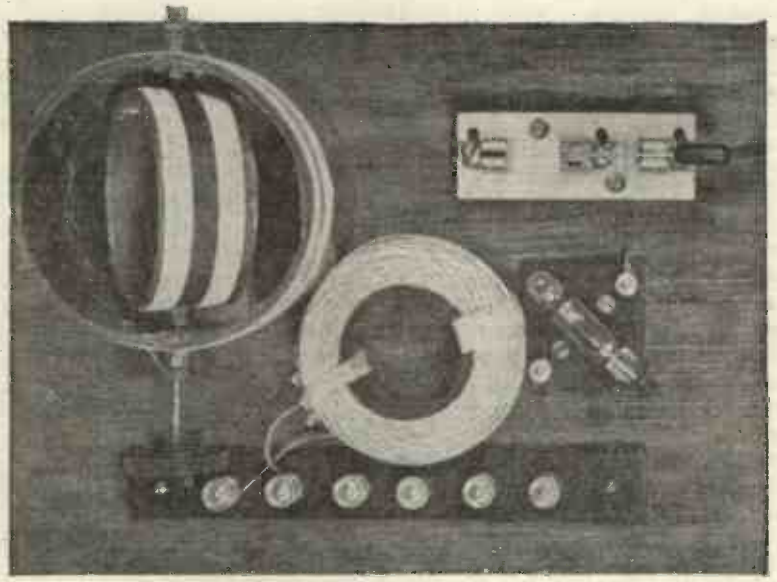


Fig. 1.—The completed instrument as seen from the top of the panel.

THIS receiver is variometer-tuned, and permits the addition of loading coils for wavelengths other than broadcasting. The components are mounted on a wooden panel 12 ins. by 9 ins. by ½ in., which is itself mounted upon battens

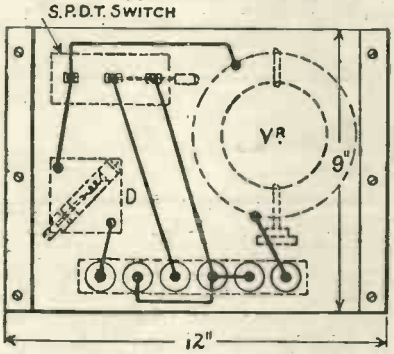


Fig. 2.—The wiring arrangements.

9 ins. by 1 in. by ½ in. This baseboard is stained and varnished before mounting the terminals and various components, and the general appearance of the receiver much depends upon care taken in the general finish of this board, and is shown in Fig. 1.

Components and Materials

One single pole single throw-over-switch, for earthing the aerial when the set is not in use.

One crystal detector, preferably of the enclosed type in order to protect the crystal from dust.

One terminal board. This may be either purchased complete or may be constructed from ebonite 8 ins. by 1 in. by ¼ in. Eight holes should be drilled 1 in. apart, the two end holes being ½ in. from the ends of the ebonite. Six terminals are mounted in the six centre holes, the end holes being used to fix the panel to the baseboard, after clearance holes have been drilled for the shanks of the terminals.

One variometer, to be either purchased complete or made up in exactly the same way as described for the aerial tuning of "A Two-valve Broadcast Receiver," described in the first issue of *Modern Wireless*. The stator consists of a cardboard tube 4 ins. in diameter by 3½ ins. wound with 25 turns of No. 26 S.W.G.-d.c.c. copper wire, whilst the rotor consists of a cardboard tube 3½ ins. in diameter by 1½ ins. wound with 24 turns of the same gauge wire. The spindles are mounted in the usual manner, and the windings are connected in series.

Six terminals.

Quantity of No. 18 tinned-copper wire, and systoflex.

Wiring

The set is wired up with No. 18 tinned-copper wire slipped into good systoflex. All joints are soldered, as are also all wires to the terminals. Fig. 2 illustrates the positions of the components, and also shows clearly how the components are wired, whilst Fig. 3 is a theoretical circuit diagram.

The Loading Coils

These coils, when used, are placed across the two terminals marked for them in the wiring diagram. The coils may be unmounted slab, basket, honeycomb, or any similar type of coil. When purchased they should be bought for wavelengths approximately 100 metres below the wavelength required, the deficiency of wavelength being made up by the variometer; it may even then be found necessary to remove some of the turns from the coils before the wavelength desired is received. Should this be the case, about five turns should be taken off at a time until the required wavelength is obtained by the tuning of the variometer. A honeycomb coil consisting of 350 turns of 22 gauge d.s.c. wire on a former 2 ins. by 1 in. was found, in the writer's case, to be about the right size for Paris.

When the set is being used for broadcast reception, for which it is primarily intended, the loading coil terminals are short circuited by means of a piece of wire or brass strap.

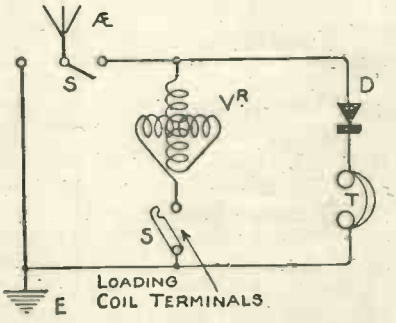


Fig. 3.—The theoretical circuit.

How to Design Your Own Set

No. VI.

By PERCY W. HARRIS, Assistant Editor.

The sixth article of a series which began in the first number of this volume.

Design of Valve Detector Units

The valve detector can be used in two different ways. We may first of all use the grid condenser and leak method, the principle of which has been described on numerous occasions in wireless books, or we may use the less well-known potentiometer method without any grid condenser. Practically any valve will give results as a detector when used with the grid condenser and leak, although some valves are much better than others in this regard. The first figure this week shows a simple detector circuit without reaction. The gridleak L is connected across the condenser G.C. The point A is shown disconnected. G.C. is usually chosen to be of a value of 0.0003 μF, although a slight variation either side of this figure does not greatly affect the efficiency of the set. The leak L is best of 1½ to 2 megohms for the ordinary receiving valve and can with a slight advantage be variable. Fortunately several good variable gridleaks are now available upon the market. In the majority of cases, however, perfectly satisfactory results will be obtainable with a fixed gridleak, but unless this is of proper value (and you can only be sure of this by buying a reliable make) the efficiency of the set will be seriously impaired.

Considerable importance attaches to where the point A is connected when the gridleak is joined up as shown. It can be joined to B_1, B_2 or D; the least efficient point is B_1, for when so connected the grid will normally have a negative bias upon it, which is not advisable for detection. Good results are often obtained by joining it to B_2, which gives the grid a normal zero potential, but in the great majority of cases it is better to connect it to D, which places a positive bias upon the grid, aiding the detection considerably.

Alternative position for Gridleak

The gridleaks can be alternatively connected between the grid and the filament (either to B_2 or to D), and indeed when the detector is used in a circuit preceded by a stage of high-frequency, using either the tuned anode choke or resistance capacity coupling, it is essential that the gridleak shall be so connected, otherwise the condenser, which in such circuits serve the double purpose of a detecting grid condenser and also a stopping condenser for the high-tension, will be useless for this latter purpose, allowing the high-tension from the plate of the previous valve to reach the grid and make it inoperative. In a circuit such as that shown in Fig. 1 there is nothing to choose in efficiency between the two methods.

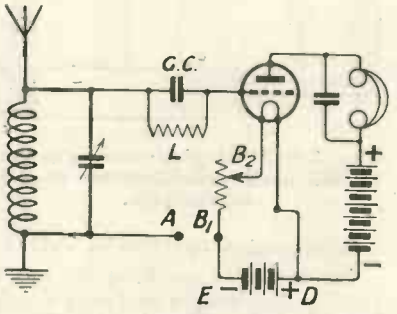


Fig. 1.—A simple valve detector circuit without reaction.

Connection of the High-Tension Battery to the Low-Tension Battery

In a single-valve circuit such as that illustrated in Fig. 1, the negative side of the high-tension battery can be connected either to D + or E − of the low-tension battery. There is some slight advantage in connecting it to D, as in this way the voltage of the low-tension accumulator or battery is added to that of the high-tension, giving a slightly higher plate potential. In all *Wireless Weekly* and *Modern Wireless* circuits the negative of the high-tension is always connected to the positive of the low-tension. It is important to point out here that whichever method is used, it must be adhered to in all units that are working together. For example, if one is using a single-valve detector circuit such as that shown followed by a note magnifier working off the same high-tension battery, the connection must be the same in both cases. As it is often desired to use a note magnifier described in *Wireless Weekly* or *Modern Wireless* with a detector described in a previous issue, sets are always so designed.

Detection by the Grid Potentiometer method

Fig. 2 shows how a single valve detector can be arranged so that detection takes place by potentiometer control of the grid. This method requires a valve specially suitable for the purpose, and works considerably better on such valves as the R4B, Q, QX and soft Dutch valves, than on the usual "general purpose" valves. Such a method cannot conveniently be used on a detector valve following a high-frequency amplifier using a tuned anode choke or resistance capacity coupling, but it can be quite satisfactorily used as the detector following a transformer coupled stage of high-frequency. Indeed when using several stages of high-frequency, it is probably the better method, for there will be far less likelihood of the grid being paralysed by very strong signals, which sometimes occurs when using the gridleak and condenser method in certain circumstances. I am at present conducting experiments in detecting valves using the potentiometer method and hope to give some interesting details later.

Detector Valves using Reaction

In the great majority of cases the designer will probably desire to use reaction from his detector valve. In such cases it is important that the reaction coil be connected between the plate and the telephones, as shown dotted in the figure and not after the telephones. The reaction coupling can be taken either on to the aerial coil or on to some other tuned circuit between the aerial and the detector if there are one or more stages of high-frequency amplification.

Choice of Reaction Coils

The size of the reaction coil is very important, and is not given the attention it deserves by the beginner. It is not possible to say the best size of reaction coil to use with a particular wavelength, for this size depends upon one or more of the following factors :—

(1) Particular valve used.
(2) Electrical properties of aerial (if used directly on to the aerial).
(3) Whether or not, when reaction is taken from the detector to the aerial, there are any stages of high-frequency preceding the detector.
(4) Whether the coil is to be tuned with a variable condenser (shown dotted in the diagram).
(5) High tension voltage used.
(6) Value of gridleak.

There are certain other factors which also have a bearing on the subject.

How to know whether you have chosen a correct Reaction Coil

You can tell whether the reaction coil is suitable by carefully noticing the effect of tightening the reaction coupling. (Make these tests outside the broadcasting hours or you will cause interference to your neighbours.) If, when you bring the reaction coil up towards the coil upon which it is acting, there is a gradual increase of signal strength and you pass into oscillation quite gradually, and if, furthermore, there is no "backlash," your coil is suitably chosen.

"Backlash" needs a little explanation. Bring your reaction coil up to your tuning coil until the set starts to oscillate. Do this very gently. Now bring the reaction coil away again and notice whether the set stops oscillating at the same coil angle as it started. If the coil is unsuitable you will find that the coil has to be withdrawn quite considerably before oscillation stops, and to start it oscillating again has to be pushed forward right past the point at which oscillation stopped when it was withdrawn. Usually this indicates either unsuitable high-tension voltage or more frequently too large a reaction coil. Too small a coil will, of course, prevent the set oscillating even when the coupling is as tight as you can make it.

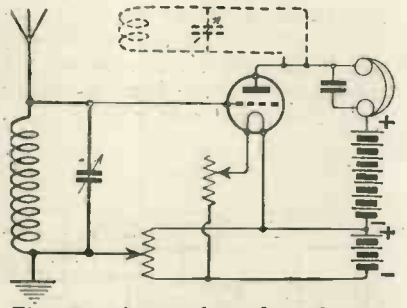


Fig. 2.—A single valve detector circuit with potentiometer control of the grid.

Oscillating properties of Valves

Some valves oscillate far more readily than others and on a much lower plate potential. The V 24 QX, Peanut and Soft Dutch valves oscillate quite readily. The V 24 valve in particular is noted for this, and will oscillate quite freely on as low as 6 volts when placed in a suitable circuit. The ordinary hard R valve requires considerably more high-tension to make it oscillate.

The Design of High-Frequency Amplifiers

While a whole series of articles could be written on the design of the high-frequency portion of a wireless receiver, the essential points can be covered in a comparatively short article.

First and foremost it is necessary to remember that if more than one stage of high-frequency is used, most elaborate precautions are required to avoid self-oscillation. In the last twelve months many special circuits have been published which aim at enabling multi-stage high-frequency amplifiers to be built and handled with ease, without the set bursting into oscillation whenever one approaches the point of accurate tuning, but none of them have become popular. The best known of all is the "Neutrodyne," which works quite satisfactorily with two stages of high-frequency, but becomes unmanageable when more stages are added. Seeing that a carefully designed amplifier along conventional lines can be made to work satisfactorily with two stages, many people have not thought the elaboration of the new design worth while.

Methods of High-Frequency Amplification

We can divide the methods of high-frequency amplification into three main divisions—transformer coupling, tuned anode coupling and resistance capacity coupling. Sub-division of each of these three headings can also be made. It is not the purpose of this article to explain the theory of wireless working, as it is presumed that the reader is well acquainted with the working of these various methods. There are several interesting sub-divisions of the transformer method, and we can list these as follows :—

(1) Tuned transformers.
(2) Aperiodic transformers.

(1) Can again be sub-divided into (*a*) tightly coupled transformers of which the primary is tuned; (*b*) tightly coupled transformers to which the secondary is tuned; (*c*) tightly coupled transformers to which both primary and secondary are tuned; (*d*) loose coupled transformers to which primary is tuned; (*e*) loose coupled transformers to which secondary is tuned; (*f*) loose coupled transformers to which primary and secondary are tuned.

Perhaps the most common form of transformer coupling is the tightly coupled transformer of which the primary is tuned. Owing to the tight coupling the two circuits act together, so that in most cases identical results are obtained, whether we tune the primary or the secondary. Owing to this tight coupling and the combined action of the two circuits, nothing is gained by tuning both.

(This series will be concluded in our next issue.)

CIRCUIT No. 17.

HIGH FREQUENCY AMPLIFICATION WITH TUNED ANODE AND REACTION.

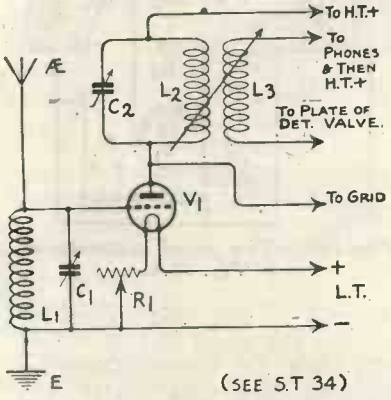


Fig. 17A.—H.F. amplification with tuned anode reaction.

Connecting Up.

Grid condenser " out." Grid-leak " out." Anode coil connected to P and XHT+. Anode tuning condenser (0.0002 μF) connected to P and XHT+. Plug No. 4 into sockets 1 and 3. *Do not plug-in the crystal detector by mistake.* Reaction coil, one lead via telephones to H.T.+ and the other to the plate of the detector valve. Short-circuiting strap across terminals 2 and 3; also across L.T.+ and H.T.− and −E and −L.T. From terminal No. 1, a lead is to be taken to the grid of the detector valve.

General Notes.

This arrangement, used in conjunction with a detector valve, forms an excellent outfit for the reception of British broadcasting. It is fairly simple to operate, and the reaction on to the tuned anode circuit will cause little or no radiation from the aerial, so that there is little possibility of interference with adjacent receiving stations. Reaction effects are obtained by increasing the coupling between the coils L_2 and L_3.

If the three coils shown are used in a three-coil holder (a method which is not recommended), the tuned anode coils should be in the centre and the A.T.I. should be kept at right-angles to it.

"WIRELESS WEEKLY" UNIVERSAL VALVE PANEL

The following are four further circuits of the twenty possible arrangements using the panel, constructional details of which are given in Vol. 3, No. 1.

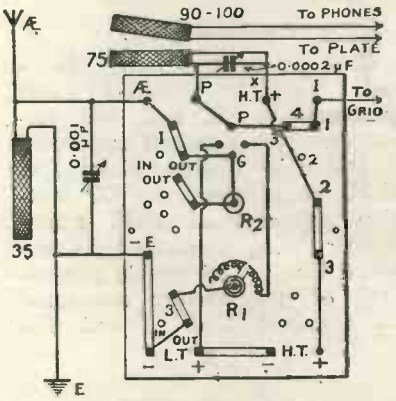


Fig. 17B. The panel connections of figure 17A.

CIRCUIT No. 18.

A SINGLE-VALVE SUPER-REGENERATIVE RECEIVER

Connecting Up.

Grid condenser " in." (If preferred the ordinary grid condenser may be plugged out and a 0.0002 μF variable condenser used as indicated by the dotted line.) Gridleak to socket marked +. Reaction coil connected to terminals P and XHT+. Telephones connected to terminals 2 and 3, and shunted by 0.004 μF fixed condenser. Short-circuiting strap between L.T.+ and H.T.−. The upper end of the special inductance coil L_1 is connected through the winding of the frame aerial (or No. 75 coil), to AE, the lower end of this coil being connected to +E terminal. Reaction coil L_2 connected to terminals P and XHT+.

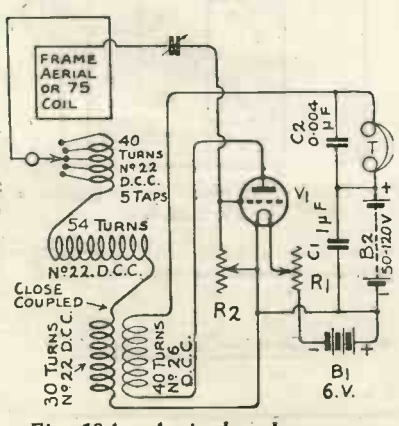


Fig. 18A.—A single valve super-regenerative circuit.

General Notes.

For full details of this type of receiver, the reader is referred to the two special articles which appeared in *Wireless Weekly*—Vol. 2—Nos. 11 and 16. Excellent results are obtainable with this arrangement, including reception from distant stations, but a fair amount of care and skill in operation is called for. Various modifications in the circuit illustrated are dealt with in the second

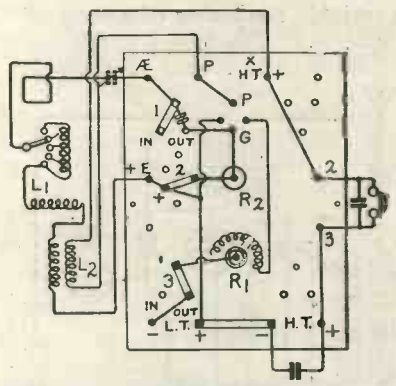


Fig. 18B.—The panel arrangement of figure 18A.

of the two articles mentioned above. Details of the inductance windings are given in Fig. 18a, the cardboard formers being 3½ inches in diameter.

We shall be pleased to consider articles from readers, of a type similar to those which have appeared. Intending contributors should make a careful study of what is required and when constructional articles are submitted, evidence of the actual working of the apparatus described, must be forwarded if required.

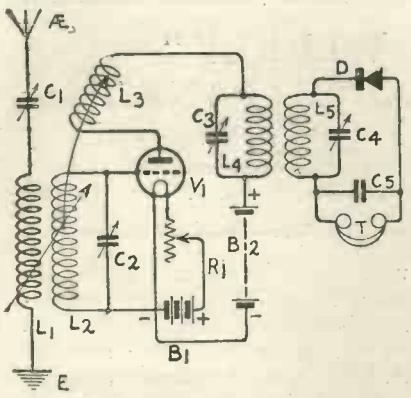


Fig. 19A.—A single-valve-crystal reaction receiver.

Connecting Up.

Grid condenser " out." Grid-leak " out." Secondary coil connected to AE and +E terminals. Reaction coil connected to P and IP (inside primary) of H.F. transformer; the OP (outside primary) of H.F. transformer being connected to terminal No. 3. IS (inside secondary) of transformer connected to terminal No. 1, and OS

CIRCUIT No. 19.

A SINGLE-VALVE AND CRYSTAL RECEIVER WITH REACTION.

(outside secondary) through the telephone receivers to terminal No. 2. Crystal detector in sockets Nos. 1 and 2. Variable condensers (two), each of 0.0002 μF capacity, across primary and secondary windings of H.F. transformer. Battery strap in position. L.T. battery connection to be reversed.

Note.—The aerial tuning condenser, shown connected in series, may be used in parallel if desired.

General Notes.

In this circuit arrangement the valve functions as a high-frequency amplifier, the amplified oscillations being passed to the crystal through the H.F. transformer, and, after rectification, to the telephone receivers. The

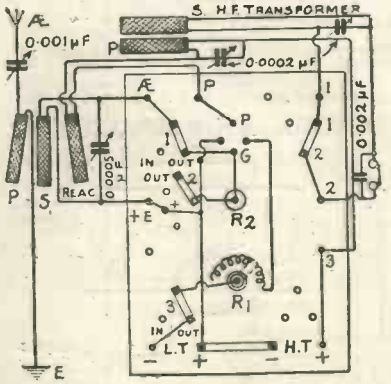


Fig. 19B.—The panel connections of Fig. 19A.

electro - magnetic coupling between the aerial and secondary coils must be loose; otherwise, radiation from the aerial will occur and may cause interference. It is also desirable that the coupling between the primary and secondary of the H.F. transformer should be loose, each circuit being carefully tuned by means of the variable condenser provided. By this means excellent selectivity is obtainable.

Connecting Up.

Grid condenser " out." Grid-leak " out " Secondary coil L_2 and coupling coil L_3 connected together in series and to terminals AE and +E, and *both* shunted by a variable condenser of 0.0005 μF capacity. The tuned anode coil L_4, shunted by 0.0002 μF variable

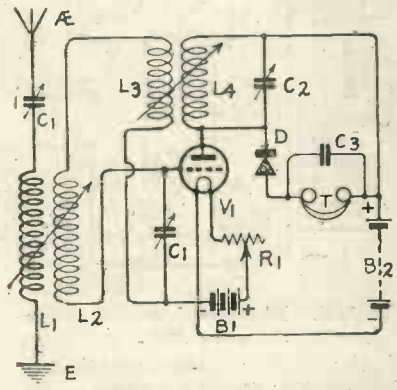


Fig. 20A.—A valve-crystal regenerative circuit.

CIRCUIT No. 20.

A VALVE AND CRYSTAL REGENERATIVE RECEIVER

condenser, has one side connected to terminal P and the other to terminal No. 3. Telephone receivers connected to terminals 2 and 3 and shunted by the usual fixed condenser. Crystal detector in sockets 2 and 3. Battery strap in position. L.T. battery to be *reversed*.

General Notes.

Reference to the diagram will show that this arrangement comprises an inductively coupled tuner, the coil L_1, together with the series condenser (0.001 μF), tuning the aerial circuit, whilst the secondary inductance is in two portions, L_2 and L_3. The tuned anode coil L_4 being inductively coupled to the coil L_3, functions as a reaction coil. The coupling between the coils L_1 and L_2 should be loose, and careful use should be made of reaction, after having ascertained that the tuned-anode (reaction) coil is connected the right way round.

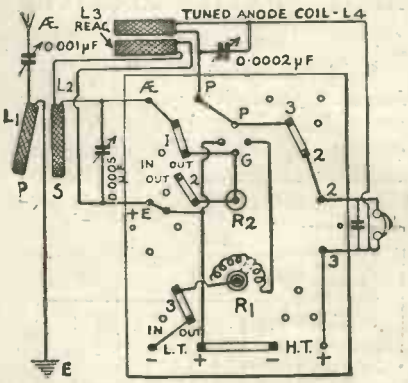


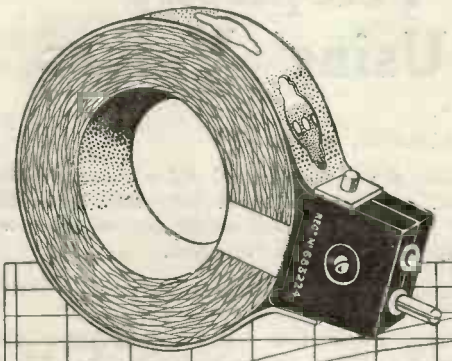
Fig. 20B.—The panel arrangements of Fig. 20A.

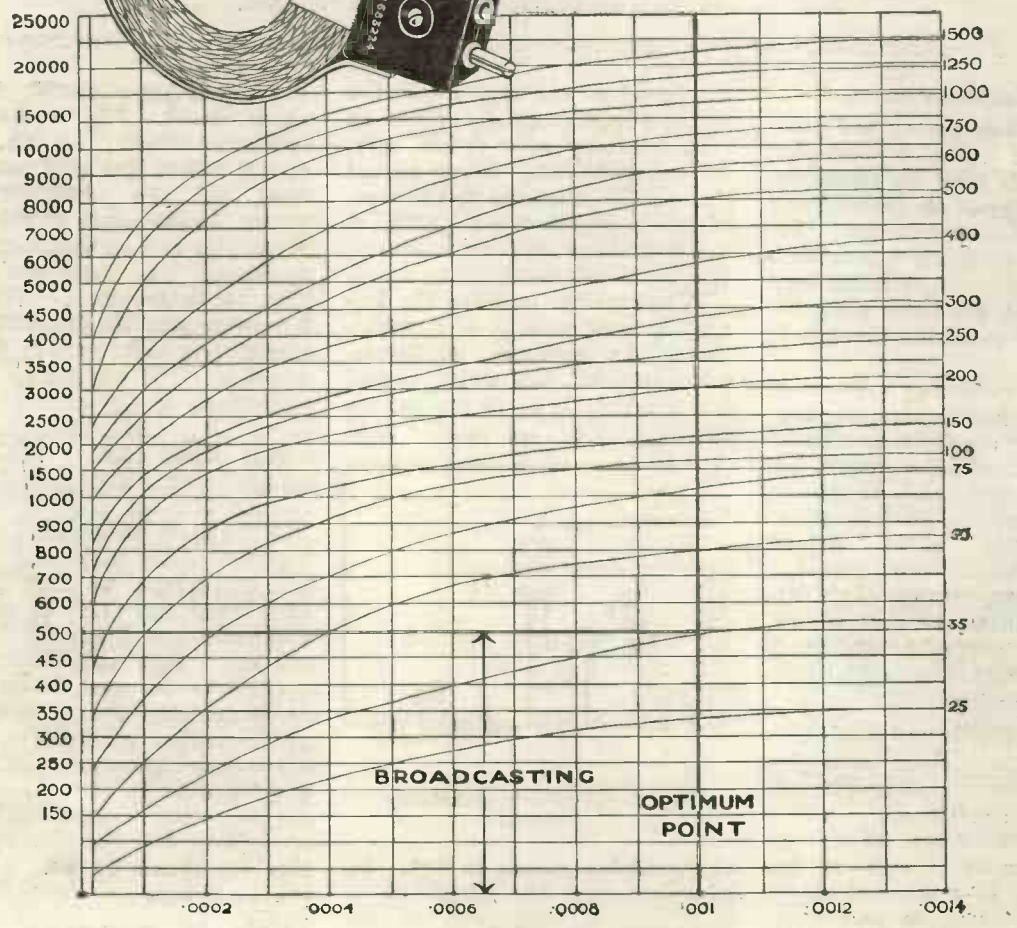
IMPORTANT NOTICE.

In our Feb. 6th issue will commence a series of Constructional Articles on the Omni-Circuit Receiver written by John Scott Taggart, F. Inst. P. Readers should not miss these important articles.

NEXT WEEK: Constant Aerial Tuning and its possibilities.

How to Choose a Honeycomb Coil





WE have received so many queries from readers asking what coil to use for a particular wavelength or wavelength range that we think the accompanying selection chart, which we publish by the courtesy of the Igranic Electric Company, will prove widely useful. The figures in the left-hand column show wavelength in metres, and those on the right the numbers of various coils. Along the bottom line are marked various capacities.

The capacity of the average amateur aerial is about 0.0003 microfarads, and if no variable condenser is in parallel with the coil, we can find the rough minimum wavelength to which the particular coil will tune in the aerial circuit by taking a vertical line from 0.0003 on the baseline to the point where it intersects the coil curve. Then a horizontal projection to the left-hand scale will give the wavelength minimum. The maximum is easily found by adding the maximum capacity of the variable condenser to 0.0003 microfarads and reading from the chart. Thus a 100 coil with a 0.0005 microfarad condenser in parallel will tune to a maximum of approximately 1,500 metres.

It must be remembered, however, that condensers have a certain definite minimum capacity which must be taken into consideration when choosing to use the bottom range of a coil.

For tuned anodes an approximate reading can be taken from the capacity of the anode condenser and the coil number on the wavelength. Loose-coupled secondaries are calculable in the same way. Reaction coils are best found by trial. Many other uses of the chart will suggest themselves to readers.

C.W. and Telephony Transmission Using Valves

No. I.

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

This is the first of a series of articles dealing with the principles of valve transmission and radio telephony. They should prove of interest, not only to those who have transmitting licences, but to a very much larger number of readers who are proposing to enter a field which is even more fascinating than wireless reception.

Introduction.

THE whole theory and practice of valve transmission depends upon an intelligent understanding of the principles of reaction and self-oscillation. The phenomena of reaction amplification and self-oscillation are very closely allied, the latter being the result of an excessive amount of reaction.

The self-oscillating valve is of very great value for receiving continuous waves and also as a transmitter of continuous waves for radio-telegraphy and telephony. Since all these applications of the three-electrode valve depend essentially on the same principle of transferring energy from the anode circuit to the grid circuit, we will briefly consider the broad idea, and later deal with individual applications.

General Principles and Analogies.

There are several analogies which have been used at different times to explain the action of the transference of energy from the anode circuit to the grid circuit of a three-electrode valve. We can, to commence with, consider an ordinary flywheel which may be set revolving. The wheel, if it is not connected to an engine in any way but is simply mounted on its bearings, will rotate for a time and then come to rest. We could prolong the period during which the flywheel rotates by lessening the resistance or friction of the bearings and the resistance of the air. We could, for example, spin the wheel in a vacuum and mount it on practically frictionless bearings. There is another way, however, in which we could keep the flywheel spinning, and that is by frequently giving it impulses at, perhaps, every revolution. If the impulses are very weak, the flywheel will gradually come to rest, but only after it has spun for a considerably longer period than would otherwise be the case. If strong impulses are given to the flywheel at suitable intervals, the wheel will continue spinning.

We may also consider the frequently used analogy of a pendulum. An ordinary pendulum, when released, will swing to and fro, the amplitude of the swings getting smaller and smaller until

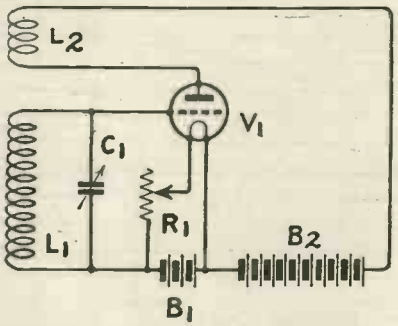


Fig. 1.—A simple oscillatory circuit.

the pendulum comes to rest. If, now, we give the pendulum a slight tap at each end of its swing, we will enable it to go on swinging for a much longer period. If the taps are correctly timed, and are sufficiently strong, the pendulum will go on swinging indefinitely. A very similar phenomenon is met with in a clock having a pendulum; the spring of the clock provides the power which swings the pendulum, and the pendulum itself times the impulses given to it through the escapement; these impulses keep the pendulum in motion.

In a three-electrode valve we have an input side which is a circuit connected across grid and filament, and an output side, which contains a circuit in the anode circuit. Fig. 1 shows an oscillatory circuit, L1 C1, connected across the grid and filament of the three-electrode valve. In the anode circuit is an inductance coil L2 which may be aperiodic. The usual anode battery, B2, is provided. Now we have seen that the input currents applied to a valve may be greatly amplified. If we set up a few oscillations in the circuit L1 C1 these will normally die down after a very short time. While the oscillations are flowing in the circuit L1 C1, the potential of the grid is being made positive and negative alternately and amplified oscillations of exactly the same frequency but of greater amplitude are produced in the coil L2. This coil L2 is now coupled to L1 and induces its oscillations into the circuit L1 C1, and since the oscillations in L2 are much stronger than the original ones in L1 C1, these original oscillations will be strengthened by the ones induced into the circuit by L2. If the coil L2 is coupled the right way round, the grid when it is being given a positive potential by the original oscillations, is also being given a stronger potential of similar sign by the E.M.F.'s induced by L2 into L1 C1. The same, of course, happens when the grid is being given a negative potential by the original oscillations. By coupling the anode circuit coil L2, which is sometimes known as the "tickler" coil, retroactor coil, reaction coil, or reactance, to the inductance L1, the weak original oscillations in the circuit L1 C1 will be strengthened by the very much larger oscillations which are superimposed on them, and which are exactly in time with them.

A Stable Crystal Detector

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

THE disadvantage of most detectors of the usual type is that the adjustments are not sufficiently positive or sufficiently firm to make the detector very stable. The smallest knock, or even a slight jar, is often sufficient to throw the whole thing out of adjustment, which is most annoying after one has laboriously found the sensitive spot in some crystal such as galena, in which real good points are few and far between. It is particularly important in valve-crystal combinations that the detector should be stable, otherwise the set may be troublesome to operate. The detector about to be described has been used most successfully as a rectifying component in "straight" sets containing from one to five valves as well as in dual amplification circuits of the ST100 type.

It is quite simple and not in the least expensive to make up in the home workshop, and those who construct it will find that its superior stability amply compensates for the time spent in its construction. The base is a piece of ¼-in. ebonite 3½ in. in length by 2 in. side. Upon this are mounted, as seen in the figure, a pair of endpieces made from ¼ in. or ⅜ in. ebonite. That on the left should be 3 in. in height, that on the right 1¾ in. Both are 1½ in. wide. The endpieces are best fixed by means of two 4B.A. counter-sunk screws ¾ in. in length driven into each from below. In the middle of each endpiece, 1¼ in. from the bottom, is drilled a ⅜ in. hole, into which a standard condenser bush is inserted, as shown in the figure. These are to act as bearings and as thrust blocks for the screwed rod. Two terminals are mounted on the left-hand end of the base, as shown in the drawings.

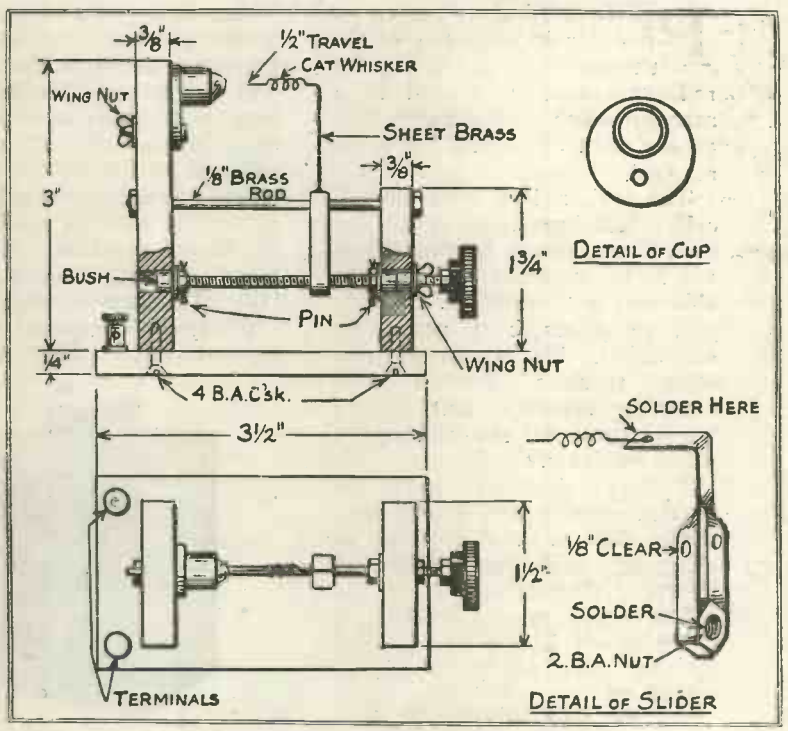
The screw which moves the slider is a 3-in. length of 2B.A. screwed rod. It is retained in position by two nuts, through each of which and the spindle a pin is driven. To fit these pins is a much easier job than would appear at first sight. One simply finds the correct position of the nut, makes a punch mark in one of its faces and drills a small hole—6B.A. clearance would be quite suitable. An alternative way of fixing the nuts is to make use of a setscrew in each in the way which has already been described in these notes. To take up any play it is as well to place a spring washer, sandwiched between two flat washers, between these nuts and the rims of the bushes. This spring washer will automatically take up any backlash.

The guide rod is a length of ⅛-in. round brass rod, each end of which is threaded and provided with a nut.

To make the slider, obtain a large-sized 2B.A. nut, either hexagon or circular in shape. The latter is preferable, since it allows more room for soldering operations. Cut out two strips of sheet brass ¼ in. wide, solder one to either side of the nut, bend them as shown in the figure, and solder them together. Then bend over at right angles and solder on a catwhisker. Through the two brass strips is drilled an ⅛-in. hole to fit the guide rod.

The cup is made quite easily in the following way. A standard cup is soldered to a disc of sheet brass about ⅞ in. in diameter, a 4B.A. clearance hole being drilled in the disc, as shown in the drawing. The cup is now mounted on the left-hand support by means of a 4B.A. screw provided with a wing nut. As the eccentric pivot allows the cup to be swung from side to side the surface of the crystal can be pretty thoroughly searched by the catwhisker. Once the sensitive spot has been found, the wing nuts holding both the cup and the travelling screw are tightened down and the detector is as firmly fixed as could be desired. It will be found that it will stand quite a considerable amount of hard usage without being thrown out of adjustment.

Leads from one of the bushes in which the traveller screw revolves, and from the crystal cup, are taken to the two terminals. The finished detector may be mounted upon a piece of ½ in. hard wood a little larger than its base.



Constructional details of the detector.

The " Exide " 3CZ5 Battery.

The Charging and Care of Accumulators

By R. Stansfield, A.M.I.C.E.

PROBABLY not one accumulator in each ten of the thousands in use to-day for radio purposes is treated in a manner which allows more than 50 per cent. of normal life to be reached.

The writer has seen several cells which have been in use less than three months in a condition not to be expected with reasonable care in three years. Muddy positive plates, bent negatives, sulphation, low capacity, and other troubles develop with alarming rapidity, and add a heavy item to the upkeep of valve receivers.

Battery diseases may be divided roughly into two classes, those due to the method of charging, and those following improper discharge.

The usual system of battery charging—if it can be dignified by the name of system—is to couple up

> " great cells, small cells, lean cells, brawny cells, brown cells, black cells, grey cells, tawny cells "

all in a line, positive to negative, and then to join in series with a d.c. supply, and a lamp or two which are assumed to pass a suitable current. This practise might have been specially devised to develop any latent troubles: it forces the same current through plates of all sizes and in all conditions. The battery which it chances to suit is the exception.

An accumulator plate under charge is somewhat similar to a lighted incandescent mantle. There is a most efficient supply pressure in each case, and higher pressures decrease the efficiency and lead to early breakdown. If long battery life is desired it is essential that the cells should be charged at definite charging currents, an average value being one ampere to each 24 square inches of useful surface of positive plate. Thus, a 6-volt accumulator of 30 (actual) ampere hours' capacity is composed of three separate cells. Each may have

The " Exide " HZ4 Cell.

three positive and four negative plates, say, 3¼ ins. by 4 ins. The total useful area of positive plates in each cell is, then, fourteen times six, there being six working surfaces for the three positive plates. This gives a total of 84 square inches, which will carry a normal charging current of 3.5 amperes.

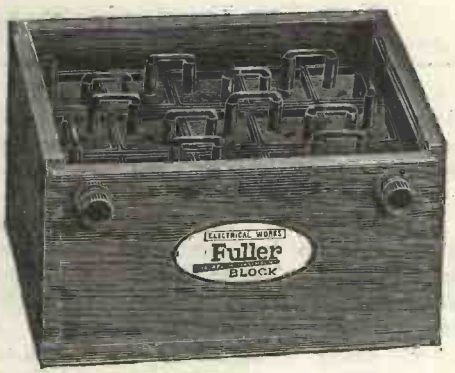
A battery, standing idle, will show a voltage reading of approximately two per cell, and practically no difference can be detected whether it is in an almost fully charged, or in a nearly discharged, state. It is only possible to determine the condition when current is flowing.

As an approximate guide it may be taken that the voltage falls to 1.8 per cell when the battery is fully discharged and current is being used at one-tenth of the actual ampere-hour capacity, i.e., at 3 amps. for a 30 ampere-hour (actual) battery. Three amperes current corresponds approximately to the use of four valves of the " R " type. If lower currents are being used the voltage should not be allowed to fall as low as 1.8 per cell. When only one valve is in use on a 30 ampere-hour battery a voltage of 1.9 per cell, or 5.7 for the three cells, indicates full discharge.

Batteries should be selected of such a size that the current demand is never more than one-tenth of the actual capacity. If it averages one-twentieth so

The " Fuller " 4-volt Battery.

In the following article the author explains how to overcome many of the difficulties experienced by users of either L. T. or H. T. Accumulators.



The " Fuller " Block H.T. Battery.

much the better. These current rates are by no means the maximum which the cells can stand, but they are such so as to keep the times between successive charges up to practical values.

With regard to high-tension accumulators which discharge at currents measured in milliamperes only, the voltage fall during discharge is so small that it is no guide to condition, and these cells should be recharged at regular intervals of, say, three weeks to keep them in good order. Such batteries will not, as a rule, require very long charges except in cases where power valves are in use and comparatively heavy discharge currents result.

Reverting to the question of suitable charging rates, it has been stated above that the charging current should have a definite value dependent on the area of the plates in any one cell. The simplest method is to charge at the specified normal rate throughout the charge, but this will take about ten hours if the battery has been fully discharged.

The " N.S." Battery.

It is frequently desirable to reduce this time, and if a little attention can be given to voltmeter readings during charge an appreciable reduction can be made by passing current through at twice the normal rate until the voltage reaches about 2.3 per cell, that is, about 7 volts for a 6-volt battery. At this voltage the current must be reduced and charge completed at normal rate.

" N.S." Battery of another type.

Full charge is indicated when both the positive and negative plates are gassing freely with normal current flowing. The cell voltage will then be about 2.5 to 2.55. It varies considerably with different makes, but complete charge is always indicated if the cells gas and the voltage does not rise for at least an hour with a steady charging current.

The cells should rarely be allowed to gas freely for as long as one hour at a time. Prolonged overcharge of this description does not increase the battery capacity; it merely breaks up the positive plates. On the other hand, if the plates are never allowed to gas at all they are liable to deteriorate and their capacity and condition will suffer.

A word of warning.—Voltage readings after the charged battery has been disconnected are meaningless. They may be anything between 2.4 and 2.1 for one and the same cell, depending on the time which has elapsed since the charge was finished and other minor circumstances.

The foregoing notes cover the main points to be observed during charge and discharge; but in addition to these there are other details requiring attention. There should not need to be much time spent keeping the battery case and terminals clean, but the careless treatment meted out by many charging establishments results in rapid corrosion of connections, acid-covered cases, and also loss of acid.

(To be concluded.)

A Double Valve Holder for Experiments

IT is always rather a difficult business to decide which of a pair of valves under test is the better performer, especially if there is not much to choose between them. To try them in turn in the same holder is rather a fiddling business if one is sufficiently cautious to disconnect H.T. + every time and a moment of mental aberration may make it rather an expensive one if one does not!

For this purpose the writer made up the little double holder which is seen in the first sketch. It plugs in the ordinary way into the legs of the valve stand, carrying the pair of valves under trial in its two sets of sockets. On the crosspiece is mounted a midget-sized double-pole change-over switch, by means of which either valve may be thrown into circuit instantly.

The wiring is seen in Fig. 2. It will be noticed that the grid and the positive end of the filament of each valve are shown permanently connected to the corresponding pins of the holder, whilst the plate and filament negative connections are taken to the middle points of the switch.

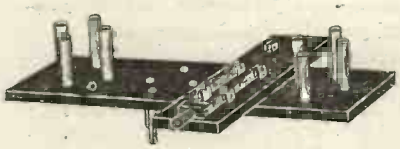


Fig. 1.—The double valve holder.

It will be seen that when the switch is opened all three circuits of both valves—grid, plate and filament—are broken. If it is turned down away from you the left hand valve (V 1) is brought in; if towards you the right hand valve (V 2). It also acts as a safety device when pairs of valves are being changed, for if it is left open no amount of absent-

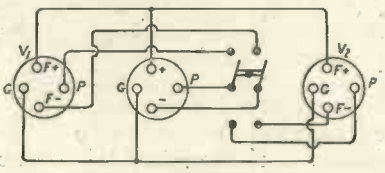


Fig. 2.—The wiring.

mindedness can result in the burning out of the valve.

To make the holder, obtain two pieces of ¼ in. ebonite, one 5 9-16 in. by 1 in., and the other 2 in. by 1 in. Join them together in the positions shown in Fig. 3. A very neat job can be made by halving them together; that is by cutting in each a slot 1 in. wide and ⅛ in. deep. This can be done by making cuts 1 in. apart with a hacksaw and subsequently removing the ebonite between them to a depth of ⅛ in. with a flat file.

Fig. 3 also shows the drilling lay-out. Though actually the measurements of the distances between valve pins are metric, the lay-out in fractions of an inch shown answers excellently, the holders being on the tight side, which is all to the good. Those who wish to save themselves the trouble of making accurate measurements should use the paper templates which were given with a recent issue of *Modern Wireless*.

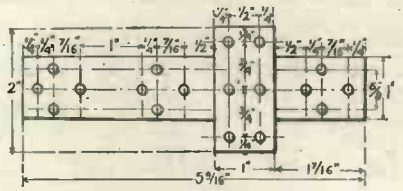


Fig. 3.—Panel dimensions.

Separate legs should be used for the valve seatings, and not ready-made holders, with sockets contained in an ebonite moulding. One wants to give valves under test every chance, and there is an appreciable amount of capacity, which is of course undesirable, in ebonite holders.

All holes are 4B.A. tapped, legs, prongs and switch clips being screwed in and not secured with nuts—again to avoid undue capacity.

The switch can be bought complete for 2s. 3d. from advertisers in *Wireless Weekly*, or it may be made at home in the way that has already been described in these notes.

Wiring is done beneath the holder, No. 20 gauge tinned copper being used. All connections are soldered and the wires are left bare. Great care should be taken to keep the grid and plate leads as far apart as possible.

R. W. H.

Broadcasting in Free State Ireland

THE Postmaster-General of the Irish Free State thinks it desirable to again give notice that without a licence granted by him no person is allowed to install there any apparatus for wireless telephony, and to warn those who may be unlawfully receiving wireless messages of the penalties to which they are liable.

Under the Irish Free State Wireless Telegraphy Act a person who establishes a wireless station without a licence may be liable on summary conviction to a penalty of £10, and on conviction on indictment to a fine of £100, or to imprisonment for a term of twelve months. In either case the apparatus would be liable to be forfeited.

Licences are only granted at present to experimenters who can satisfy the Postmaster-General that they have in view some object of scientific value or general public utility, and that they are competent to carry out experiments in wireless reception.

Pending the completion of the arrangements for the establishment of a broadcasting station in the Irish Free State, no licences for broadcast reception are being issued in Ireland outside the six Northern Ireland Counties. The delay in issuing these is causing much grumbling, especially since the country is now enjoying peaceful conditions.

"WIRELESS WEEKLY" FREE GIFT SCHEME

THE present issue concludes the six special numbers, and therefore marks the conclusion of our FREE GIFT SCHEME whereby we offer free gifts, up to 5s. in value, to all readers who comply with certain simple conditions.

THE CONDITIONS.

Upon another page will be found a coupon (FREE GIFT COUPON, No. 6), which should be cut out and sent with the five coupons from the five previous numbers. For the benefit of new readers, a *seventh* coupon will appear in the next issue and will be accepted in lieu of Coupon No. 1. The six coupons, together with an order for any *one* of the Radio Press series of handbooks named below, are to be sent in an envelope marked "COUPON" to Radio Press, Limited, Devereux Court, Strand, W.C.2, accompanied by a postal order for *one-half of the list price of the book chosen,* plus 2d. for postage.

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	Price
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A Selective Broadcast "Pea-nut" Receiver

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

THE pea-nut type of dull-emitter valve oscillates with the greatest ease on small plate voltage, and works exceedingly well in American types of single-valve circuits which use a form of electrostatic reaction. A curious type of single-valve circuit, suitable for use, in particular, with the pea-nut dull-emitter, is one with which the writer has been experimenting recently and is shown in the diagram, Fig. 2.

On analysis it will be seen that the circuit is derived from the Air Force short-wave receiver, the De Forest Ultra-Audion circuit, and the type of coupling devised recently by the writer for stable high-frequency amplification on short waves (the "series-tuned-anode" arrangement). The inductances described in recent numbers of *Wireless Weekly* in connection with the latter (*Wireless Weekly*, No. 19, p. 645, No. 21, p. 720), are specially suitable for use in this circuit, the type and values required being very similar.

Besides remarkable selectivity for a direct-coupled circuit, approaching that of the Reinartz tuner without the loss of signal strength associated with the original form, and the unusual feat is achieved of tuning a direct-coupled circuit on a P.M.G. aerial over the whole broadcast range of wavelength by means of a 0.0001 μF parallel variable condenser, or from 320 to over 700 metres with one of 0.0002 μF (with low minimum).

The tuning is very insensitive to aerial characteristics, and is extremely sharp, while the capacity reaction is nearly independent of wavelength, needing but small adjustment in order to keep just below oscillation point, whilst tuning over the whole range. Thus, in the lower range, the addition or disconnection of a P.M.G. aerial of 0.0003 μF capacity merely makes a change in wavelength of some 15 metres, and is hardly noticeable at all near the other end of the range. In the latter respect the circuit is markedly superior to the original De Forest Ultra-Audion circuit in ease of tuning.

It is well known that, with the Ultra-Audion circuit, tuning is a matter of juggling the two adjustments (wavelengths and reaction), by a two-handed simultaneous control, each affecting the other continuously. This at least makes the present circuit far more suitable for the reception of broadcasting by other than an expert operator—though it is not suggested here that it is a particularly easy one to set up It is offered here rather as a theme for the genuine experimenter, who boasts of some form of wavemeter to guide him in uncharted seas of unfamiliar inductance and capacity values.

The main point of the circuit is the A.T.I., other components being more or less standard. The radio-choke can be of the small frame-aerial type frequently referred to recently in *Wireless Weekly* (No. 19, p. 643, etc.), with ¼ lb. No. 26 S.W.G. d.c.c. wire wound in six ¾-in. saw-slots in a former of three-ply wood 6 ins. by 1¾ ins.—or can be a plug-in coil of low distributed capacity, No. 200 or 250, or a simple solenoid single-layer inductance of about 250 turns and ordinary size, the two last-named being not so critical.

For the A.T.I., the best results were obtained with a frame-aerial coil of No. 18 S.W.G., d.c.c. wire, having altogether 90 turns (30 turns in each of three wide saw-slots in the usual 6-in. wooden "X" former, slots being 2 ins. deep, and spaced about ¼ in. apart). The amount of wire may seem excessive (nearly 1 lb.), but the number of turns must be large to tune to the desired wavelength on the

Fig. 1.—A g the ins

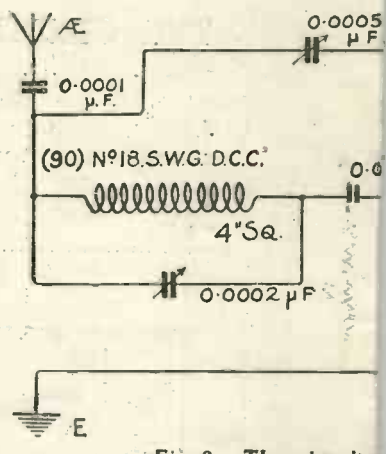
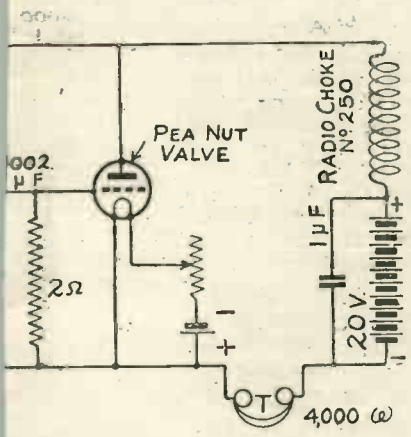


Fig. 2.—The circuit

Fig. 3.—The panel and coil r

A compact and efficient single valve set for which the only external items required are a 2-volt accumulator or large dry-cell and the usual aerial-earth connections.

eneral view of trument.



arrangement employed.

moved from box to show wiring.

extremely small capacities available.

The 0.0002 (or 0.0001) μF variable condenser must have a *low-minimum* capacity. Thus a 0.0005 μF condenser of an old type had so much minimum capacity that it would not tune down to 350 metres at all on such a coil, whilst another, 0.0001 μF, on the same coil, tunes from 320 to over 500 metres.

A *large* variometer of the type made expressly for intervalve or secondary circuit use, with some 160 turns of wire, can be substituted for this coil and its tuning condenser, and gives quite good signals and sharp tuning; but on account of the fine wire necessarily used, and distributed capacity, the actual signal-strength is markedly inferior to that obtained with the No. 18 coil and small parallel condenser. The type of variometer described in *Wireless Weekly*, No. 21, p. 720, is quite suitable here, if wound with about 150 turns of No. 20 S.W.G., d.c.c.

The circuit can be operated with a "capacity" earth, *i.e.*, no actual earth connection, and probably would be suitable for use with electric-lighting wires as aerial at a short range, though this last has not actually been tried.

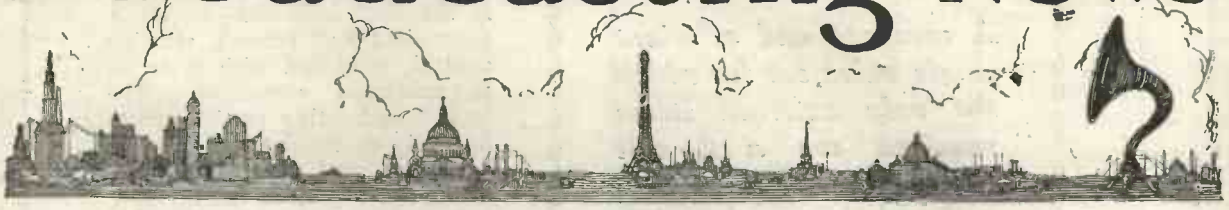
As the tuning is practically "wavemeter," *i.e.*, largely independent of aerial characteristics, this arrangement, if set up in a small box (with the five flash-lamp batteries for H.T. and one large dry-cell for L.T.), provides a handy heterodyne wavemeter as well as a sensitive receiver.

Actual results in reception are extremely encouraging, though nothing of a "super" effect is in the least indicated—merely a convenient and smooth reaction control, combined with a circuit of minimum capacities. The local broadcasting station comes in nicely on the loud-speaker (at 13 miles), and most, if not all, of the other stations can be read, some at considerable strength, *e.g.*, Glasgow (in London), as well as numerous experimental transmissions. London can be cut out completely 20 metres either way, even without much reaction.

Once set up, it is a handy and satisfactory one-valve circuit for use with one or two pairs of headphones, and has a considerable receiving range. In a receiver constructed along these lines, a Baty two-plate condenser was found very satisfactory as reaction condenser, while a J.B. 0.0002 μF variable condenser gave the low minimum required as aerial-tuning condenser, and a Microstat filament resistance gave good control. The fixed condensers used were of Grafton make; grid-leak by Dubilier; the valve was a Mullard Wecovalve; and a Siemens Bros. No. 948 dry-cell proved satisfactory for L.T. supply. Other types of soft detector valves could also be used, with suitable L.T. and H.T. valves.

With the small instrument illustrated, at a distance of about 45 miles west of London, both Cardiff and Bournemouth, as well as London, came in readily audible on two sets of 'phones, with careful tuning—though the location was a notorious "blind-spot" for the latter station. Birmingham also came in well. Hand-capacity effects, however, were noticeable to an extent which called for anti-capacity handles on both A.T.C. and reaction condenser. Increasing the aerial series condenser to 0.0002 μF and cutting down the A.T.I. in proportion improved matters somewhat in this respect. The selectivity obtained was quite extraordinarily high, which in many cases will amply compensate for the somewhat tricky tuning.

Broadcasting News



LONDON. — Monday, January 7, ushered in the Grand Opera Season, and listeners-in had the very great pleasure of hearing the 3rd Act of "Die Meistersingers," rendered by that splendid organisation, the British National Opera Company. The music, under the baton of the Conductor, Mr. Eugene Goossens, was delightfully rendered and came to us full of life and sparkle, and the singing of the artistes seemed remarkably good. Mr. Robert Parker's unimpeachable enunciation, coupled with his fine round notes, clearly made every word understandable, and his excellent appreciation of the *rôle* of Hans Sachs made his long declamatory and admonitory passages grand, and brought into bold relief the subtleties of the great Wagner's orchestration in the 3rd Act of this opera. And, of course, it is self-evident that Tudor Davies' fine rendering, among other things, of the "Preislied" was quite on a par with the performance of Mr. Robert Parker, and last, but not by any means least, we thoroughly enjoyed the exquisitely sweet voice of Miss Miriam Licette as "Eve." Our one great regret, when we turned off our valve at 11.30, was that we had not been present to hear the preceding acts.

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All kinds of rumours have been floating round as to what Capt. West of the B.B.C. has been doing down at Biggin Hill. The interesting theory was advanced that he was attempting to relay a concert to South Africa. Further, to relay other concerts to Australia. Needless to say, the answer to both of these statements is in the negative. What Capt. West has been doing is erecting a new aerial at Biggin Hill, and perfecting his receiving apparatus in order to better receive American programmes for the purpose of relaying them in future.

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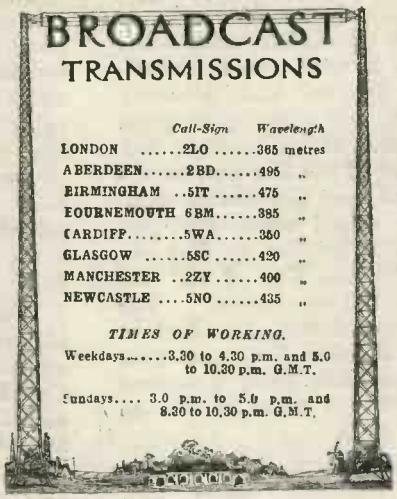
With regard to the statement well authenticated that 2LO has been heard several times in South Africa, the interesting point has been raised that long-distance transmissions are more likely to be successful in a north or south direction. It so happens, however, that just about the time 2LO was heard in South Africa it was also heard in Vancouver, which is at least 5,000 miles



West. Therefore there does not seem to be very much in the theory of the north or south direction.

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Forthcoming Events

JANUARY.

16th (WED.).—Acts I and II of Opera "Aida," relayed from Covent Garden. Dance Music.

17th (THURS.).—Orchestra. Miss Gwen Godfrey, soprano. Mr. Joseph Farrington, bass. Mr. Jack Millard, entertainer.

18th (FRI.). — Orchestra. Mr. Keighley Dunn, tenor. Christmas Party. Dance Music.

19th (SAT.).—Orchestra. Mr. Gibbon Loweden, baritone. Mr. Bernard Turner. Mr. Charles Wreford, entertainer. Dance Music.

20th (SUN.).—An Organ Recital by Mr. William Wolstenholme, the blind organist, will be relayed from the National Institute for the Blind. Miss Margery Phillips, contralto. Miss Constance Izard, violinist. Mr. William Anderson, bass. Hymns and an Address by Dr. Lavington Hart.

21st (MON.).—Mr. John Collinson, tenor. A Comedian and a Baritone, both of whom shall be nameless, in an argument.

22nd (TUES.).—The Roosters' Concert Party. Talk on "Technical Topics" by Capt. Eckersley. Act II of the Opera, "Tristan and Isolde," relayed from Covent Garden. Dance Music.

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ABERDEEN.—Auld Yule (5th January) was celebrated at 2BD in traditional style with Scottish song and story and the requisite bowls of "sowens." Much of the success of the evening was due to Mr. Duflin Scott, a well-known exponent of North-Eastern doric, who proved to be in his breeziest vein and kept both listeners and entertainers in the best of spirits.

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A request made by Mr. R. E. Jeffrey, Station Director, at the conclusion of the programme for opinions on the entertainment led to a shoal of letters of approval, with requests that another of the kind should not be long delayed.

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Forthcoming Events

JANUARY.

16th (WED.).—S.B. from London. Orchestra. Dance Music.

17th (THURS.). — Patriotic Songs and Airs. The Aberdeen Battalion Boys' Brigade Band. Miss Tina Macintyre, soprano. Mr. Hugh Munro, baritone.

18th (FRI.).—Mozart Night. Miss Isobel Shaw, soprano. Mr. A. Simpson, pianist.

19th (SAT.).—Students' Night—Songs and Choruses. Orchestral Selections.
20th (SUN.).—Rev. John A. Martin. John Knox, U.F. Church Choir.
21st (MON.).—S.B. from London.
22nd (TUES.).—Julian Rosetti's Ensemble. S.B. from London.

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BELFAST.—It seems to be generally believed by many people that the B.B.C. intend opening a Belfast station next month, and no doubt this credence has been fostered by certain data in the *Irish Radio Times*. However, the Belfast correspondent of *Wireless Weekly* is officially informed by the Ministry of Commerce for Northern Ireland, the Parliament controlling wireless affairs, that nothing whatever is definite, either as to the proposed station's site or date of the opening. Meanwhile, is the Belfast Branch of the Radio Society going to remind the Northern Parliament of this want?

BIRMINGHAM.

Forthcoming Events

JANUARY.

16th (WED.).—S.B. from London.
17th (THURS.).—S.B. from London.
18th (FRI.).—Pianoforte Lecture-Recital by Mr. Wilfred Ridgway.
19th (SAT.).—Popular Orchestral Night.
20th (SUN.).—Rev. T. E. Titmus. Miss Emily Broughton and Station Repertory Chorus.
21st (MON.).—S.B. from London.
22nd (TUES.).—The Greys Concert Party. S.B. from London.

Broadcasting by wireless a description of the play, at the recent France v. Scotland International Rugby Match, from the ground through "Radiola."

BOURNEMOUTH.—From a London listener comes the news that the recent concert given at Bournemouth by the Royal Air Force Band, and simultaneously broadcast from 2LO, was the purest transmission heard in London for some months. This is a delicate compliment to the engineering staffs at Bournemouth and London.

Among other interesting items from Bournemouth must be mentioned the Dickens recital by Major Stanley How. His rendering of "Nicholas' chastisement of Mr. Squeers" was positively delightful, and it is to be hoped that another such treat is in store for Bournemouth.

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Forthcoming Events

JANUARY.

16th (WED.).—S.B. from London.
17th (THURS.).—The Bournemouth Welsh Male Voice Party.
18th (FRI.).—Third Symphony Concert. Russian Night.
19th (SAT.).—The Blue Lagoon Dance Orchestra.
20th (SUN.).—Rev. James O'Connell, Address. Richmond Hill Congregation Church Choir.
21st (MON.).—Entire programme relayed from London.
22nd (TUES.).—S.B. from London.

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GLASGOW. — The Glasgow broadcasting station is to give a special Burns Night on January 25, and a most interesting announcement is made in connection therewith. From Poosie Nancy's Inn, the famous

resort of the poet and the original of the inn, "The Jolly Beggars," will be transmitted as part of the programme of the evening. At this inn the Mauchline Club meets annually to celebrate the day of the poet's birth, and some of the members will take part in the broadcasting. The historic inn will be connected to 5SC studio by means of a landline, and a programme of recitations and songs in the Ayrshire dialect will be given.

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Forthcoming Events.

JANUARY.

16th (WED.).—S.B. from London.
17th (THURS.).—Orchestral Night.
18th (FRI.).—Mr. Percival Steeds, B.A., in "David Copperfield."
19th (SAT.).—Orchestral Night.
20th (SUN.).—Rev. G. W. Taylor, M.A.
21st (MON.).—S.B. from London.
22nd (TUES.).—Band of H.M. Royal Scots Fusiliers.

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MANCHESTER. — Considerable interest has been taken in the experiments recently made by the B.B.C. and also the Metropolitan Vickers works at Trafford Park in relaying transmissions from KDKA, the Pittsburg works of the Westinghouse Company. These efforts have met with varying success; sometimes the atmospherics were so bad as to make relaying impracticable, but occasionally quite good results were obtained, both speech and music being clearly heard. An interesting comparison was possible on one occasion when 2ZY and 2AC broadcast simultaneously the same concert, the former on 375 and the latter on 400 metres, each station receiving the KDKA transmission independently. It was possible to switch over from one to the other in the simplest manner and contrast the results obtained. 2AC was considerably stronger than 2ZY, but the latter far excelled in quality and was much easier to understand.

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Forthcoming Events.

JANUARY.

16th (WED.).—3.30, Concert. 6.30, Organ Recital. 8, Special Choral and Orchestral Night. S. Coleridge Taylor's "A Tale of Old Japan" and Beethoven's Choral Symphony. Orchestra and Opera Chorus.
17th (THURS.).—2ZY Trio. 6.40, German Talk. 8, Concert. Mr. T. H. Morrison, solo violin. Miss Kathleen Hartley, contralto. Miss Molly Gray, soprano. Mr. Victor Smythe. S.B. from London.
18th (FRI.).—3.30, Concert. 6.40, French Talk. 8, Garner Schofield Dance Band. Talk by Mr. T. A. Coward, M.Sc., on "Bat Hunting in Winter."
19th (SAT.).—3.30, Oxford Picture House Orchestra. 6.30, Organ Recital, Piccadilly Picture House. 7.30, Concert by The Jesters Concert Party. 8.20, Mr. Victor Smythe. S.B. from London.
20th (SUN.).—3, Concert S.B. from London. 8, Young People's Talk by Mr. S. G. Honey. 8.35, Talk by the Very Rev. Mons. F. Gonne, M.A. Miss Emily Seddon, soprano. Miss Amy Howell, elocutionist. Mr. Harry Hopewell, baritone. Mr. Samuel Spurgeon, solo violin.
21st (MON.).—3.30, 2ZY Orchestra. 6.40, French Talk. 7.30, S.B. from London.
22nd (TUES.).—3.30, 2ZY Trio. 7.45, 2ZY Orchestra. Mr. Klinton Shepherd, baritone. 8.20, S.B. from London. 10.15, Dance Music.

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NEWCASTLE.—A statement was recently broadcast from 5NO to the effect that there were several cases in the Victoria Infirmary which could only be satisfactorily treated by transfusion of blood, and appealing to any listeners who cared to place themselves at the disposal of the hospital authorities for this purpose. An immediate reply was received from several men and one lady offering their services.

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Forthcoming Events

JANUARY.

16th (WED.).—3.45, Bijou Orchestra. Miss Eva Smith, soprano. 7.30, S.B. from London. Mme. Betty Humble, soprano. Mr. Ernest Hind, bass.
17th (THURS.).—3.45, Misses F. and B. M. Turnbull, pianoforte duets. Miss Isa Spence, soprano. Mr. Jack Watson, baritone. 7.30, Mme. Ethel Foulkes, soprano. Mr. Weallans, violin. Mr. W. A. Bates, entertainer.
18th (FRI.).—3.45, Mr. Jack Mackintosh, cornet. Mme. Mabel Offer, soprano.
19th (SAT.).—3.45, Miss Florence Farrar, pianist. Apollo Male Quartette. Mr. Ernest Fletcher, 'cello. 7.30, Jazz Orchestra. Mr. Jack Kelley, baritone. Mr. Michael Kelley, saxophone.
20th (SUN.).—Rev. W. A. Studdert-Kennedy, Address. Mr. Wm. Laws' Trio. R. L. C. W. Male Quartette.
21st (MON.). 3.45, Miss Edythe Elven, soprano. Mr. S. W. Barry, violin.
22nd (TUES.).—3.45, Mme. Alec Thompson's Quartette Party. Mr. John Sowerby, 'cello. 7.30, Orchestra. Mme. Alec Thompson's Quartette Party.

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SHEFFIELD. — Considerable dissatisfaction is being expressed by certain local listeners to the effect that the broadcasting service supplied by the relay station is inadequate. Increased power is advocated, together with better land-line conditions between Manchester and Sheffield. On the other hand, other listeners experience no difficulty and offer nothing but praise for the entertainment supplied. It would appear that the faults lie not with the B.B.C. but in the inability of listeners to understand the simple rules regarding crystal reception and the necessity for clean contacts and non-fingering of the crystal.

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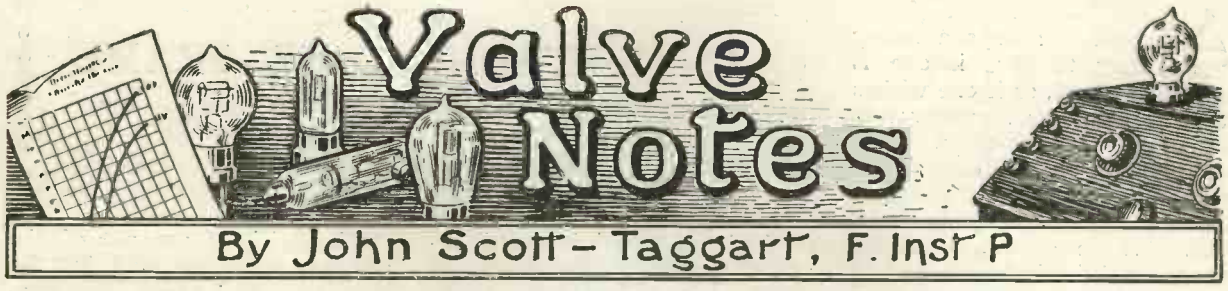
Simultaneous Broadcasting Events.

JANUARY.

16th (WED.).—The B.B.C. Dramatic Critic. 7.45, Acts I and II "Aida," relayed from Covent Garden. All stations except Manchester.
17th (THURS.).—7, The B.B.C. Music Critic. Talk by the Radio Society of Great Britain.
18th (FRI.).—7, The B.B.C. Film Critic. 9.45, "Othello," Act III, relayed from the Royal Opera House, Covent Garden.
19th (SAT.).—Dance Music.
20th (SUN.).—Organ Recital from Blind Institute. Children's Corner from Cardiff. British Composers' Night from Cardiff.
21st (MON.).—B.B.C. Literary Critic. Popular Concert (all stations except Cardiff).
22nd (TUES.).—8.45, "Tristan and Isolde," Act II, from Covent Garden. Savoy Orpheans and Savoy Band. Talk by Capt. Eckersley.



Notes on Intervalve Transformers.

Very little has been written on the subject of intervalve transformers. Those who have produced a good type are somewhat inclined to rest on their laurels, and declare that there is nothing to touch it. This, of course, is a provocative attitude to adopt, and there is a tendency for manufacturers to investigate the design of inter-valve transformers with greater care. We have from time to time tested some excellent transformers, but we feel that there is still more to do in the way of design.

For example, why does one manufacturer of transformers use one ratio, and another maker, another, and why is it that frequently the value of their transformers is the same?

Some manufacturers imagine that by increasing the ratio of their transformers the wireless public will imagine that they are getting more for their money, or getting an increase of amplification. Other manufacturers, with less originality, knowing that a certain type of transformer which has a very good market, uses a certain ratio, decide to employ the same ratio, without any other particular reason.

In making these remarks, I am not in any way thinking of any particular types of transformer, but I think most of us are beginning to feel that there is a great deal of work to be done in transformer design. As far as I know, only one large firm of electrical transformer fame have taken up the manufacture of wireless transformers. It seems a pity that so many types of transformers at present on the market are of inefficient design. Most types seem to work fairly well after a crystal detector, but in a valve amplifier weaknesses soon become apparent.

Is a 4 to 1, or 5 to 1 ratio needed in an intervalve transformer? Does a transformer really transform? Measurements of the degree of amplification obtained with a valve amplifier give surprising results. One might at first think that a transformer giving twice as great a step-up ratio as another would result in twice the voltage step-up in the valve amplifier, but this is certainly not the effect.

Iron-Core Chokes.

Recent experiments I have carried out with iron-core chokes as couplings seem to indicate that a step-up intervalve transformer is a very inefficient piece of apparatus, and that in many cases an iron-core choke will work just as well, in spite of the fact that the ratio of the auto-transformer, for this is really what a choke amounts to, is 1 to 1. One begins to wonder whether a step-up intervalve transformer really does its job. I have almost come to the conclusion that it does *not*. Mr. Frank Phillips, the Chief Engineer of Burndept Limited, once raised the controversy as to whether the high-frequency transformer did transform, and it was not long before we all came to the conclusion that a step-up intervalve high-frequency transformer was a myth and Mr. Phillips carried many with him when he stated his opinion that high-frequency inductive coupling played no part, or no important part, in the action of a high-frequency transformer. The great popularity of the tuned-anode method of coupling two valves has shown that, in many cases, not only is the high-frequency transformer not a real transformer, but that its efficiency is lower than that of a tuned-anode circuit.

Is it possible that we may arrive at the same decision in the case of intervalve transformers? I believe that iron-core choke coils will replace transformers in many circuits, but there are many advantages in having separate windings, and in many cases two windings are almost a necessity. Perhaps some of our transformer manufacturers will explain to us the mysteries of transformer design. Personally, I have obtained excellent results with two-coil iron-core transformers using a ratio as low as 1 to 1.

I have before me some figures of two transformers which have been tested by the National Physical Laboratory. The first transformer has a step-up ratio of 1 to 5. At 500 cycles frequency in an amplifier circuit the voltage amplification was 6.5; the other transformer, which has a ratio of 1 to 2.2, gave 13.0.

At 1,000 cycles the 1 to 5 transformer gave an amplification of 9.0 as against 15.0. At 2,000 cycles the 1 to 5 gave 15 as against 14.0 in the case of the 1 to 2.2 transformer.

These figures are not only illuminative as regards transformer ratios, but also as regards the uneven amplification on different frequencies, obtained with widely marketed transformers.

REFERRING to the report of the Sydenham and Forest Hill Radio Society contained in our last issue, we are given to understand that Mr. IVOR COX was awarded SECOND prize in the competition organised by the R.S.G.B. held at the White City last November, the FIRST prize being awarded to the Woolwich Radio Society.

AN ATTACHE CASE FRAME AERIAL

A SMALL portable frame aerial is always a handy thing to have if one is travelling about, or if one wishes to give a wireless demonstration in the house of a friend who has no aerial. Below is described a way in which a very convenient type can be made up at small cost. When closed, its frame measures 18 in. in length and 2½ in. in thickness. It will therefore fit easily into a medium-sized attaché case. It can be made from any seasoned wood, straight grained pine ¾ in. in thickness being excellent for the purpose. In the middle is a square with 2½-in. sides, to which the arms are hinged so that they can fold inwards.

The arms are 1½ in. in width. Three of them are 15½ in. in length, but the fourth measures 18 in. This last forms the upright by means of which the frame is fixed to its stand. The arms when extended are kept in place by swing hooks attached to the square, which engage with screw eyes in the arms.

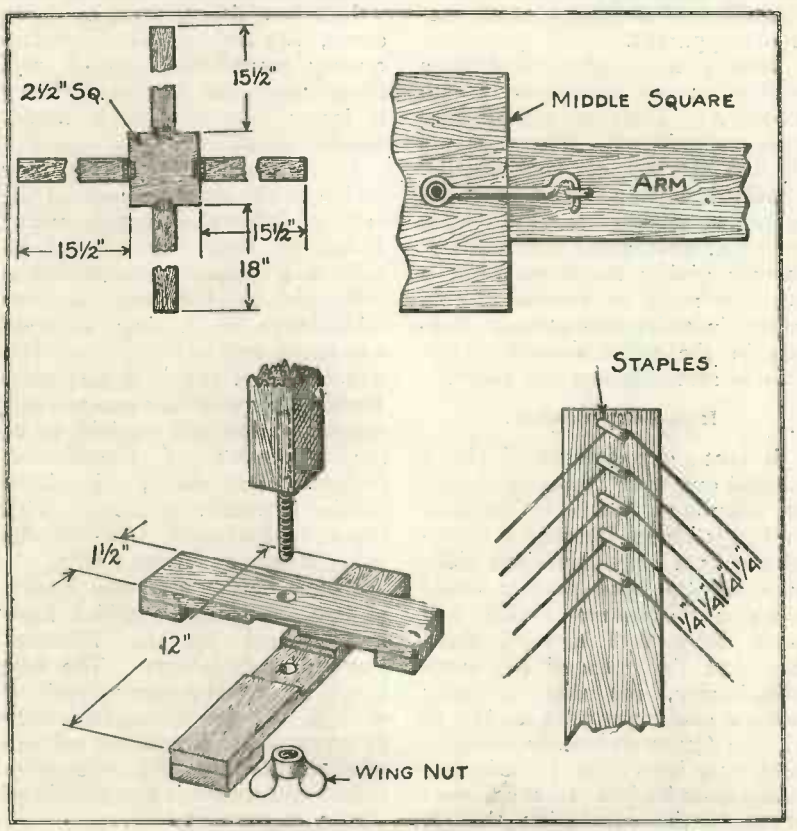
Details of the stand are given in the figure. Into the lower end of the longest upright arm is inserted a screw. Two pieces of wood, 12 in. in length and 1½ in. wide, are cut out and slotted together, as shown in the drawing. A hole, through which the screw just mentioned will pass easily, is drilled through the two at the point of junction, and a wing nut makes all secure when the frame is erected. Small feet are fixed to both ends of each member of the stand in order to give the screw and the wing nut clearance above the surface of the table on which the aerial stands.

Wiring cannot be done in the ordinary way by means of "combs," for the wires must be tightly fixed so that they cannot move when the frame is folded up. The best way of accomplishing the desired end is to use staples. These are not of the ordinary household type, but the insulated kind used by electricians. They can be obtained from any good wireless shop, or a good substitute can be made by passing both the arms of each staple through a small square of rubber cut from an old inner tube before driving it in.

On each arm make as many marks, ¼ in. apart, as there are to be turns of wire, the top mark being quite close to the end of the arm. Begin winding at the long, upright arm. Place the wire over the outside mark and drive in a staple, set slantways, as shown in the figure. Carry on in a clockwise direction to the second arm and fix in the same way. The arms should, of course, be fully extended whilst wiring is in progress. The wire should be pulled tight between each pair before being fixed with a staple.

For broadcast reception with a 0.001 μF condenser in parallel about 12 turns will be required; the number is best found, however, by experiment. Each end of the wire should be fitted with a tag so that the aerial may be attached in a moment to the terminals of the set.

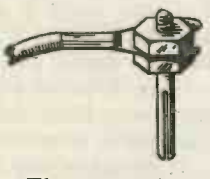
R. W. H.



Constructional details of the frame aerial.

A LITTLE GADGET

It is often desired to make a plug-in connection instead of a terminal connection, and the existing connecting links, when fitted with spade terminals, may be adapted for this purpose without any trouble and without making fresh leads, by inserting the spade terminal between two valve pin nuts and then tightening.



The connection.

H. B.

Broadcast Reception in Northern Ontario

By MICHAEL J. CAVENEY.

This unconventional article by one of our readers carries with it an atmosphere associated in our minds with magazine fiction. We confess that we cannot understand all of it, but it is a true account of what broadcasting means to some.

I MADE a trip up to Ogoki in Northern Canada on a power development project last fall, and, as usual, to keep in touch with things as long as possible on the trip I packed along the old wireless receiver. The weather was nice on the way up; no flies to bother with in the bush; but while I was pulling out on a portage by way of Kenogamissi I ran into a bad thunderstorm, and was fortunate in striking a trapper's trail, which I followed, and ended by staying the night with the owner of a small log cabin in a clearing of about half an acre.

He had been around that part of the northern bush for sixteen years, he told me; never out except down to the little post for supplies and to barter his furs each season, and altogether did not show much inclination to talk.

These fellows are short on talk, anyway, as a rule, so the night being still young and the storm cleared up I dragged out the old wireless set from the canoe and had him hold a barn lantern while I slung an aerial over a tall spruce at the edge of his clearing.

It took a little fussing around, but finally got hold of KDKA, and here passed the 'phones to my host, who seemed scared for a while, and by the time I had assured him that the thing was natural, and he could tune in himself, Pittsburgh had signed off, and owing to the fact that I had to nurse my storage battery along on the trip, I called it a night. Next morning was bright and I pulled out early, promising him to drop in on my way back and give him a real concert if my storage would last out that long, but circumstances kept me up at Ogoki well into the winter. This meant digging up a dog team for the journey back, and not caring about striking bad weather with a strange team I decided to pass up the return visit to the trapper (battery had been dead months ago, anyway) and take a short cut advised by the Indians, which they claimed would save half a day's travel.

The first day was my best day; I made 36 miles on the good snow. The second night I lost two of my dogs in a scuffle with wolves, and the third morning saw me in the dog harness and mushing south-east in the direction of the trapper's shack in the hope of borrowing, or, if necessary, buying enough dogs to take me through to civilisation.

It was past nightfall when I got in to his place, cold, 32 below, and when I topped the last rise was glad to see his light in the shack half buried in snow, with a white plume of steam from his stove pipe going straight up to the moon.

He was glad to see me again, had given me up, and evidently was a changed man somehow; he seemed more chatty and got around to talking wireless before I had the dogs unhitched

I saw the reason when I got indoors. He had bought a wireless set since my last visit, and told me that he makes a trip of 37 miles with the dogs every three weeks to get his battery charged!

There it sat on the table, a long and short wave tuner, detector and two-step amplifier.

It cost him two first-grade fisher and three beaver skins, and he surely was highly enthused over his bargain; really, he praised the set so much that my numb fingers itched to take whirl at the knobs before I had the dogs fed.

I was hungry, too, more so when the trapper got a savoury smell floating round the room and promptly fell to the minute he dropped the meal on the board table. Pretty soon he looked at his watch, filled his pipe, and, dragging over an old packing case close to the set, sat down and began tuning in.

My physical condition had now about reached a point where it was not absolutely necessary to give my undivided attention to the meal, and on looking round I noticed a long, low table, one end of which was near the table holding the wireless set, while the greater portion of the table was occupied by the dead bodies of fisher, mink and marten, frozen hard in many cases, except those nearest the stove, which had thawed out and hung limp over the edge of the table.

They were placed so the heat of the big box stove would gradually thaw them in rotation, and as I was mentally commenting on the prime quality of the fur, my host, who was listening at the set, gave a grunt, turned sideways so as to face the end of the low table, reached over and seized the carcase of a fine mink, and began to skin the animal with a murderous-looking knife, which leaped from nowhere.

I had about finished supper, anyway, and as I rolled a cigarette I seemed to get an entirely new viewpoint on radio.

Realising that at just about the same time there were families by the hundred thousand in the "cities of crowds," clustered happily round their radiophone sets, I wondered just how many of them ever thought that every word and note they heard

was also floating back here in the twisting snowdrifts of the North to an unkempt bearded man in a log shack, who sat on an old soap box, shrouded in vile tobacco smoke, listening to Pittsburgh, and *skinning mink* to music.

The programme that night was from the Carnegie Music Hall in Pittsburgh, and as I watched the great hairy hands of the man make the knife flicker deftly round the lips of each animal, and peel off the hide from the mouth backwards like removing a sock, while the mind and spirit of him was in a box stall at the Carnegie Theatre a thousand miles to the south. "Oh, well; wonderful isn't the word for it; it simply staggers the mind on the first impact, that's all."

Think of it! Hitherto, the only sounds this lone trapper ever heard in the white silent nights here were the whispering of the winds, the distant howl of

wolves, or the piercing squeal as some bead-eyed weasel locked its lance-like teeth in the neck of a dying rabbit.

Now, he tells me, he is never alone.

He has even taken advantage of the bad weather which kept him indoors, and learned the telegraphic code, and demonstrated fairly decent speed in copying stations.

He says he had laughed heartily at the "Bedtime stories," often cries like a child when he hears some lady sing or talk with a voice just like his mother.

Radio brings all this to the trapper here, as he silently works over his catch of furs in a land where nothing moves.

If he wishes to go across the globe instanter, he simply wipes his bloodstained fingers on his hip, and—twists a knob!

The Radio Society of Great Britain.

Presidential Address—Conference of Affiliated Societies—The Society Dinner.

Presidential Address.

The Presidential Address of the Society will be delivered by Dr. W. H. Eccles, F.R.S., at the Institution of Electrical Engineers, on Wednesday, January 23, at 6 p.m.

Conference of Affiliated Societies.

The Conference of Affiliated Wireless Societies will be held at 2 p m. on Wednesday, January 23, at the Institution of Electrical Engineers. It is hoped that secretaries of affiliated societies will notify the Hon. Secretary of the R.S.G.B. of the names of the delegates who will be able to attend. Particulars of the matters to be discussed, which are of an important nature, are being sent to Hon. Secretaries.

The R.S.G.B's. Dinner.

The Dinner of the Radio Society of Great Britain will be held on the evening of January 23 after the Presidential Address. Ladies are specially invited. Single tickets 12s. 6d. each, and double tickets £1 1s. each, may be obtained on application to the Hon. Secretary of the Society.

RADIO PRESS ENVELOPE No. 1.

It is regretted that a few copies of Radio Press Envelope No. 1 ("How to make a successful Two-Valve receiver") containing a printer's error, have been allowed to go out. In these envelopes the list of components contains the item "2 fixed condensers of 0.002μF." This should read "one fixed condenser of 0.001μF, and one of 0.002μF." The rest of the description is correct, the condenser C_3 being rightly given as 0.001μF capacity.

Apparatus we have tested

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

Low Frequency Transformers.

The Manchester Radio Co., Ltd., have submitted for test a low-frequency intervalve transformer. This is of medium size, standing about 3½ in. high, and of conventional design. It is strongly made, and the insulation resistance proved on test to be excellent, standing up well to 500 volts. Soldering tags, plainly marked, are fitted in lieu of terminals.

On practical trial in receiving circuits, the transformer showed excellent amplification, freedom from distortion and noises, and operated well in dual circuits.

Telephone Transformers.

The Manchester Radio Co., Ltd., have sent for test a telephone transformer, uniform with the intervalve type already described. This showed the same excellent insulation resistance, and on test in crystal and valve sets, with 90 volts on the plate, gave good signals with different types of low-resistance telephones.

A Two-valve B.B.C. Cabinet Set.

Messrs. W. G. Pye & Co. have submitted for inspection and practical trial a two-valve B.B.C. receiver, with one H.F. and detector valve, mounted in a sloping-front or desk type of cabinet, and with a range of 300 to 600 metres wavelength on a P.M.G. aerial. This has much in common with the four-valve receiver already reported upon, both in the tuning devices and circuit arrangements. In this receiver the H.T. battery is housed in the cabinet, thus simplifying the external wiring.

On trial, the local station came in well on the loud-speaker at a dozen miles, whilst Birmingham, at 100 miles, was nicely audible during the intervals of 2LO.

A Three-coil Tuning Stand.

From the Radio Communication Co., Ltd., comes a three-coil tuning-stand, for ordinary plug-in coils, providing fine adjustment by a gear action on each of the two outside movable coils. This has a substantial wooden base, carrying the three pairs of terminals on ebonite; while a metal and ebonite structure carries the vertical spindles which swing the two outer coils, and fixed centre coil. The adjusting knobs are at a good height above the coils, thus avoiding hand-capacity effects. Each moving coil has an angular range of about 120 degrees. The instrument stands 7 in. high, and occupies a space of about 4 in. square.

On test, the insulation was found up to standard, and the mechanical action smooth and free from shake and back-lash. In actual reception, the ease and certainty with which reaction could be adjusted was very marked, distant stations being tuned-in with comfort.

It would appear at first sight to depart from the best practice in high-frequency work to make connections to moving coil-holders by twin flex, but on actually measuring the stray capacity introduced by the leads in this instrument, together with other stray capacities between the plugs, the total came out at 0.000007 μF—a negligible quantity here.

In general, this instrument is strongly made, workmanlike, and can be recommended for serious experimental work as well as for the lighter side of the art.

Variable Grid-leak and Anode Resistance.

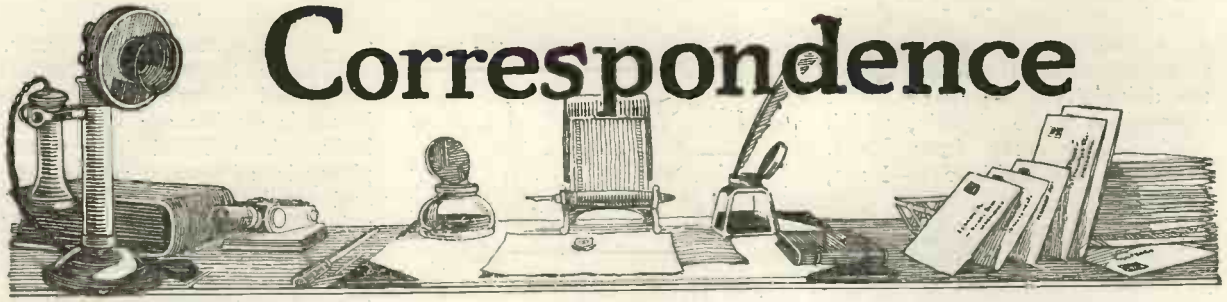
The Lissen Company have submitted for trial samples of their variable grid-leak and anode resistances.

The grid-leak is in the form of a slender pencil $\frac{3}{8}$ in. in diameter and about $2\frac{1}{2}$ in. long. It is mounted on the panel by a simple screw collar, and occupies, of course, a minimum space. It is provided with small terminal screws and soldering tags.

On actual test the sample submitted showed a continuous variation from .6 to 6 megohms. In reception of telephony, using this grid-leak, the latter was found to fulfil its purpose admirably, giving a smooth and silent adjustment. The unit is neatly finished, and is of good workmanship.

The anode resistance of similar mounting, but about $\frac{7}{8}$ in. diameter by 1 in. long, showed a range from 50,000 ohms to 3 megohms. It is claimed that this will pass heavy currents without deterioration. Certainly it stood up well to severe tests, including 500 volts D.C. applied directly for some time, and when used as a grid-leak gave highly satisfactory results in the heavy service demanded in the grid-leak-howl type of super. It can be heartily recommended for this latter purpose.

As a variable grid-leak for ordinary valve reception, it was silent and convenient in use, and showed a suitable range of values for use in dual circuits as stabilising resistances and in resistance-capacity-coupled amplifiers.



Correspondence

MORE DETAILS WANTED.

SIR,—I am heartily in support of Mr. J. C. H. Howell's suggestion in correspondence of *Wireless Weekly*, Vol. 3, No. 3, that details of the outfit be given when reports are furnished. These reports of experiments are by far the most interesting reading that any paper can give to a lot of us. I see Mr. Howell refers to a third variable condenser, and another correspondent did so a few weeks ago, but I can find no reference to such a condenser in any of your articles. If there is an improvement on ST100, I think that you should publish it for the benefit of the many users of this wonderfully practical circuit.—I am, etc.,

A. WRIGHT.

Shepperton.

[Mr. Howell refers to the condenser across the transformer secondary in the aerial circuit. It was suggested that this might be variable, but a fixed value of 0.001 μF cannot be improved upon in most cases.—ED.]

MARS ?

SIR,—With reference to the letter from "X-Ray" in Vol. 3, No. 3, of *Wireless Weekly*, I should like to suggest that "Violet Ray" generators used for electro medical work and for beauty treatment are frequently the cause of interference. These machines produce a high-frequency current by means of a Tesla coil. In order that it shall be harmless, this current must be of a very high-frequency, which means that it will cause radiation in the ether having a wavelength within the limits of the band used for radio purposes. These radiations will influence any ordinary radio set within 30 yards.

Another point which might be of interest is that some experiments with a Tesla coil, capable of producing a 50-inch spark,

were carried out in London in 1919-1920. Soon after the commencement of the experiments the daily Press began to report mysterious radio signals, which might have come from Mars. Was this a coincidence?—I am, etc.,

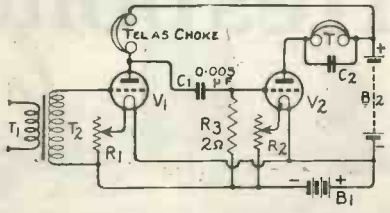
H. J. HOWARD.

Wimbledon, S.W.19.

USING TELEPHONES AS L.F. CHOKE.

SIR,—Apropos your article on choke-coupled L.F. amplifiers, the following wrinkle may appeal to some of your readers. It concerns the use of a pair of 'phones as L.F. choke. Using a single H.R. earpiece, which was handy, the amplification was at least as good as that of some of the cheaper transformers on sale, and if one has a spare or perhaps an insensitive pair of headphones, this is a rough and ready method of adding a valve to one's set.

For those unacquainted with this method of coupling, the following was the circuit used :—



The arrangement referred to by Mr. Fletcher.

Trusting this may be of use, and wishing *Wireless Weekly* continued success.—I am, etc.,

A. P. FLETCHER.

Redhill.

DUAL AMPLIFICATION.

SIR,—In view of the articles on dual amplification appearing at present in your excellent paper, you may be interested to learn of the results I have obtained with the one valve dual circuit ST74.

I get all the British stations regularly, Bournemouth being the loudest of the distant stations. Glasgow (22 miles distant) comes in with sufficient strength to work a small loudspeaker, but not very efficiently.

L'Ecole Superieure, Radiola, the Eiffel Tower and the new Brussels station are heard regularly. The Eiffel Tower telephony is, of course, very strong, and can be listened to with ease using three pairs of 'phones, this at a distance of 550 miles.

On December 18, at 12.35 a.m., I was successful in obtaining reception from America. For an hour nothing came through distinctly, but at 1.40 I heard the call-sign WGY very distinctly and the announcements of two songs. I then heard a piano solo and another song.—I am, etc.,

J. FERGUSON.

Stirling.

We understand that Messrs. Eustace Watkins, Ltd. are now representing Messrs. Gambrell Bros. in the West of London and have now opened a showroom on the first floor of 91, Bond St., W.

Information Department

J. S. W. (WIMBLEDON) points out that it has been stated in connection with the relaying of the Pittsburg station by the B.B.C. station that the B.B.C. receiver was tuned to 100 metres, and asks whether the American broadcasting stations commonly work on such short wavelengths.

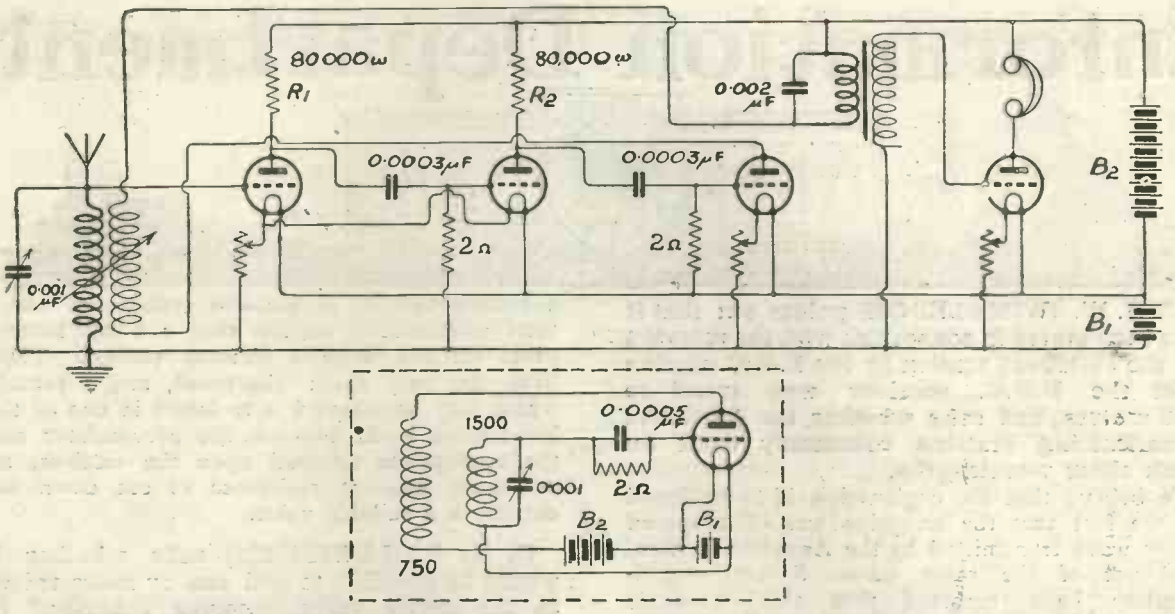
We believe that the explanation is to be found in the fact that the reception was of a special short wave transmitted by the American station, and not of the main wave. Several experimenters have reported that this wave is stronger than the signals upon the main wavelength, and it would no doubt be more suitable for the purposes of the B.B.C., in that it would be free from heterodyning by amateurs.

W. S. A. (BATH) asks why it is that several of his valves, though of good make, have burnt out after quite a short period of use.

It would appear from the querist's description of his receiver, that he has been using a 6-volt accumulator and filament resistances of an unsatisfactory pattern. There are on the market a certain number of filament resistances whose total resistance is so low that a 6-volt battery gives far too large a filament current. Their lives are very much shortened, and a remedy which may be adopted is to insert in one of the low-tension leads between the accumulator and the appropriate terminal upon the receiver, an additional filament resistance to cut down the current to a suitable value.

C. K. F. (LEWISHAM) asks whether it would be possible to add one or more valves to the single valve receiver described in "WIRELESS WEEKLY," Vol. 2, No. 19.

It is quite an easy matter to add one or more stages of low-frequency amplification to this set, the connections being made in the usual way between the primary of the first intervalve transformer and the telephone terminals of the single-valve set. To add a high-frequency valve to the receiver, as some of our readers have asked, is a matter of much greater difficulty. It would involve re-designing the receiver, and a certain amount of experimental work.

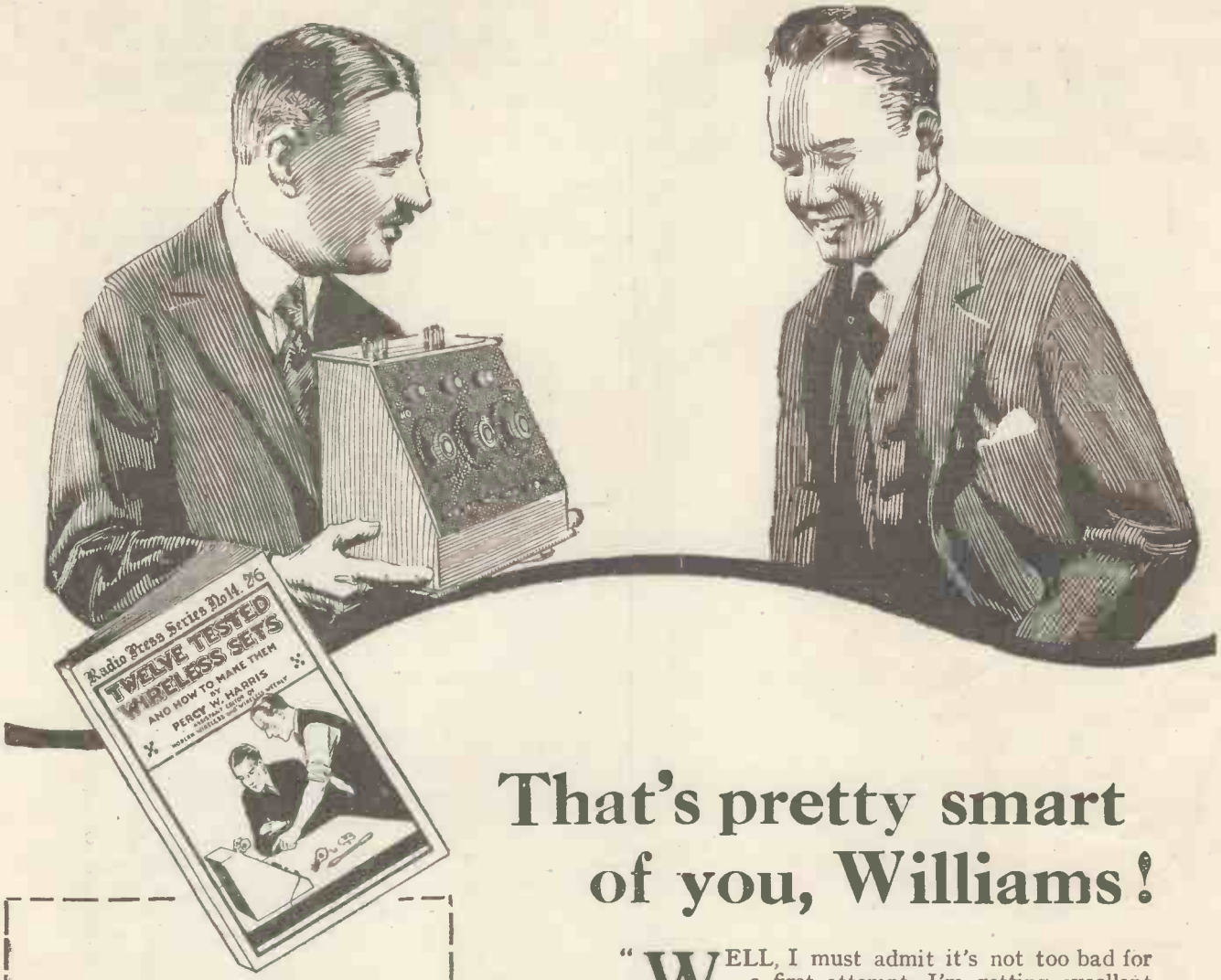


J. L. M. (DARTMOUTH) asks for a circuit capable of picking up the American long-wave stations upon a rather small aerial, the receiver to be easily handled.

Since it is desired that the operation of the set shall be simple, resistance-capacity coupling is suggested, a suitable circuit being given herewith. If possible, use a separate heterodyne, as shown. Adjust the reaction so that the main receiver is on the brink of self-oscillation, and use the local oscillator to produce a beat-note with the desired signals.

W. L. C. (CARDIFF) enquires as to the cause of the fluctuating note of low-power C.W. transmissions from many amateur stations.

This phenomenon is the result of the employment of a transmitting circuit in which the aerial forms part of the circuit in which oscillations are generated by the transmitting valve. Slight variations in the capacity of the aerial will therefore produce variations in the transmitted wavelength, and such variations are easily produced by the swaying of the aerial in the wind.



That's pretty smart of you, Williams!

"WELL, I must admit it's not too bad for a first attempt. I'm getting excellent results from it, too."

"Tell me, how did you obtain your knowledge and skill? I suppose you have had some sort of engineering training?"

"Oh, no. My job is in the insurance line—I've never been in any works in my life. As a matter of fact, it was Garnett who put me up to it. He told me how simple it was to build up a really good Set from ready-made components."

"It is a very creditable piece of work—I must congratulate you. I suppose Garnett showed you how to make it?"

"Not a bit of it. He merely advised me to get a copy of a book called *Twelve Tested Wireless Sets* and to follow the instructions. By the way, your boy is coming home from school next week, why not spend a couple of evenings or so with him making up a good Set?"

"That's not a bad idea. He'll sure to be at a bit of a loose end. Let me make a note of the book and I'll call in at the bookshop on the way home for a copy."

Twelve Tested Wireless Sets.

By Percy W. Harris.

Assistant Editor of "Modern Wireless" and "Wireless Weekly."

One of the most practicable constructional books yet published. Mr. Harris' reputation as a bright and informative writer of constructional books is well known and his latest book is easily the best he has written.

Every Set described in this book is well within the capabilities of any enthusiast and provided the very clear instructions are followed perfect results will be obtained at the first attempt.

The following instruments are fully described.

1 A 2/6 Crystal Set.
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3 A Single Valve Magnifier.
4 A 2-Valve Magnifier.
5 A Simple 2-Valve Receiver.
6 A 2-Valve Cabinet Set.
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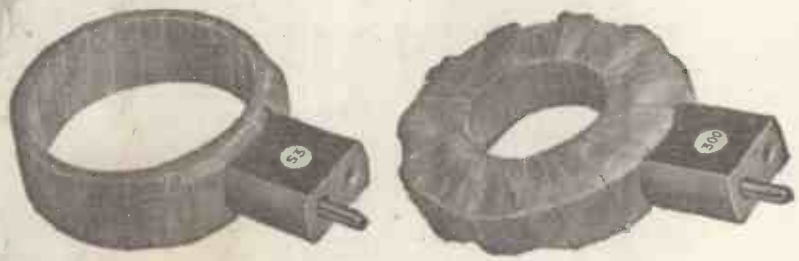
GILBERT AD.

BURNDEPT Coils

BRITISH AND BEST



BURNDEPT Coils Patent Nos. 168249 191550

NOTICE is hereby given that BURNDEPT COILS are manufactured under Patents owned by Burndept Ltd. BURNDEPT COILS do not infringe any existing Patents, they are not so-called "Honeycomb Coils."

We claim that BURNDEPT COILS have lower distributed capacity and less high frequency resistance than any make of "Honeycomb Coils." Our claim we are prepared to substantiate. The following table speaks for itself.

BURNDEPT COILS are mounted on plugs of the highest class insulating material, which have non-reversible spring plug and socket fittings, facilitating quick and easy changing and ensuring perfect electrical contact at all times. No losses owing to poor insulation when using **Burndept Coils.**

When buying coils, insist on Burndept Coils, which are the original British Coils and are still the best.

Burndept Coil Stands can by used in any position owing to their geared construction, which feature also ensures easy smooth adjustment. They are perfectly insulated and are equipped with the same plug and socket fittings as the coils.

No. 135, for Panel Mounting £1 5 0
No. 136, Mounted £1 15 0

Data prepared in BURNDEPT Research Laboratories.

Coil No	Tube Inductance — Microhenries	Distributed Capacity — Micro-Microfarads	Stand-by Tuning on Average P.M.G. Aerial with .00075 Condenser or Burndept Tuner. Condenser in Series min.	Condenser in Series max.	Condenser in Parallel min.	Condenser in Parallel max.	Wave Length in Metres Obtained with Burndept Condenser of Capacity Indicated in Parallel. Secondary Circuits min.	Secondary Circuits max. .0005	Secondary Circuits max. .00075	Secondary Circuits max. .001	Tuned Anode Circuit min.	Tuned Anode Circuit max. .0002	Price (Mounted) £	Set of 4 Concert Coils (combining 2A) £
S 1	36	10	150	260	300	380	120	280	330	375	80	175	5/-	
S 2	58	10	165	290	340	470	155	355	420	475	100	220	5/-	
S 2½	84	9	180	340	390	560	185	425	505	575	120	265	5/-	
S 3	110	9·5	200	360	420	640	210	490	580	655	130	305	5/-	
S 4	220	9·5	260	470	590	900	300	690	820	930	200	430	5/-	
75	294	32·5	350	570	700	1100	380	820	970	1095	275	525	5/6	
100	583	27	450	750	950	1450	525	1150	1350	1530	375	730	7/-	
150	1193	22	650	1050	1300	2100	730	1625	1930	2180	520	1035	7/6	
200	2300	21	900	1450	1900	3000	1010	2260	2670	3020	710	1420	8/6	
300	4770	17	1250	2000	2600	4100	1430	3250	3850	4350	1000	2050	9/-	
400	9600	17	1750	2900	3700	5800	2030	4600	5450	6200	1420	2900	10/6	
500	23550	20·5	2600	4300	5500	9000	3235	7250	8600	9750	2320	4550	12/-	
750	53250	19	4000	6600	8500	13500	4840	11000	13000	14600	3400	6900	13/6	
1000	104650	17·5	—	—	12500	21000	6750	15300	18200	20500	4700	9650	16/6	
1500	182000	22	—	—	16500	28000	9040	20200	23800	27000	6400	12800	24/-	

Set of 4 coils, 25 to 100 £4 10 0 A

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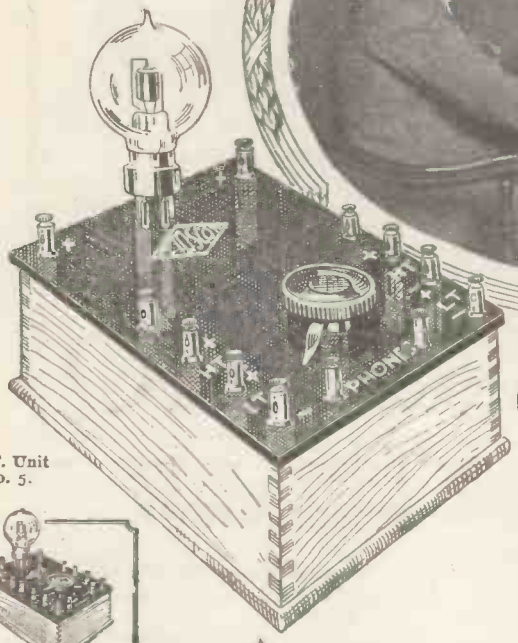
BURNDEPT
WIRELESS APPARATUS

Illustration shows Mr. Keith Jopp and his Peto-Scott Units.

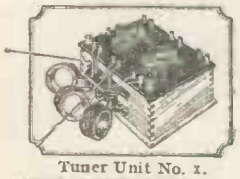


L. F. Unit No. 5.

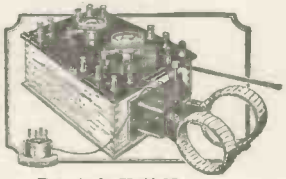
Detector Unit No. 4.

Crystal Detector Unit No. 6.

H. F. Unit No. 3.



Tuner Unit No. 1.



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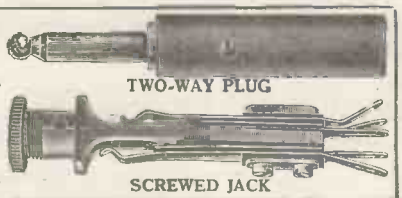

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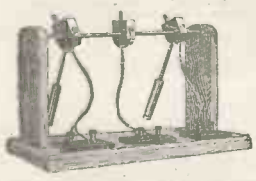

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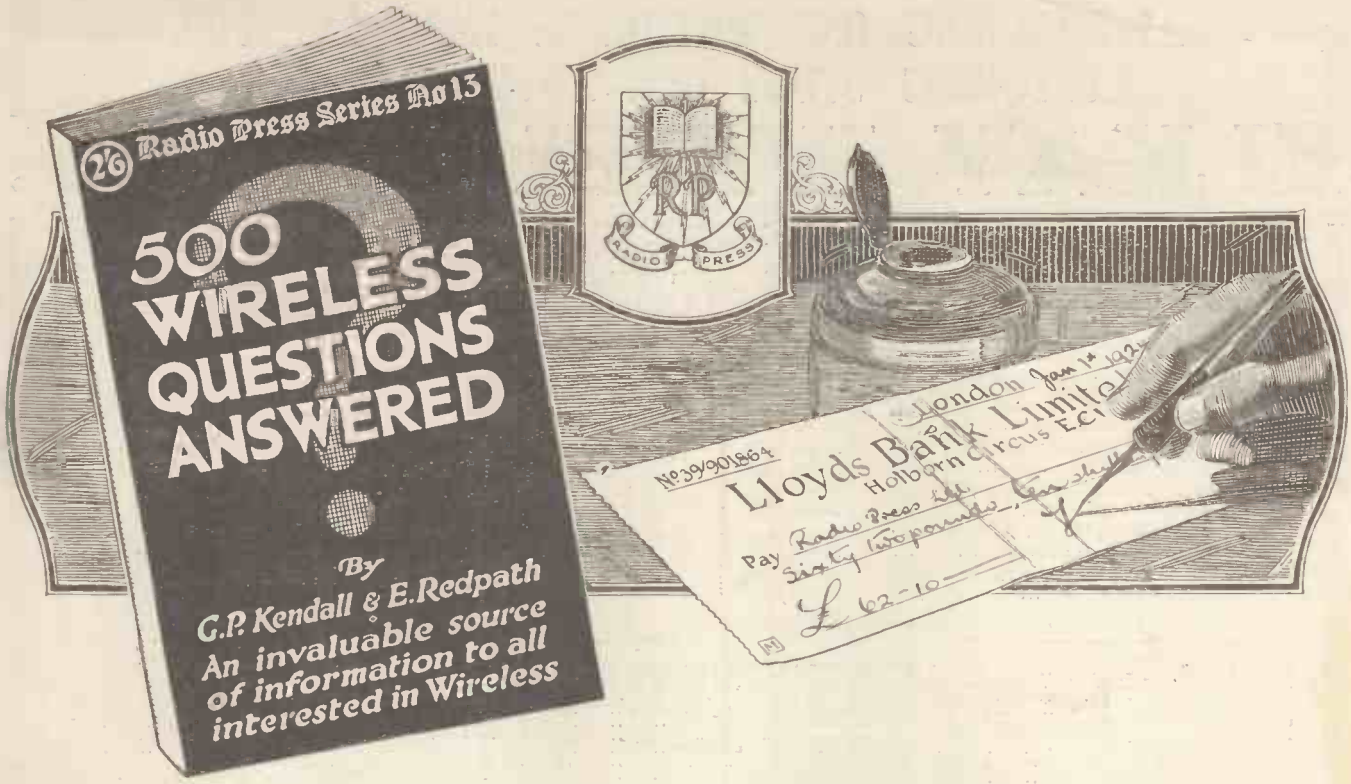

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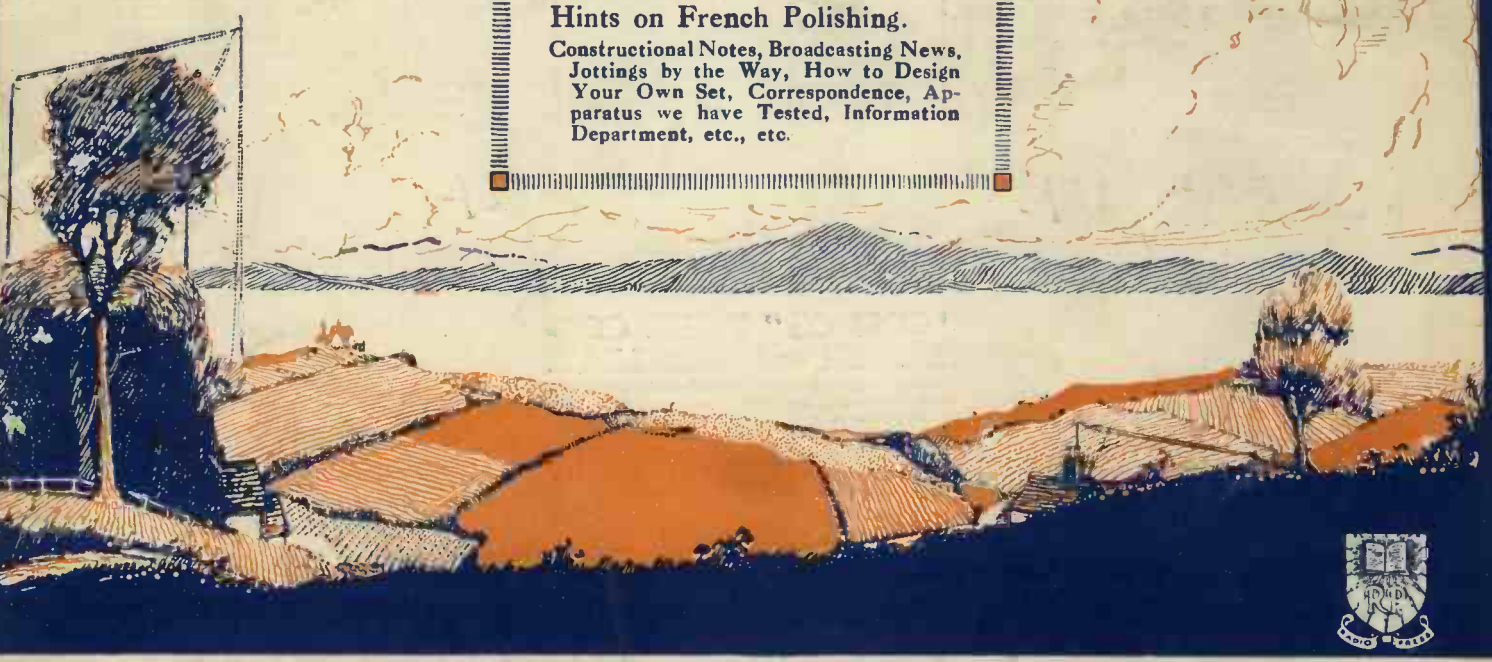

The Constant Aerial Tuning System

By JOHN SCOTT-TAGGART, F. Inst. P

Wireless Weekly

Vol. 3, No. 7
Jan. 23 1924.

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Editor: JOHN SCOTT-TAGGART, F.Inst.P.

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Editorial

A Few Words to the Wireless Industry.

THE wireless industry is gradually becoming more and more stabilised, and it is just as well occasionally to review the position. The industry has not yet become one of the principal ones in the country, but it is more than probable that time will remedy this.

As is usually the case with a new industry, there are numerous matters which remain in doubt in the minds of the individual members of the industry.

There is still a considerable amount of jealousy between manufacturing firms, and this jealousy results in a certain hesitancy which should be replaced by an earnest desire to develop business.

In some quarters there is a hesitancy to establish a real goodwill with the wireless public. This is seen most clearly in the case of advertising.

Advertising, of course, is a matter which intimately concerns publishers, but nevertheless we hope we can make a few remarks without being considered unduly prejudiced.

Recently several manufacturers apparently decided to desert the wireless technical papers and to indulge in advertising in the general Press. They were encouraged to do this by advertisement experts who, however eminent they may be in a wider field, do not appreciate the position in a specialised industry of this nature.

It is argued that wireless sets and apparatus should be advertised to the people who have not yet become interested. It is suggested that gramophones would never have reached their present popularity if the advertising of them had been confined to musical papers.

Gramophones, however, are very different from wireless sets. There are certainly points of difference between different gramophones, but it is largely a question of detail, whereas wireless sets vary enormously regarding their qualities of range, clear reproduction, selectivity, etc.

As regards components, of course the wireless papers are the only place where results are obtainable. Advertising component parts to the public is as expensive and useless as trying to advertise spare parts for motor-cars to cannibal islanders.

As regards sets, practically all those who have tried advertising to the general public have found that this is a very wasteful method. After all, if we wish to buy a car, we would certainly not be converted by an advertisement in a newspaper. The first thing we would buy would be one of the technical motor journals and read through their pages of advertisements, comparing the merits and prices of all the different cars therein advertised; from these we would make our choice. Some articles the public buys without choosing. You do not find people comparing different kinds of candles before buying them; hence, newspaper advertising is the ideal method of selling candles.

When it comes to wireless sets, however, the would-be purchaser takes very good care to have a look round, and the place in which he looks round is the pages of a technical wireless paper. Incidentally, by purchasing from advertisements in a reliable journal he protects himself against fraudulent or exaggerated claims. The more respected the technical journal, the greater faith has the would-be purchaser in the apparatus advertised in it. You cannot exaggerate very much about a gramophone.

The industry is merely wasting its time and money if it experiments in advertising to the public. Although it is true that a person who wishes to buy a set without troubling about technicalities will not regularly take in a wireless paper, yet nevertheless he will buy one in order to choose his set.

What is really wanted is for the manufacturers, or preferably the B.B.C., to conduct an energetic campaign advertising wireless *per se* as in the case of joint publicity for radiators, gas fires, milk, etc.; so should there be a publicity programme for broadcasting. We advocated this long ago and the B.B.C. have already done a little in this direction recently, but much more is needed.

Constant Aerial Tuning

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

An article dealing with an idea for the fool-proof design of a wireless receiver.

IN my Radio Press Envelope No. 1 dealing with the detailed construction of an ST100 receiver, I described a method of tuning the aerial circuit which ensured that everybody making the set would have not the slightest difficulty in tuning to the desired wavelength.

The idea, of course, may be adapted to any circuit, including even crystal detector receivers.

Fig. 1 illustrates a very popular circuit, the ST34 fitted with constant aerial tuning. It will be seen that the ordinary parallel tuned circuit is employed, but that in addition a very small condenser is used in the aerial circuit. This condenser has a value of 0.0001 μF. The condenser is fixed, and a low value of this kind is necessary to obtain the desired effect.

Disadvantage of Ordinary Tuning Systems.

The disadvantage of the ordinary method of tuning in which an inductance is shunted by a parallel variable condenser is that the tuning is entirely altered if a different-sized aerial is employed. Consequently, if one experimenter obtains certain results with a receiver, made to a published design, for example, another experimenter may find that entirely different coils are necessary, and perhaps this results in different signal strength being obtained. A reason for such change in signal strength, for example, might be caused through the change in the degree of reaction produced, owing to the difference in the sizes of the coils, and consequently in the magnetic coupling between them. The reason for the variation in tuning is, of course, that different aerials have different capacities. Incidentally they also have different inductances, but the inductance of an aerial is so small that for practical purposes it may be ignored, because it is always very much less than the added inductance. Aerial capacities vary greatly, even when the aerials are of the same length.

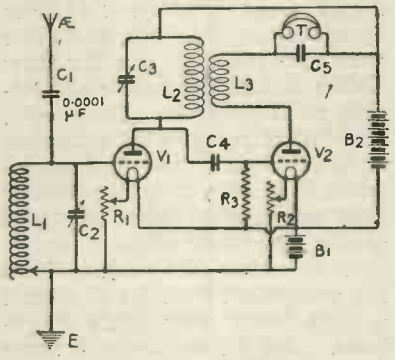

Fig. 1.—The ST34 circuit arranged for constant aerial tuning.

The result is that when ordinary tuning methods are adopted, an experimenter may find that with an S2 or a No. 25 plug-in coil the signals desired are received on

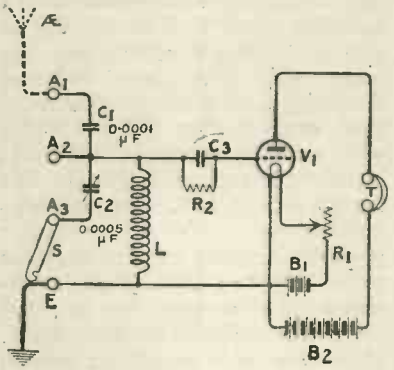

Fig. 2.—A four-terminal arrangement, permitting either series or parallel capacity.

a given adjustment of the condenser.

Another experimenter using a smaller aerial will perhaps find that he needs the next size larger in coil. The result of this is that when a set is described in the Press, there are always a certain number of experimenters who do not seem to get the full results which others are obtaining. In the case of beginners, the reason probably is that they are not properly tuned to the incoming signals. In the case of the more advanced experimenter, the reason probably lies in an undesirable variation in the amount of reaction, intentional or otherwise, introduced into the circuit.

Nor is it only a question of the sizes of inductances. It is a well-known fact, among experimenters, that the lower the value of the capacity across the inductance, the more readily will a high-frequency amplifying valve oscillate, and consequently, whereas in the case of one experimenter there is no tendency whatever to oscillation, in another case, where the tuning adjustments are such that the capacity across the aerial inductance is small, there will be an excessive tendency to oscillate.

By using a small series condenser of the order of 0.0001 μF capacity the total capacity across the inductance, due to the aerial, is rendered so small that it will be negligible in comparison with the parallel tuning condenser which is connected across the inductance. If, for example, the aerial capacity has a value of 0.0002 μF, then the addition of a capacity of 0.0001 μF, in series with the aerial, will have the effect of a resultant capacity of only 0.000067 μF, which will be very small in comparison with the 0.0005 μF variable condenser which is connected across the inductance.

(*Concluded on page 207*)

Rending the Welkin

I HAD a sort of lingering suspicion which I believe I communicated to you that they would. They did. I refer, of course, to the torturing of the ether at the hands of newcomers into wireless at Christmastide. It appears that everyone who was not a radioist was seized with the same bright inspiration at the approach of Yule, that now, and now indeed, was the moment to enter the realms of wireless. Therefore he trotted hot-foot to the nearest wireless shop, where he provided himself with the necessary box of mystery, a coil of wire and a couple of batteries. From that time onwards there were but two things in life that really mattered. The first was to get the nearest broadcasting station louder and louder and louder; the second, to make that engaging little jaunt round the other broadcasting stations whose delights facile pens describe for us so alluringly.

It has been calculated by no less an authority than Professor S. O. High, the eminent authority upon feeding bottles, dynamometers, hygienic clothing, botulism, atmospherics, and nearly everything else, that the amount of energy put into their combined aerials by the massed reaction coils of the Christmas neophytes would have sufficed to move the moon 31.4672 feet further away from the earth had it been employed in working the new engine that he intends to place shortly before a startled world. I understand that the popular professor has not worked out what might have been accomplished had the energy expended by those who said what they thought of reaction been harnessed for some perfectly futile, but nevertheless amazing, purpose. He has, however, promised to do so if he can spare the time in the midst of his present researches into paleobiology.

The Secret Disclosed

And so, I am afraid, it will go on for a space until the offenders either learn wisdom or become sick of hearing nothing but music so distorted that it is impossible when using their sets to distinguish between "Yes, We Have No Bananas" and the Largo Movement (if there is such a thing) from Beethoven's Fifth Symphony. And we meantime must endeavour to give the most lifelike imitation possible of grinning and bearing it. Personally, I feel that my grin is becoming a little forced, and I have no doubt that you, too, are finding that resignation shows signs of giving way to ferocity.

It all comes, of course, from the praiseworthy desire to do just a little better than one's neighbour. But let me beseech those whose feet have but lately crossed the threshold of wireless not to neglect one of the most important principles of reception which, besides making for a free and peaceful ether, also enables one to receive any station at any desired strength even with a crystal set. Fish are supposed to be the only creatures which possess the amazing quality of increasing in size and weight after their demise. Our brothers of rod and line long since made the discovery that, even if they left the water with nothing but a six-inch trout reposing in the creel, the day was by no means lost. In such circumstances, the wise angler presents his sole captive to some small boy, in whose hands it proceeds not merely to put on weight, but also to multiply itself. He is thus able to tell his friends without a single twinge of conscience that he was so stricken by the sight of a hungry fellow-creature that he gave away his entire catch of three brace of two-pounders. Thus, no one is injured; the small boy receives the fish and is able to extract much admiration from his friends by declaring that he caught it. The angler gains the reputation of being not merely a generous fellow, but also a skilful exponent of the finer side of fishing. No one, of course, believes the story, but his hearers are unanimous in their admiration, recognising that he is one who makes sport and romance go hand in hand, as it is fit that they should.

Tact

In wireless, tact of the same kind is required for perfect reception. If you are using a small set, ginger up your imagination rather than your reaction coil. But never overdo the thing. Receive WHAZ, if you will, on a single valve with the phones on the table—make a note of that phrase; it is one of the hall marks of the finished wireless man. But don't do it on a crystal. That is not tactful. In the same way it is seldom, if ever, permissible to receive a station more than a hundred miles away upon the loud speaker without at least one note magnifier. Attention to such little points as these and the cultivation of a well-trained imagination, exuberant but never outrageous, will suffice to place you securely in the forefront of local wireless men.

Practise also a careful control of the eyebrows and of your breath, so that you may neither unconsciously raise the former nor emit gasps with the latter when you are listening, as you will have to do to your friends whilst they report what they accomplished. In wireless, as in other things, live and let live should always be one's motto.

A Lost Opportunity

One is only sorry for those who came too late into wireless to make the most of American broadcasting. Now that the B.B.C. has, so to speak, taken the bread out of our mouths by picking up U.S.A. stations with

an umpteen-valver and relaying them far and wide over this happy land, everyone hears WGY and all the rest of them, so that one can no longer claim any particular merit for so doing. The best way of tackling this very difficult problem is, I think, to give up 2.30 a.m. as the mystic hour. Even such hardened enthusiasts as those who work the B.B.C.'s mighty engine of reception have usually enough of it by 4 o'clock, which you will remember is only 9 p.m. in New York. There remain, therefore, still two good hours in which the imagination can get successfully to work.

You must drop the heavy-eyed, yawning attitude which was suitable for 2.30 receptions, and adopt in its stead rather the brisk, breezy manner of the man who rises from his couch and plunges into a cold bath at indecently early hours. Preface your remarks by saying how chilly or warm or light or dark it was at 5 o'clock that morning. "It was jolly well worth it, though," you continue. "I got up to finish some important work, but I could not resist switching on the set just to see if there was anything on. . . . Oh, yes, I got WGY all right. In fact, I have never heard him so strong. That is the time for American broadcasting, my boy; you take it from me." And don't forget to add that, though there was considerable fading, you were able to get him from 5.43 to 5.52 with the phones—well, you know where the phones ought to be in such a case.

Keeping the Home Fires Burning

Terrible things may happen at the time in the homes of wireless men. Only the other day I read a harrowing little tale from the police courts of a wife who, recounting her husband's dreadful temper, told how on one occasion he seized the wireless set and flung it into the fire. I have never got quite so far as that, but I must admit that there have been many occasions on which I have been on the verge of so doing. One has sat up actually, and not in imagination only, into the chilly small hours. The fire has burnt low. One's teeth rattle. The set has been playing every conceivable kind of pranks. It has hissed and roared and rattled and crackled until your ear drums ache, but never a proper sound has it delivered. At last it goes completely numb, possibly out of sympathy with one's own fingers. It is obviously possessed of devils, and fire is the recognised means of exorcising them. The temptation is therefore considerable to hurl it into the grate, where it will make a generous blaze before which one's chilly hands can regain a little warmth. Ebonite burns beautifully.

It is better, though, really to keep something which may enact the part of the whipping boy. You will remember that in the good old days when youthful princes were naughty, the stripes which they richly deserved were handed out to an unfortunate lad especially employed for the purpose. The sight of his suffering was, in theory, supposed to produce anguish and repentance in the royal delinquent, but, if I know anything of boys, I doubt whether these effects are not at times the opposite. In any case, the royal prince was saved, and I suggest a similar way of punishing the wireless set by proxy. A worn-out high-tension battery, a dud condenser, or anything of the same kind may be kept handy on the mantelpiece to be flung into the flames when one's wrath is really aroused. The process is eminently satisfactory—and it is a good deal cheaper than the real thing.

WIRELESS WAYFARER.

CONSTANT AERIAL TUNING

(Concluded from page 205)

A Useful Switching Arrangement

A method of using the constant aerial tuning system, or the use of a variable condenser in series with the aerial for tuning, or the use of a variable condenser in parallel with the inductance, is illustrated in Fig. 2. We have here four terminals marked A1, A2, A3 and E. These four terminals may be fitted to any receiver, and they enable any of the three methods of tuning to be adopted. Across the terminals A1 and A2, we have the fixed condenser C1 of 0.0001 μF capacity, while across A2 and A3 we have the variable condenser C2 of 0.0005 μF capacity. Across A2 and E we have the inductance; leads are taken from the ends of this inductance to the valve detector, or to the high-frequency valve of a receiving set.

When the aerial is connected to the terminal A1 and the earth is connected to the terminal E and the strap marked S, which enables the terminals A3 and E to be shorted when desired, is left open, no tuning is possible. If, however, the strap across A3 and E shorts these terminals then the condenser C2 is connected in parallel with L and condenser C1 is in the constant aerial tuning system. If, however, we keep the strap across A3 and E shorted and connect the aerial on to the terminal A2, then the ordinary parallel condenser tuning arrangement is used.

If now we desire to have a series tuning arrangement the aerial is connected to the terminal A3, and the strap which is normally across A3 and E is taken out, then it will be seen that the condenser C2 is in series with the aerial inductance L and the desired effect is obtained.

A Loose-Coupled Crystal Receiver

By H. BRAMFORD.

An article giving full constructional details of an easily made crystal set.

THE set here described is of a type particularly easy for construction and manipulation. The design is so thought out as to enable the constructor to make the complete set with ordinary parts, complicated fittings of an unobtainable type not being required.

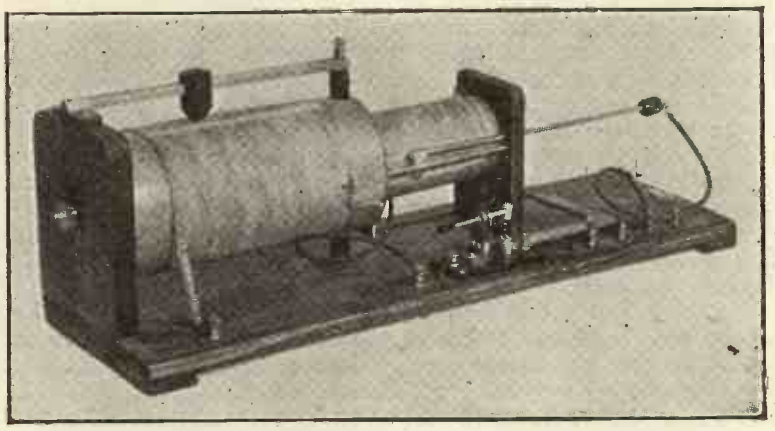

Fig 1.—The general appearance of the finished instrument.

Materials

The materials necessary for the construction of the receiver herein described are :—

2 ft. x 6 in. x ⅜ in. board, preferably mahogany.

1 ft. of ½ in. dia. ebonite tube.

1 plunger rod, with slider.

2 ft. of ⅛ in. dia. brass rod.

1 cardboard former, 7 in. x 3½ in. dia.

1 cardboard former, 7½ in. x 2 in. dia.

Four terminals.

One crystal detector.

Quantity of No. 22 S.W.G. d.c.c. wire.

Quantity of rubber-covered connecting wire.

The Primary Coil.

The aerial or primary coil is made from the cardboard former of 3½ in. dia. cut to a length of 7 in. It is closely and firmly wound with 115 turns of No. 22 S.W.G. d.c.c., leaving a length of wire at the end in order to make the necessary connection.

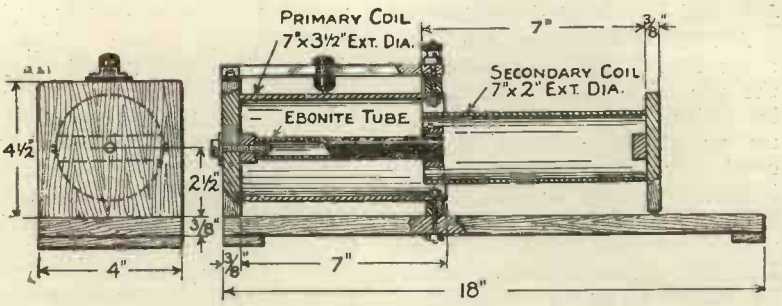

Fig. 2.—Details of the assembly of the parts.

The winding should occupy approximately a length of 4¾ in. on the former, leaving a space of 1⅛ in. clear at each end.

Next build the baseboard and side support, details of which are given in Fig. 2, which is a section taken through the centre of the complete instrument. The base board itself should be 18 in. long x 6 in. wide x ⅜ in. thick. At one end fix the primary support, which is made of wood 4½ in. x 4 in. x ⅜ in. This is screwed into position from the underside of the baseboard. A hole is drilled in the centre of the support, as shown in the figure, to clear a 4 B.A. screw. The primary coil is fixed to this support by means of wood strip screwed to the inner side of the support. If these instructions are carefully followed, the coil when placed should be exactly central with the 4 B.A. hole. The final securing is made by passing two small screws through the former and into the wooden rest.

The other end of the primary is fixed by the following means : From a length of ebonite tube cut a ¾ in. length ; pass through the base board and secure on the under side by means of a nut a piece of 2 B.A. brass rod over which slip the ebonite tube previously cut; pass the rod through the former and secure on the inside by means of a further nut. No length of rod should be left projecting on the inside of the former, and no rough edges must appear above the nut in order that a free passage for the secondary coil may be ensured. The former will now be found to be quite secure.

An ordinary slider rod and plunger, as shown in Fig. 2, is next assembled. The length of rods usually procurable are 12 in., and this will do if it is cut to 7 in. by means of a hack saw. The end which is attached to the support is fixed by means of a small brass bracket, preferably mounted on ebonite strip. The other end is fixed in a way similar to that adopted when fixing the former to the baseboard, but in this case 4 B.A. rod is used in order that it will pass through the existing hole in the slider rod. To secure this latter a suitable length of ebonite tube is passed over the 4 B.A. rod followed by the plunger rod and the whole tightened by means of a nut and the top portion of a 4 B.A. terminal.

The adjustment of the plunger rod is a very important matter, and can only be successfully achieved by careful tests as regards the action of the plunger and its distance from the windings.

After treating the coil with shellac and allowing it to dry, it will be necessary to slide the plunger rod back off the turns, having first made a mark of its trail across the coil in order to remove the cotton covering and leave the wire bare. The best way of doing this is to wrap a piece of rough sandpaper round a flat stick and rub backwards and forwards until the cotton is taken off, leaving a line of perfectly clean bare copper.

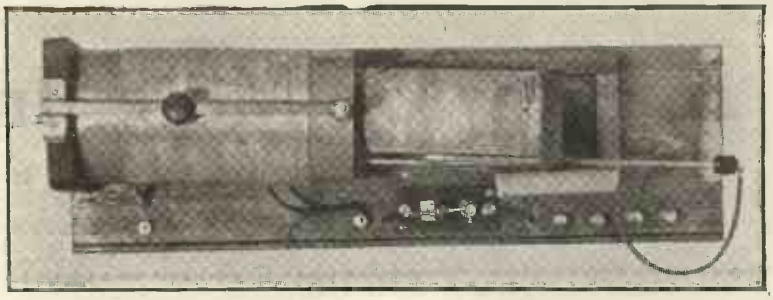

Fig. 5.—A plan view of the Set.

force a 4 B.A. nut into one end by means of gentle tapping. Secure this end in the hole in the primary support by means of a 4 B.A. screw and a large washer.

Cut a length of 2-in. former to 7½ ins. and wind with 150 turns of No. 22 S.W.G. d.c.c. This

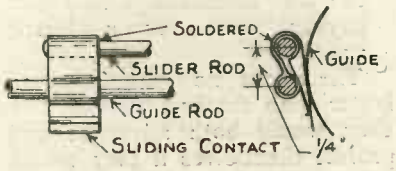

Fig. 4.—Details of the slider.

winding occupies a length of 6 ins. approximately, leaving ¾ in. of tube clear each end. A length of wire is left over at the end of the winding for connecting purposes. The details of the secondary coil are shown in Fig. 3. A piece of wood, having a central hole to clear the ½-in. ebonite rod, is cut to fit tightly into the coil. The shape of this wood is shown in the left-hand drawing of Fig. 3, the projecting portion being drilled to clear ⅛ in. diameter plain rod. The purpose of this wood is to act as a bearing for the guide rod which actuates the slider rod. The other end of the secondary coil is supported by means of a piece of wood 4 by 3 by ⅜ ins. Two small screws are placed on the bottom edge of this support and the heads are filed smooth—these act as runners on the baseboard. The inner face of the same support has a piece of wood screwed on from the inside, in the position shown. The cardboard former is fixed to this piece of wood by means of two small screws. A further hole is drilled in the support to clear the ⅛ in. plain rod, which acts as the other bearing for the guide rod. Just above this hole drill another of ⅛ in. diameter to act as a bearing for the slider rod. The winding of the coil is bared in a similar manner as described for the primary on a line just above the two bearing holes of the guide rod. The secondary is now completed by constructing the slider and guide rod, constructional details of which are given in Fig. 4.

(To be concluded.)

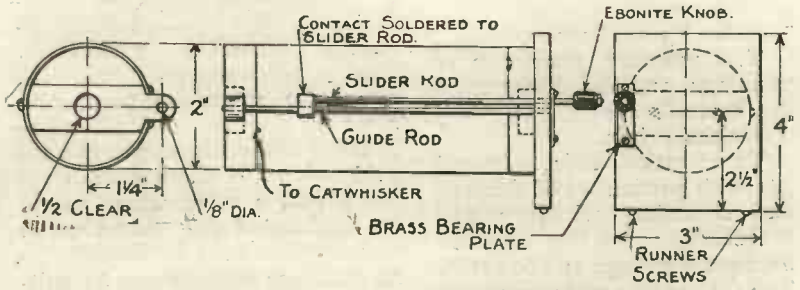

Fig. 3.—How the secondary is assembled.

The Secondary Coil

To construct the secondary coil a bearing must first be made upon which it will run backwards and forwards. Cut a length of ebonite tube 7 in. long; expand the tube by slight warming and

A Plea for More Information

By W. E. MILTON AYERS, A.M.I.E.E., Mem. A.I.E.E.

[We fully endorse our correspondent's remarks.]

IT is sometimes asserted that British amateur wireless enthusiasts purchase foreign goods by preference or for mere cheapness. This is not always the case, and in this article an endeavour will be made to show how British manufacturers could benefit themselves by the supply of a little reliable technical information concerning their products.

It will be argued by some that the public would not benefit by such a policy, as they are not educated to understand it, and that the manufacturers would only play into the hands of unscrupulous competitors. I do not believe either argument. As regards the first objection, it must be admitted that there are thousands of non-technical amateurs now who talk quite intelligently of inductance, capacity and impedance, who but twelve months ago had never heard such terms. The second objection is a mere bogy, for anyone can buy the article concerned and make "Chinese copies."

The result of present policy, however, is that unscrupulous and ignorant manufacturers put meaningless figures on wireless apparatus to deceive the public into the belief that they are buying first-class tested fittings. Two instances will be given:—

A. A L.F. intervalve transformer was marked "Tested ratio 5:1," so the writer pressed the question as to what such a statement meant. It was ultimately admitted that the number of turns were approximately — Primary, 2500; Secondary, 5000 (primary probably less); and the ratio of resistance to D.C. current was about 5:1. Such a label, with the figures filled in in ink, so as to look like a genuine test result, is nothing but arrogant deception.

B. A variometer was handed to the writer to test for a dealer before he took it up as a marketable line. Here again was a printed label with blank spaces filled in in ink as test results, but the inconsistency was amusing, as follows:—

	Min.	Max.
Tested Inductance millihenries	20	50
Natural wavelength ...	200	500

which is quite absurd to those who know, but very deceptive to the unknowing who are paying more for a tested article.

There are no manufacturers better than the best British, but they would both advertise and protect themselves if they would tell us more about their goods.

Here are a few examples of technical information supplied concerning articles at present on the British market from other countries:—

L.F. TRANSFORMERS.

German origin.

Stage I.—P5000/S20000.
Stage II.—P5000/S30000.
Stage III.—P7000/S17000.
Stage IV.—P7000/S12000.

French origin.

Ratio P5000/S25000.

Test pressure, resistance of windings, and tested magnetising current.

American origin.

Three ratios, 10/1, 5/1 and 3/1, with particulars of primary and secondary windings and resistances, also test pressure between windings and to earth. Tab attached, giving tester's initials and date with serial number of transformer. A booklet is issued, giving best positions for the various ratios with different types of valve or following a crystal.

FILAMENT RESISTANCES.

American origin.

Particulars of total resistance and vernier step.

VARIOMETERS.

American origin.

Particulars of stator and rotor inductance with maximum and minimum for series and parallel connection.

Now there are some excellent British intervalve transformers on the market, but scarcely one manufacturer will tell you the number of turns, and in nearly all cases only one ratio is made. This one ratio may be a very good compromise, but cannot be the best for all positions and conditions. The discriminating amateur, therefore, turns to other products—often regretfully.

Valves are another case in point. If our manufacturers are asked for technical information concerning their valves they will give filament voltage and current, and plate voltage. This they consider quite ample information with the remark that their valve "is the best." In the case of only two valves has the writer seen printed characteristic curves published, and in neither case did the information really advertise the valve. It is an easy matter to obtain the characteristic curves of American valves, as the manufacturers are quite willing to supply technical particulars. Really, we amateurs require to know the saturation point and slope of a valve, with plate impedance and milliamperes at zero grid volts. If these particulars are given, a valve which would be condemned for distortion in ordinary use may be brought to an excellent performance by suitable grid bias. Instead of the manufacturer losing anything by the information supplied, he would gain the advertisement of another satisfied customer.

Let our manufacturers fully understand that to be niggardly with technical information always conveys the impression of there not being much to know, whereas the supply of a few curves and figures cannot convey the information of years of accumulated experience.

How to Design Your Own Set

No. VII.

By PERCY W. HARRIS, Assistant Editor.

The following is the concluding article of a series which began in Vol. 3, No. 1.

THE first practical point to be considered in making up a high-frequency amplifier is to keep the lead from the tuner to the grid of the first valve as short as possible and well away from any other lead. The utmost care must be given to the insulation of everything connected to the grid, and weak signals may often be the result of using inferior valve sockets. The lead from the plates must also be kept well separated from the gridlead, for capacity between the plate and the gridlead is one of the most frequent causes of self oscillation. We have in the valve itself a certain capacity between the grid and the plate (varying with the different types of valves) and the smaller this capacity, the better. It is often overlooked that there is a considerable capacity between the pins of the valve, particularly where they are pushed into the socket. Another source of coupling capacity is between the wires in the "pinch" of the valve, *i.e.*, the glass portion through which the leads from the plate, grid and filament pass. For this reason considerable advantage is gained on short wavelengths by using low-capacity valves in which the grid and plate leads are brought out not through the base of a valve, but on different sides. A series of valves (V24, Q, QX, D.E.V., etc.), is made by the Marconi Osram Valve Co., specially for short wave work, while the Mullard Radio Valve Co., also make certain valves of low capacity. A new valve to come on to the British market, possessing this desirable characteristic, is the "Myers," in which the grid and plate leads are brought out at opposite ends of the valve. If then we carefully avoid capacity effects between the leads to the grid and the plate and use valves and sockets which have a minimum capacity, then we reduce the tendency to self oscillation very considerably. Whilst speaking of low-capacity valves I would like to point out that it is quite futile to buy an expensive low-capacity valve and then fit it to an adapter so that it may be used in a four-pin socket. In doing this you are first of all using a valve with low capacity and then making up for this low capacity by adding that which normally existed between the pins. Very often, too, the adaptors themselves have a far larger capacity than is necessary. The use of adaptors is merely for the purpose of utilising existing valves in the four-pin socket, and is not a means of reducing the capacity of the valve portion of the circuit.

A tapped anode coil with variable reaction coupling.

When laying out a set containing high-frequency valves, there is always a tendency to overlook the fact that the most convenient part of the panel for handling the component is not always the best position electrically. Recently I saw a photograph of a large set containing two high-frequency valves, in which the tuning condensers were placed at the bottom of the panel quite a foot away from the sockets which carried the coils. This meant, of course, that very long leads had to go from the condenser to the coil, not only introducing unwanted capacity and making the minimum value of the capacity much higher than should be, but really asking for trouble by induction between the circuits. Be careful, then, to place your tuning condenser as close as possible to the coil or transformer associated with it. The position of the filament resistances does not greatly matter. The leads to a potentiometer should also be kept short, and at all costs avoid much crossing of wires when switches are introduced in various parts of the circuit. Once again I would like to emphasise that there is a tremendous difference between a conventional circuit diagram and an instrument made from it. Only a few weeks ago a set was brought to me purporting to be my "All Concert" receiver "improved" to meet the needs of the constructor who wished to utilise a very large cabinet. The wiring up of the set was entirely different from that given in my original article, and some of the leads which were in vital parts of the circuit were no less than 15 in. long. The builder was quite surprised that he got such poor results, and was inclined to blame my design. It took some time to explain to him that the use of the same components and the same circuit did not justify him in stating that the design was mine, and after he had rebuilt the set, following closely the original lay-out, the results were as satisfactory as could be wished.

If you are designing a resistance-coupled amplifier for long wavelengths, you will also find it of value to shorten all leads as much as possible, particularly those which are connected to the anode resistance and grids and plates. It may be thought that on long wavelengths, with resistance-coupled amplifiers, the length of leads is not so important, but an examination of a circuit will show you that if there

are many stray capacities present in the leads connected to the anode resistance, these may seriously reduce the impedance of this resistance at radio frequencies. Indeed, it is the stray capacities and the valve capacity which makes it impossible to use resistance coupling satisfactorily on very short wavelengths. On longer waves, shunting capacity is not so important, as its impedance to radio frequencies increases with the wavelength, but nevertheless it is quite easy to have stray capacities sufficiently large to reduce signal strength appreciably even in long wavelength receivers, and in addition there is, of course, a tendency to set up self-oscillation by these stray capacities.

General Hints

This series of articles was originally planned to be completed in six issues. It has run into a seventh, and even now has scarcely touched upon more than the broad principles of design. Before concluding, however, I would like to suggest a few general ideals to the home constructor. The first relates to symmetry.

As a general rule, when laying out your set, aim first of all to get the disposition of parts such that it will comply with the general rules outlined in this series. Then, having found the best arrangement so as to make your leads short where necessary, try to arrange the various parts symmetrically upon your panel. The reason so many home-made sets look amateurish is simply because the parts are not so arranged. Of course, I do not suggest for a minute that you sacrifice efficiency to obtain this symmetrical lay-out, but you will find that some amount of thought given to the subject is worth while. For convenience, the aerial and earth terminals should always be kept on the left, and battery terminals at the back or on the right. If you have such terminals in front, you will find the leads get in your way when manipulating the set. Telephone or loud-speaker terminals are best placed either immediately in front of the panel or on the right-hand side.

Ebonite seems to exercise a great fascination with the beginner, and is frequently used to excess, largely because the commercial manufacturers are lavish in its use. Nowadays ebonite can be largely dispensed with (at least in sheet form) if one uses bushes and small pieces of this material to insulate those parts which require it. Several firms sell excellent board-mounting components which, when properly attached, give a very pleasing appearance. Practically every component is now obtainable in this form, so that the experimenter who wishes to make up even an elaborate set using board-mounting is not hindered in so doing. At the same time, it should not be imagined that, in a set containing a large number of components, there is any great saving by using wood panels. If, for example, you need to purchase coil-holders, switches, valve sockets, filament resistances, etc., all on special pieces of highly-finished ebonite for board-mounting, it may be cheaper to buy a piece of ebonite the size of the top of your cabinet and mount the switch arms and points yourself. On the other hand if you are an experimenter who likes to change his set and design very frequently, there is the advantage that the board-mounting components can be taken off the board and wired up in quite a different way, in which case all that has to be scrapped is a piece of wood.

Do not attempt to get greater strength of signals by using more than two note magnifiers. With two really good inter-valve transformers, there is very little distortion, but even the best makes give unsatisfactory results in three stages. Recently resistance capacity coupling of note magnifiers has been advocated in many quarters. It should be borne in mind, however, that it requires at least three valves with resistance-capacity coupling to give the results obtainable with two stages of transformer-coupled note magnification. Although good reproduction is obtainable with this method of coupling, a badly-designed resistance capacity-coupled note magnifier can give just as bad results as a badly-designed transformer-coupled unit. A great virtue of resistance-capacity coupling is that all audio frequencies are amplified to approximately the same degree.

Poor results in wireless sets are often obtained by using the wrong filament voltage and unsuitable plate voltage. The serious experimenter will find it well worth while to invest in a small voltmeter reading up to 6 or 8 volts with a good open scale, which he can use to find whether his filament resistances are correctly adjusted. If the valve is rated by the makers at 4 volts filament voltage, the voltmeter should be placed across the two filament pins when the valve is alight and the rheostat varied until the voltmeter reads exactly 4 volts. A mark can then be made on the panel for the correct setting, so that it can be reproduced at any time. If the filament is burnt brighter than this, no better results will be obtained, but, on the other hand, the life of the valve will be considerably shortened. If it is not burnt at this voltage there may be distortion. There is greater flexibility in the plate voltage, and the average valve works quite satisfactorily on anything from 70 to 100 volts. Dull emitters, of course, require more care in this respect, and the rated plate voltage should not be exceeded.

(*An article on the Design of Note Magnifiers will appear in the next issue.*)

The new broadcast station of the Société Belge Radio-Electrique at Brussels, has been satisfactorily received in Manchester, when the local station is closed down. It transmits telephony every day from 5 to 6 p.m. and from 8.30 to 10 p.m. on a wavelength of 410 metres. Between 5 and 6 p.m. on Sundays has been found a good time for receiving this transmission.

The strength of reception is reported to vary very considerably from day to day, and fading is noticeable.

The Charging and Care of Accumulators.

By R. STANSFIELD, A.M.I.C.E.

An article explaining how to overcome many of the difficulties experienced by users of secondary cells.

(Concluded from Vol. 3, No. 6, page 185.)

If a battery is carefully handled the electrolyte only requires the occasional addition of a little distilled water towards the end of a charge in a sufficient quantity to keep the tops of the plates well covered. When acid is spilt the treatment of the electrolyte is less simple, and it is necessary to add dilute brimstone sulphuric acid towards the end of charge to make up the loss. The specific gravity of this acid should be about 1.250, and if evaporation as well as spilt acid is to be made up, dilution is necessary.

Batteries should never be allowed to stand for many hours after being discharged as this leads to sulphation, indicated by the formation of yellowish-grey patches on the plates, the discolouration sometimes spreading over the whole surface. For bad cases there is no cure, but milder attacks can be treated with more or less success by charging at half normal rates for several successive charges, giving good but slow rate overcharges and taking great care not to over-discharge.

A healthy and fully-charged battery has slate-grey negative plates and dark chocolate—almost purple-black—positives. When the same cells are discharged the positives change in colour to a reddish-brown, change in the negatives being only slight.

The use of high-tension accumulators instead of dry cells commends itself to all amateurs for many reasons, amongst which may be mentioned the fine anode voltage regulation which can be obtained; the freedom from noises, and the ease with which each cell can be inspected. The great objections to their use are the cost of and the difficulty of charging. The charging rate is measured in tenths of amperes, and few ordinary charging stations can handle either these low rates or the comparatively high voltages with any degree of satisfaction. A further source of difficulty between the charging station and the experimenter is that the latter wishes to tap off part of the battery and therefore different cells in one group may need different amounts of charging. Failing this, the cells used

The "Exide" B.K. H.T. Battery.

the least will be overcharged and their life reduced.

There is actually no need for anyone to forego the advantages of accumulators in the H.T. circuit on account of these supposed disadvantages. They can be charged up at home with perfect simplicity, safety and selectivity, and at a much lower cost per group than that for charging an ordinary 6 volt L.T. battery.

The method is as follows: couple a filament resistance in series with, say, the negative lead from an ordinary 6-volt accumulator and carry the lead from the resistance to the negative pole of the H.T. battery. Connect the positive lead of the second cell of the H.T. battery to the positive lead of the L.T. cells. In this way a pressure of 6 volts is forcing current through the resistance and two cells of the H.T. battery. The resulting current depends on the value of the resistance and falls during charge. Good results are obtained by selecting a resistance such that RC = 1.6 where R = resistance in ohms and C = normal current for H.T. cells in amperes.

A filament resistance of 16 ohms will be suitable in most cases.

Charge is continued for the two cells until both are gassing freely, and then the leads are changed to the next pair, the negative lead going to the connection previously used as positive, and the positive lead to two cells further along the group. The only precautions to note are that the lead from the L.T. negative must always be nearer the negative end of the H.T. accumulator than the positive lead, and that neither more nor less than two cells of the H.T. are coupled in circuit with a 6-volt L.T. supply. If desired, single cells may be charged from a 6-volt L.T. battery by arranging the resistance so that RC = 3.9.

The ease of manipulation of H.T. accumulators would be much increased if the makers carried the lugs of the plates through the connecting bars in the form of conical projections and supplied lead terminal cups to drop over these for use as wanderplugs. The current values are so small that screw contact between the lead cups and the projections themselves is quite unnecessary, and the alteration should not add to the cost by any appreciable amount.

A Novel Single-Valve Receiver

By STANLEY G. RATTEE, Staff Editor.

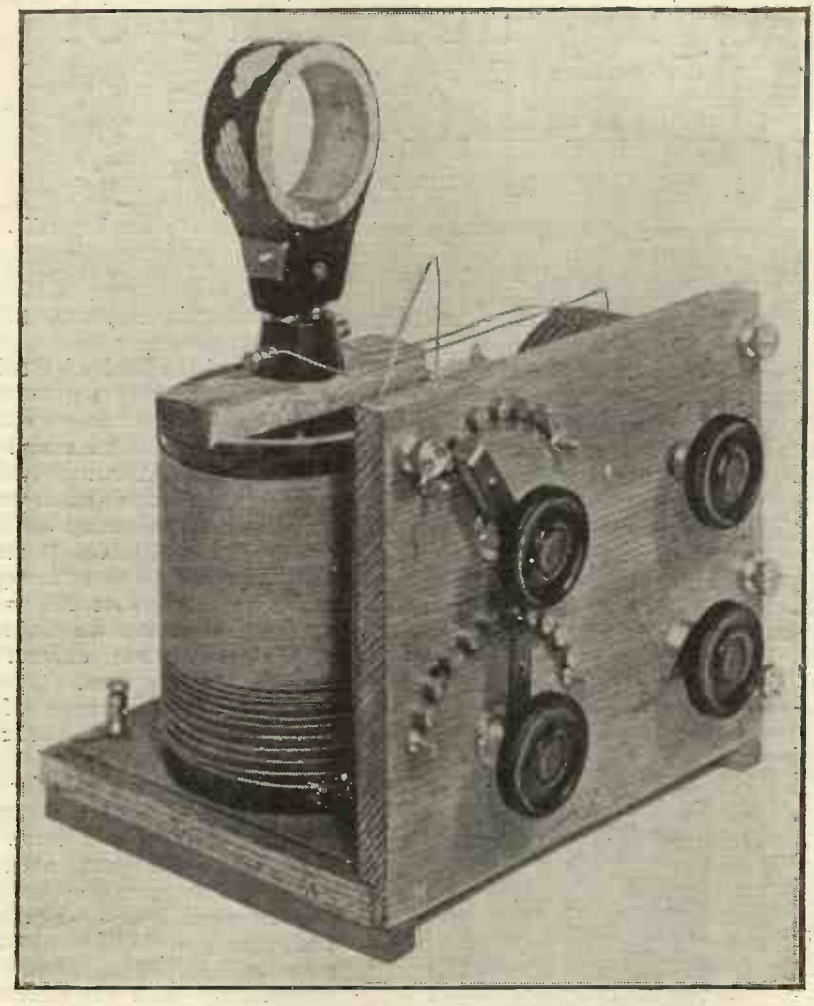

Fig. 1.—Note the method of mounting the plug-in coil.

IN the majority of single-valve receivers where reaction is employed the type of reaction used is what is known as electro-magnetic reaction and is obtained by means of a coil in the plate circuit of the valve, coupled to the aerial coil so that electro-magnetic induction takes place between the anode and grid circuits. The same reaction effect may be obtained by employing electro-static or capacity reaction which is brought about by introducing a variable condenser between the plate and grid circuits.

In the case of single-valve receivers, however, the obtaining of capacity reaction usually presents some difficulty, and for this reason the receiver about to be described is somewhat novel, in that this type of reaction is used with marked success. Fig. 1 shows a front view of the instrument with the aerial and earth terminals seen to the left and right respectively on the top of the wooden panel. The two right-hand bottom terminals are for the telephones. The two knobs seen to the left of the panel are the tuning coils adjusting handles, whilst the two knobs to the right are the reaction condenser and filament resistance handles. Fig. 2 is a photograph of the back of the instrument from which it will be seen that the low-tension and high-tension batteries have terminals fitted to the baseboard, those on the left being for the high-tension supply, whilst those on the right are for the low-tension.

Components and Materials

The materials and components required for assembling such a receiver as is herein described are as follows :—

1 piece of mahogany, or other hard wood, $7\frac{3}{4}$ by $6\frac{1}{4}$ by $\frac{1}{2}$, to form the panel, or, if preferred, ebonite of $\frac{1}{4}$ in. thickness may be used.

1 piece of mahogany, or similar hard wood, $7\frac{3}{4}$ by $6\frac{1}{4}$ by $\frac{1}{2}$ to form the baseboard. Ebonite may also be substituted if desired.

1 wood strip $4\frac{1}{4}$ by 1 by $\frac{1}{2}$, for securing the inductance.

2 wood strips $6\frac{1}{4}$ by $\frac{1}{2}$ by $\frac{1}{2}$, on which the base is supported.

2 laminated switch arms with knobs.

17 contact studs.

4 stopping pins.

1 valve socket.

1 filament resistance.

1 cardboard tube 4 in. by 5 in. long.

$\frac{1}{2}$ lb. No. 24 S.W.G.-d.c.c.

8 terminals.

1 variable condenser of 0.0003 μF capacity or parts to make.

1 grid condenser of 0.0003 μF capacity.

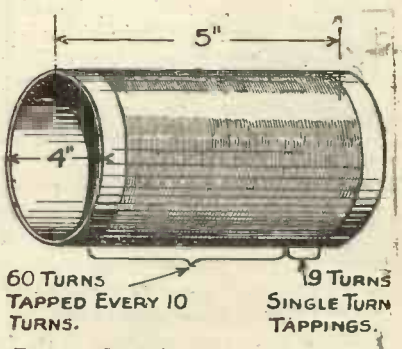

Fig. 3.—Details of the tuning coil.

The following constructional article describes a single-valve receiver for broadcast reception, employing electrostatic reaction.

1 gridleak of 2 megohms resistance.
1 0.002 μF fixed condenser.
1 coil socket.
1 100 turn honeycomb coil.
Quantity of No. 18 or No. 20 tinned copper wire for connecting purposes.
1 6-in. length of 2 B.A. rod, with 2 nuts and washers.

The Inductance

This is wound on the cardboard former 4 in. × 5 in. long with No. 24 S.W.G.-d.c.c. copper wire, and is illustrated in Fig. 3. There are in all 69 complete turns, the first 60 being tapped every tenth turn and the remaining nine turns are tapped at every turn. The beginning of the winding is anchored by boring two small holes ¼ in. along the former and threading the wire through, leaving sufficient loose end to permit connection to the first stud. The tappings are made by making a 6-in. loop of the wire, after the required number of turns have been wound and twisting sufficiently tight to prevent unravelling. The finish of the winding is secured as in the beginning by means of two small holes through which the wire is threaded, care again being taken to leave sufficient free wire for connections.

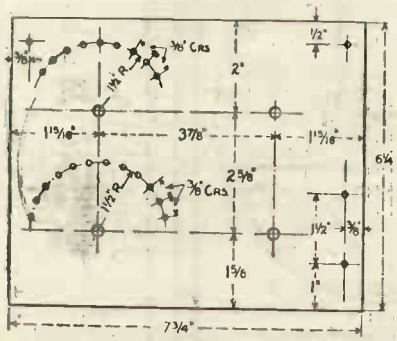

Fig. 4.—Drilling plan of the front panel.

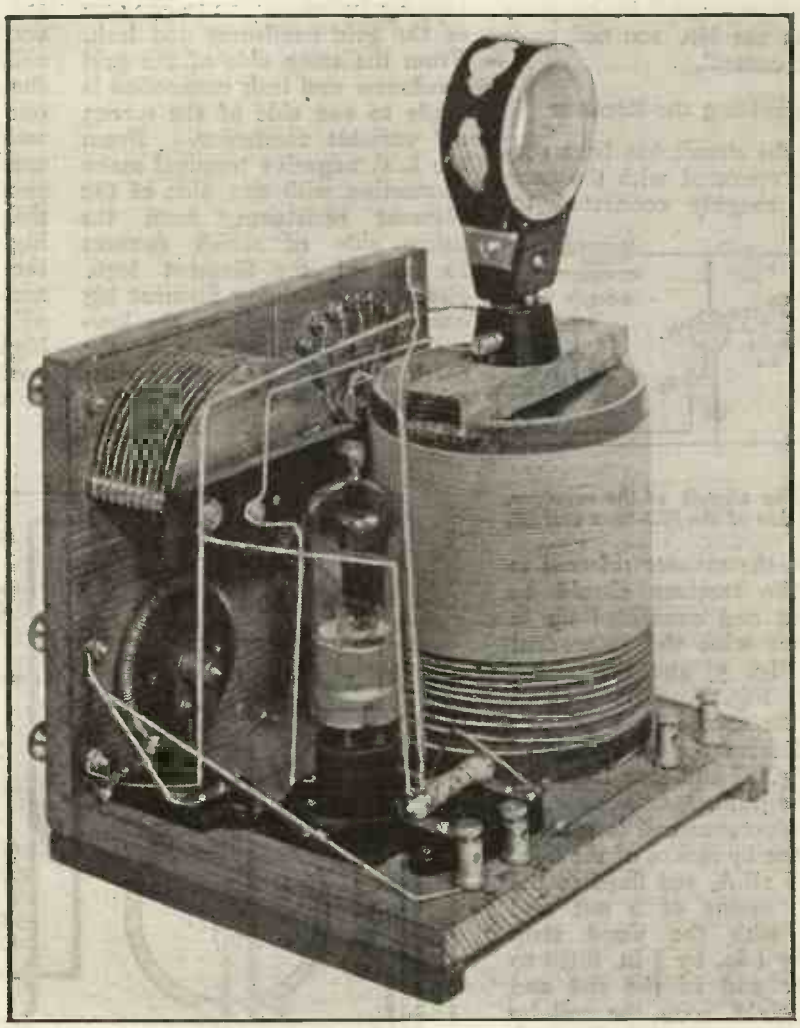

Fig. 2.—A rear view of the receiver.

The Panel and Base

Should the reader decide to make these from wood, then after drilling in accordance with the dimensions given in Fig. 4, both panel and base together with battens should be gently baked until completely dry.

If ebonite is chosen for either the panel or base or both, then with all holes drilled as per Fig. 4, the glossy surface should be removed by means of smooth emery cloth or pumice powder before mounting the components.

The Circuit

The circuit employed is illustrated in Fig. 5, and before assembling and finally connecting the components readers are recommended to try out the circuit with the various parts laid out on the table and roughly connected together.

The choke coil connected between the plate of the valve and the telephones is given as a No. 100 honeycomb coil, though the reader may find that with other coils better signals may result. In the writer's case, using a 0.0003 μF variable condenser for reaction, a No. 100 coil gave the best effect, though when using a 0.0005 μF condenser for reaction a No. 75 coil was preferable. A number of experiments

with coils and condensers showed, however, that a 0.0003 μF condenser used in conjunction with the No. 100 coil gave the best control.

Assembling the Receiver

Once the circuit has been successfully operated with the components roughly connected to-

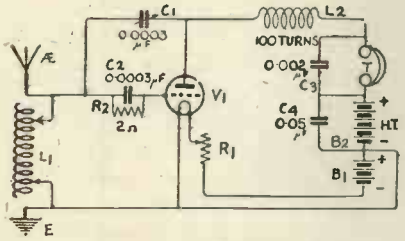

Fig. 5.—The circuit of the receiver. Note the use of the 100-turn coil L2.

gether in the manner referred to above, the receiver should be assembled and connected up in accordance with the theoretical circuit, Fig. 5, and the wiring diagram, Fig. 6. The disposition of the components may be gathered from the back-of-panel view, Fig. 2, and also from the wiring diagram.

The inductance coil is secured to the base by means of the 6-in. length of 2B.A. rod fixed to the base by means of a nut and washer, with the wood strip $4\frac{1}{4}$ ins. by 1 in. by $\frac{1}{2}$ in. fitted to the other end of the rod and screwed tight upon the coil by means of a nut and washer.

The coil mount may be fitted to this wood strip, as seen in Fig. 2, when it will be easily accessible with plenty of clearance for the coil.

The connecting up of the receiver is best accomplished in the following manner, all connections being soldered:—The ten-turn inductance tappings are connected thus: The beginning of the winding is connected to the first stud of the seven seen at the top of Fig. 1. The first tapping is connected to the second stud, the second tapping to the third stud, and so on, until the last of the ten-turn tappings is connected to the seventh stud. The first single turn is connected to the first stud of the ten seen on the bottom left of Fig. 1, each successive turn being connected to its own stud until the end of the coil is connected to the tenth stud. Connection is now made from the aerial terminal to the single-turn tapping switch and on to one side of the grid condenser and leak. From the same side of the grid condenser and leak connection is made to one side of the 0.0003 μF variable condenser. From the L.T. negative terminal make connection with one side of the filament resistance, from the other side of which connect to one of the filament legs. From the remaining filament leg connection is made to the low-tension positive terminal, the earth terminal and the switch controlling the ten-turn portion of the inductance. From the plate leg of the valve-holder make connection to the unconnected side of the 0.0003 μF variable condenser and to one side of the coil mount. The other side of the coil mount is connected to one of the telephone terminals, whilst the remaining latter is connected to the high-tension positive. The low-tension positive is now connected to the high-tension negative. Across the telephone terminals is connected a fixed condenser 0.002 μF capacity, whilst across the high-tension terminals may be connected a 0.05 μF condenser, as shown in Fig. 5.

(*Concluded on page 218.*)

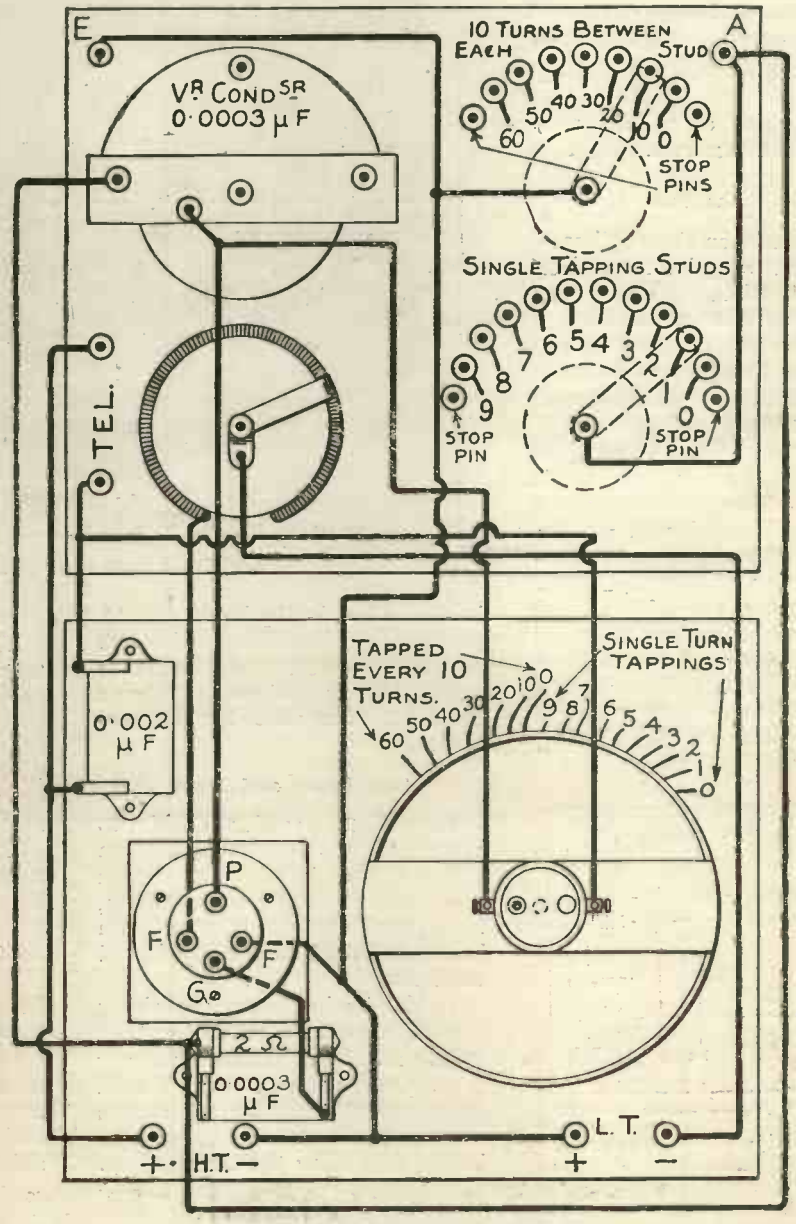

Fig. 7.—Complete wiring diagram.

CIRCUIT No. 21

THE "VOIGT" DOUBLE AMPLIFICATION CIRCUIT

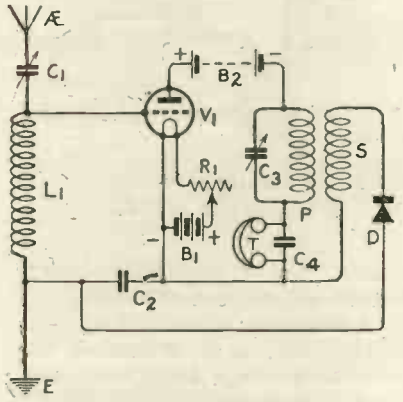

Fig. 21A.—The Voigt dual amplification circuit.

Connecting Up

GRID condenser "out." Gridleak "out." High tension battery to terminals P and XHT+ (+ to P and — to XHT+ terminals). Primary of high-frequency transformer to terminals 2 and 3 shunted by 0.0003 μF variable condenser. Telephones to + and — H.T. terminals. Battery strap in position. Reverse L.T. leads. 0.002 μF condenser to +E, earth lead and A.T.I. Upper end of secondary of H.F. transformer to crystal. Other side of crystal connected to earth lead and the 0.002 μF condenser. Connect the other end of secondary of H.F. transformer to — H.T. terminal, *i.e.*, to the other side of telephones.

General Notes

This circuit is a simple dual arrangement and is particularly good for long-distance reception. It should be noted that the positions of the H.T. battery and telephones are somewhat different from those chosen for the majority of the other circuits. Tuning of this circuit is accomplished by means of the inductance L1, which may be a plug-in coil if desired, and the variable condenser C1.

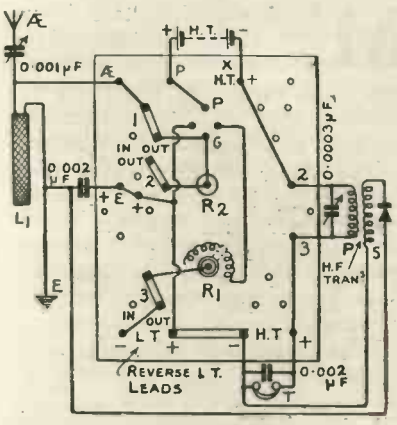

Fig. 21B.—The panel connections of Figure 21A.

"WIRELESS WEEKLY" UNIVERSAL VALVE PANEL

The following are the two concluding circuits of the several possible arrangements using the panel, constructional details of which were given in Vol. 3, No. 1.

CIRCUIT No. 22

A SIMPLE SINGLE-VALVE TRANSMITTER

Connecting Up

Grid condenser "out." Gridleak "out." A.T.I. connected to aerial and P. The other side of A.T.I. to earth and H.T.+. The microphone is shunted across the absorption circuit coil L3. The reaction coil is connected to —LT and Æ terminals. Battery strap in position.

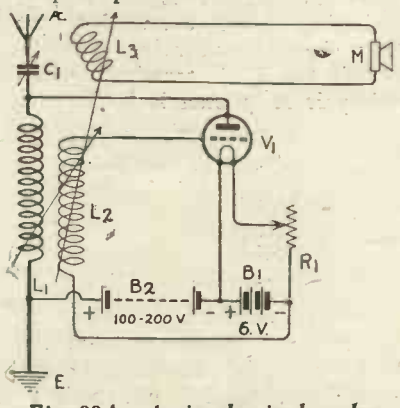

Fig. 22A.—A simple single valve transmitter circuit.

General Notes

This circuit is not to be used except by those experimenters who possess a transmitting licence.

This concludes the series of circuits to be published, and although only some 22 circuits have been given, numerous other arrangements can be tried.

In this direction the following few suggestions taken from recent issues of *Wireless Weekly* and *Modern Wireless* will be of use to the experimenter for making further use of the Universal Valve Panel :—

VOL. 2, NO. 12.—SHORT WAVE TRANSMISSION.

VOL. 2, NO. 13.—C.W. TRANSMISSION.

VOL. 2, NO. 13.—A "SQUEGGER" CIRCUIT FOR TESTING GRIDLEAKS.

VOL. 2, NO. 16.—A CRYSTAL RECEIVER AS A WAVEMETER.

VOL. 2, NO. 16.—ARMSTRONG SUPER-REGENERATIVE RECEIVER.

VOL. 2, NO. 16.—THE SATTERLEE SINGLE VALVE RECEIVING CIRCUIT.

VOL. 2, NO. 16.—THE FLEWELLING "FLIVVER" CIRCUIT.

VOL. 2, NO. 18.—THE AUTOPLEX CIRCUIT.

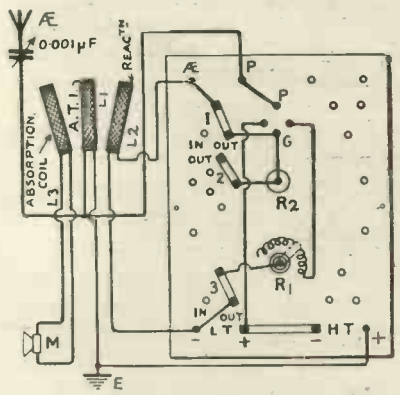

Fig. 22B.—The panel arrangement of Figure 22A.

Still further circuits which will be found possible with this unit are given in "Practical Wireless Valve Circuits," by John Scott-Taggart, F.Inst.P.

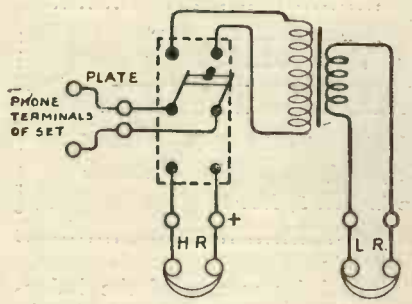

Fig. 1.—The Circuit.

Using High or Low Resistance 'Phones at Will

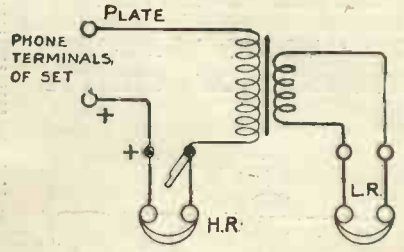

Fig. 4.—A simpler arrangement of that given in Fig. 3.

MANY experimenters have both high- and low-resistance headsets in general use, and there are hundreds of wireless men who began with the crystal and 2,000-ohm 'phones, going later to the valve set and fitting it with a telephone transformer and 'phones with a resistance of 120 ohms. Though it is not wise to use 2,000-ohm 'phones if the plate current exceeds 100 volts, and then only if they are of a reliable make, the writer finds that they are better for the reception of very faint speech, the reason probably being that even with the best of telephone transformers the introduction of yet another iron-core into the set makes for slight distortion.

For general work the low-resistance 'phones are used, but if some weak and distant transmission is picked up, such as an American broadcast on a small set, then the usefulness of some device for allowing either headset to be used at will becomes apparent.

The circuit is shown in Fig. 1. As will be seen when the D.P.C.O. switch is turned away from the user the telephone terminals of the set are connected to the primary of the transformer, from the secondary of which leads run to the L.R. terminals. On turning the switch towards you the output from the set is taken direct to the H.R. terminals, the transformer being thrown entirely out of action.

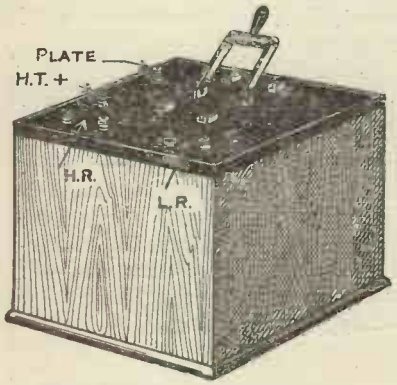

Fig. 2.—The unit shown in a compact form.

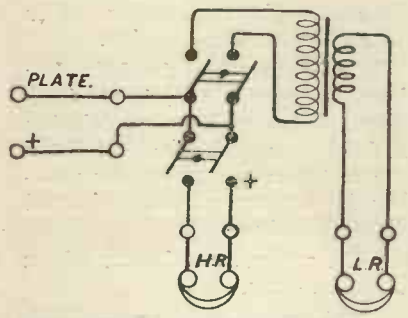

Fig. 3.—Circuit arrangement for using both H.R. and L.R. 'phones.

A neat way of making up this fitting (Fig. 2) is to mount the transformer in a hard wood box lined with copper foil to absorb any stray fields. The top of the box is a piece of ¼ inch ebonite upon which are mounted three pairs of terminals and a D.P.C.O. switch of the midget type. The dimensions of the box will, of course, depend upon the type of telephone transformer that is used. The writer's is 3¼ inches square at the top and 4 inches deep, the transformer used being that made by the M-L Magneto Syndicate.

If it is desired to be able to use both pairs of 'phones simultaneously so that a visitor can listen-in at the same time as yourself two double-pole single-throw switches should be used, the circuit being that shown in Fig. 3.

A very simple circuit which allows both pairs of 'phones to be used at once is shown in Fig. 4. Here no switch is needed, a swinging hook connection cut from sheet brass serving to short-circuit the H.R. terminals when this pair of 'phones is not in use.

R. W. H.

A NOVEL SINGLE-VALVE RECEIVER.

(*Concluded from page 216.*)

In the set under description this latter condenser was not found necessary and is therefore omitted.

Operating

The operation of a receiver of this type is extremely simple and is best carried out by first setting the two inductance switches to the minimum position. Move ten turns into circuit, then one turn, then two turns, and so on, until signals are heard. If no signals are heard, move a further ten turns into circuit and start again with the single turns. A detailed description of the tuning of an inductance of this type is given in *Wireless Weekly*, Vol. 2, No. 9, in an article entitled "Practical Tuning." Once signals have been picked up, slowly vary the reaction condenser until the best result is obtained, taking care that the set is not made to oscillate meanwhile. When using a condenser and honeycomb coil of the sizes given, the operation of the reaction circuit is much the same as that of a Reinartz receiver—that is, slow and easy yet sensitive.

A Safety Device for Dull Emitter Filaments

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

THOUGH dull emitter valves such as the Wecovalve, the Ediswan A.R.06, the B.T.H.B5, and the M.O.D.E3 can now be worked quite satisfactorily off dry cells, owing to their very low current consumption for heating the filaments, there are a good many small points of importance which do not always occur to one at first sight. The chief difficulty lies in the peculiar behaviour of primary cells of the Leclanché type, whether dry or wet.

When these cells are in use a gradual polarisation takes place which raises the internal resistance and so cuts down the E.M.F. Hence when valves are run off them for any length of time it is necessary to reduce the resistance in the circuit by adjusting the rheostat in order to compensate for the falling off in voltage. Take the case of a Wecovalve to which is connected a brand new dry cell. As the valve requires approximately one volt, the greater part of the resistance of a large rheostat will be in use to begin with. At the end of an hour or so the current demand of .25 ampere will have told upon the cell and the filament will require to be brightened a little. As we continue to work the E.M.F. of the cell will decrease until it reaches perhaps 1.1 volts. We now break the circuit by opening the low-tension switch and leave the set for 24 hours. At the end of that time, leaving the rheostat in the position which was correct when the set was last used, we close the low-tension switch—result possibly a burnt-out filament, certainly a damaged one through an excessive voltage.

During the twenty-four hours' interval the cells have picked up until they have regained almost their initial voltage. When brought into use again the output will fall off very rapidly until it reaches a fairly steady figure; but the first burst of high voltage when the cell is brought into use again is sufficient to do damage. Matters are rather worse with valves requiring .06 ampere at 3 volts, since these have filaments so fine that they are very easily spoilt. Further, with these valves three dry cells are used so that the voltage which may have fallen off to something like 3.6 may so pick up that for a few moments the best part of the original 4.5 is delivered.

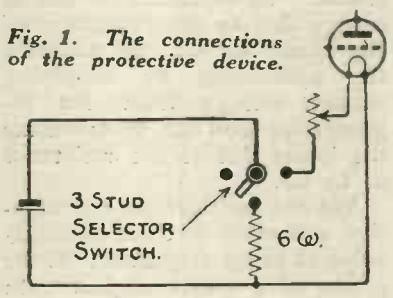

Fig. 1. The connections of the protective device.

One can, of course, ensure the safety of filaments by making a rule of always breaking the low-tension circuit not by opening the L.T. switch, but by turning the rheostats to the off position. This, however, is not a process that appeals to everyone, in fact most of us prefer, once we have found the best setting of the filament resistances, to be able to switch on without altering them. The most satisfactory way out of the difficulty is to make up a simple device which will tone down the first exuberance of rested cells before they are brought into use. This can be done very simply in the way shown in Fig. 1.

A three-stud selector switch is used instead of the usual single pole, single throw switch for controlling the L.T. circuit. The left-hand stud gives the off position; that on the right throws the battery into circuit with the filament; that in the middle places a fixed resistance of 6 ohms in shunt with the battery, the filament being disconnected. The switch is used in the following way. When the set has been resting over night, one's first action as a preliminary to using it is to turn the switch one step to the right, so that the arm makes contact with the middle stud. This throws in the 6-ohm resistance and allows the cell to work off its extra E.M.F. at a maximum rate of .25 ampere even if the voltage has picked up to 1.5. The switch is left in this position for a few minutes. It is then turned over to the right, thus bringing the valve into play. It need not be feared that any great waste of current will occur whilst the switch is in the "toning down" position, for leaving it there is equivalent merely to running the valve for an equal number of minutes.

Fig. 2 shows how the switch can be made up very neatly. An ordinary selector spindle knob and arm are used, such as can be purchased for a shilling from advertisers in this journal. The studs are spaced well apart so that there is no possibility of two being covered at once if the knob is turned rather carelessly to the off position. Below the panel is a bobbin made of a 1½-in. length of ½-in. round ebonite rod upon which are wound 1½ yards of No. 28 enamelled Eureka resistance wire. Each end of the wire is anchored to a 4B.A. screw, which serves also for an attachment for the connections from the middle stud of the switch and the positive lead from the dry cell. As this wire has a current-carrying capacity of ¾ ampere, there need be no fear that it will overheat. The bobbin is secured to the panel by means of a 1-in. 4B.A. countersunk screw.

The device made as described is intended for use with the Wecovalve. For 3-volt .06 ampere dull emitters a similar contrivance

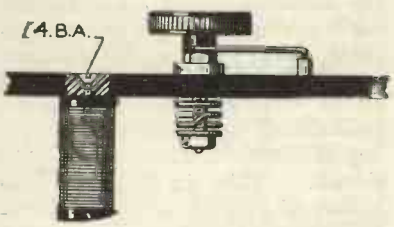

Fig. 2. The constructional details of the switch and resistance.

can be made up, but in this case the bobbin will have to contain 14 yards of No. 30 enamelled Eureka wire. It must therefore be one inch in diameter and three inches long.

C.W. and Telephony Transmission Using Valves

No. II.

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

This is the second of a series of articles which began in our last issue, dealing with the principles of valve transmission and radio telephony.

OWING to the inductive (or magnetic) coupling between L2 and L1 (see Fig. 1), not only will the oscillations in L1 C1 be increased in magnitude, but they will also be prolonged. That is to say, if the oscillations normally died out in 1-100,000th of a second, they would perhaps continue for 1-40,000th of a second. By the use of a regenerative coil L2, we increase the period during which an initial oscillation in L1 C1 will continue.

If the energy transferred from the anode circuit L2 to the grid circuit L1 C1, is sufficiently strong, the oscillations in L1 C1 continue indefinitely. The valve is now oscillating of its own accord, and will continue to produce continuous oscillations as long as there is a flow of anode current. Just as the energy to maintain the oscillation of the pendulum of a clock comes from a spring, so does the energy for maintaining the oscillations of the valve come from the anode battery. Just as in the case of a clock, the pendulum itself times the impulses given to it by the main spring through the escapement, so are the high-frequency impulses from the anode circuit of the valve communicated to the grid circuit by an automatic timing of the oscillations in the grid circuit. This is because the action of amplification is instantaneous and the anode current variations take place at the same time as the grid potential variations.

We may regard the regenerative action of the three-electrode valve in rather a different light. If initial oscillations were set up in the oscillatory circuit L1 C1, they would very soon die out, and this would be largely due to the resistance of the oscillatory circuit. To overcome the loss of energy due to the resistance of the circuit L1 C1, we maintain the oscillations by supplying enough energy from the regenerative coil L2 to overcome the losses due to the resistance of L1 C1.

We can consider the regenerative action of a three-electrode valve as being very similar to the action of a steam engine. In the very early days a steam engine was worked in the following manner:—A flywheel was provided, and was connected through a piston rod to a piston moving in and out of a cylinder; this cylinder was supplied with steam through a tap; when the tap was turned on, steam rushed into the cylinder, forced the piston outwards, and moved the flywheel. The steam was then turned off, the piston returned to its former position, and the steam was once more turned on. A boy was employed to turn the tap on and off at the correct moment. This arrangement may be compared with the ordinary high-frequency amplifying action of the three-electrode valve.

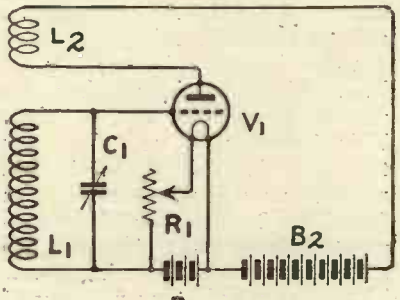

Fig. 1. A simple circuit for the production of oscillations.

The input oscillating potentials correspond to the turning on or off of the tap. Just as the tap sets up powerful mechanical forces which act on the flywheel, so do the oscillations on the grid of a valve produce powerful oscillations in the output or anode circuit. It occurred on a memorable occasion to the boy who operated the tap, that since he always had to turn it on at a certain moment, or, in other words, at a certain point on the stroke of the piston, he could connect the flywheel or output side of the steam engine to the tap which let in the steam. He therefore connected the tap to a point on the flywheel by means of a rope, so that the flywheel itself, when it came round to a certain point, opened the tap, which subsequently was closed until the same operation took place at the next revolution. In this way the output side of the engine was connected to the input or controlling side and the whole arrangement became automatic. In the case of the three-electrode valve, we can consider the arrangement as an automatic amplifier in which the output side is connected to the input side, output currents being liberated at suitable moments by the timing of the grid circuit.

Another circuit in which regenerative amplification takes place is shown in Fig. 2. In this arrangement we have a tuned-anode oscillatory circuit L2 C2, and an aperiodic grid circuit L1. This arrangement works in the same way as the Fig. 1 arrangement; all that is necessary is to connect or couple the two circuits, the input and the output circuits of the valve. This is

done in Fig. 2 by the magnetic coupling between L2 and L1. If the coupling between L2 and L1 is sufficiently strong, the valve will oscillate of its own accord. If the coupling is not sufficiently strong for this purpose, any initial high-frequency oscillating potentials in either coil, L1 or L2, will be prolonged and magnified.

Let us examine the self-oscillating action of the Fig. 2 circuit; let us assume the existence of a few initial oscillations in the circuit L2 C2. These would normally die down in a very short time. Instead of dying down, however, the original oscillations, when induced into the coil L1, will produce varying potentials on the grid; these potentials would liberate varying energy in the anode circuit of the valve and these anode current variations taking place at the same frequency and in time with the oscillations in L2 C2 will strengthen these latter, and the strengthened oscillations will once more induce into the coil L1, the process being repeated. The result is that weak initial oscillations in L2 C2 will be amplified by the valve, and will be caused to persist; in other words, continuous oscillations will be set up in the circuit L2 C2, and the energy for these will come from the anode battery B2.

The circuit of Fig. 2 is a very suitable one for comparing with the above explanation of the action of the steam engine and the clock. The circuit L2 C2 is comparable to the flywheel of the steam engine. Impulses to the circuit are given by variations of electron current through the valve; in the case of the steam engine, the flywheel is given impulses due to the flow of steam into the cylinder. The potentials on the grid vary the amount of electron current passed through the valve, just as the tap turned on the steam. The coupling between the flywheel circuit L2 C2 and the inductance L1 enables suitable spurts of current to pass through the valve at the right moment to maintain the oscillations in the circuit L2 C2. The coupling between L2 and L1 is to be compared in the modern steam engine to the slide-valve operated from the crankshaft of the flywheel.

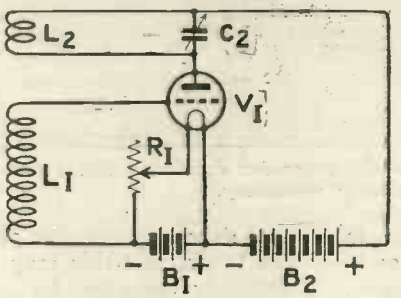

Fig. 2.—A self-oscillating arrangement in which the anode circuit is tuned.

In some circuits both the grid and anode circuits are tuned by means of condensers, but if we are to obtain the regenerative action we must tune both circuits to the same frequency. When one of the circuits is aperiodic we can obtain the regenerative amplification or self-oscillation effect over a wide range of wavelengths by simply adjusting the tuned circuit. The regenerative circuit of Fig. 1 is generally used in receiving apparatus, whereas the Fig. 2 arrangement is used for transmitting purposes. When it is desired to generate considerable power, the anode circuit is always used as the power circuit, and contains an inductance shunted by a capacity.

"Wireless Weekly" Free Gift Scheme

Elsewhere in this issue will be found the additional (Seventh) Coupon, which will be accepted in lieu of any missing Coupon of the six Special Numbers.

The six coupons, together with an order for any *one* of the Radio Press series of handbooks named below, are to be sent in an envelope marked "COUPON" to Radio Press, Limited, Devereux Court, Strand, W.C.2, accompanied by a postal order for *one-half of the list price of the book chosen,* plus 2d. for postage.

Here is an opportunity to obtain, at half price, any one of the most authoritative and practical wireless handbooks published. It should be particularly noted that any given set of coupons only entitles one reader to receive a copy of *one* book. Further, it is only possible to obtain books at half price in this way directly from the publisher, and it cannot be done through a bookseller. To assist readers in making a choice, we give below a complete list of the Radio Press books.

Choose your Book from this List:

	Price
Elementary Text-book on Wireless Vacuum Tubes	10/-
15. More Practical Valve Circuits	3/6
1. Wireless for All	6d.
2. Simplified Wireless	1/-
3. How to Make Your Own Broadcast Receiver	1/6
4. How to Erect Your Wireless Aerial	1/-
5. The Construction of Wireless Receiving Apparatus	1/6
6. The Construction of Crystal Receivers	1/6
7. How to Make a "Unit" Wireless Receiver	2/6
8. Pictorial Wireless Circuits	1/6
9. Wireless Valves Simply Explained	2/6
10. Practical Wireless Valve Circuits	2/6
12. Radio Valves and How to Use Them	2/6
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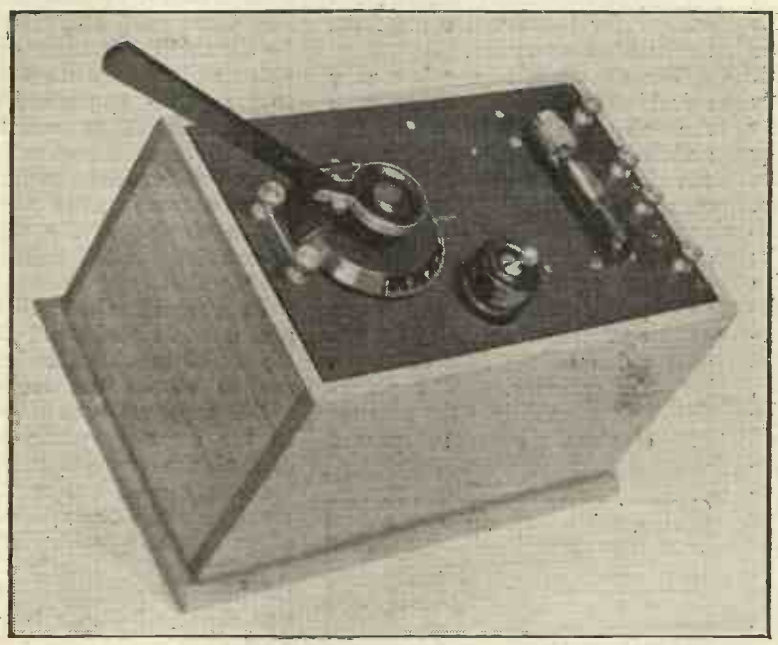
Radio Press Envelope No. 1 (an ST100 Receiver)	1/6
Radio Press Envelope No. 2 (a 4-Valve Receiver)	2/6

A Separate He
Short Wav

By Percy W. Harris,

The increasing interest in short-wave
structional article of much value to
developm



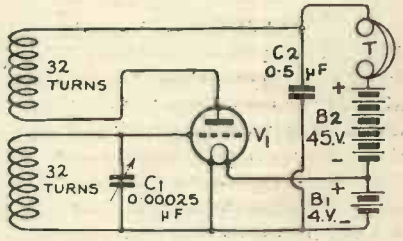
Exterior of the Heterodyne. An extension handle is useful but not absolutely necessary.

THE recent achievements in two-way Transatlantic communication between British, French and American experimenters and the success of this year's Transatlantic tests have caused more experimenters than ever to turn their attention to short wave reception. "Short wave reception" nowadays means the reception of signals on wavelengths which may go as low as 100 metres; 180- and 200-metre signals being at the moment, however, the most numerous. While it is comparatively simple to pick up continuous wave signals with very elementary apparatus, it must not be forgotten that in all ordinary reaction circuits with the reaction so tightly coupled as to give autodyne reception, the radiation from the receiving aerial is very considerable. Only with a separate heterodyne is really satisfactory and non-radiating reception of C.W. signals possible, and even then care must be taken in coupling the heterodyne if radiation is to be entirely avoided.

An advantage too little realised is that the received signals are far more constant when picked up with separate heterodyne. With an autodyne circuit the frequency of the beat note depends upon the setting of the tuner, and this may be considerably affected by a slight swaying of the aerial in windy weather. Movement of the operator close to the receiver will also have a substantial effect on the beat notes, unless special precautions are taken. When using a separate heterodyne, the beat note is dependent upon the wavelength of the transmitting station and the adjustment of the heterodyne only, and if this latter is placed some little way away from the receiver it will not be affected in any way by the operator's body. Swaying of the aerial will, of course, slightly alter the tuning of the set, but this is not so irritating as frequent variations of the beat note.

The Present Instrument.

The short-wave heterodyne illustrated in this article has several points of interest. Firstly its wavelength range (from about 70 metres to 250) is sufficient to cover all ordinary short-wave reception; secondly, by the use of a Squarelaw condenser the calibration is made very simple; and thirdly a low-capacity valve of a new type is used. It should also be mentioned that in practice an alteration of as much as 60 volts in the high-tension voltage makes very little difference to the heterodyne note, merely sending it up slightly, and very little alteration of the beat note is produced by the proximity of the hand to the tuning dial. On 175 metres, for example, the difference in the beat



Theoretical circuit.

note when the knob is held and that when the operator is several feet away from the instrument is only about a third of an octave. A change of valves has been found to make about half of this alteration.

Construction.

All of the component parts are mounted on an ebonite panel measuring 10 in. by 6 in. by ¼ in. The box on which the panel is mounted is deeper than need be, but in this particular case was made to match a long-wave heterodyne possessed by the author.

List of Component Parts.

1 Ebonite panel 10 in. by 6 in. by ¼ in. thick.

Suitable box.

Variable condenser 0.00025 μF. (Sterling Squarelaw, *without vernier*).

Myers Universal valve with clips (these are provided with the valve).

Ebonite tube, 2 in. in diameter by 3½ in. long.

eterodyne for velengths.

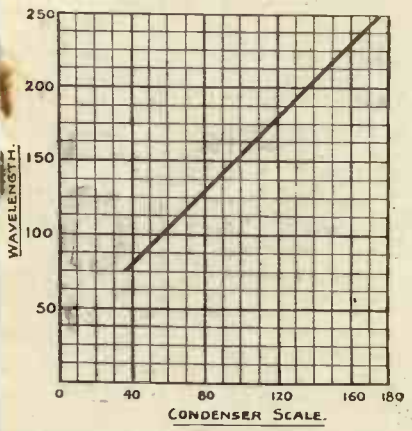
Assistant Editor.

reception should make this con- all who desire to keep abreast of ents.

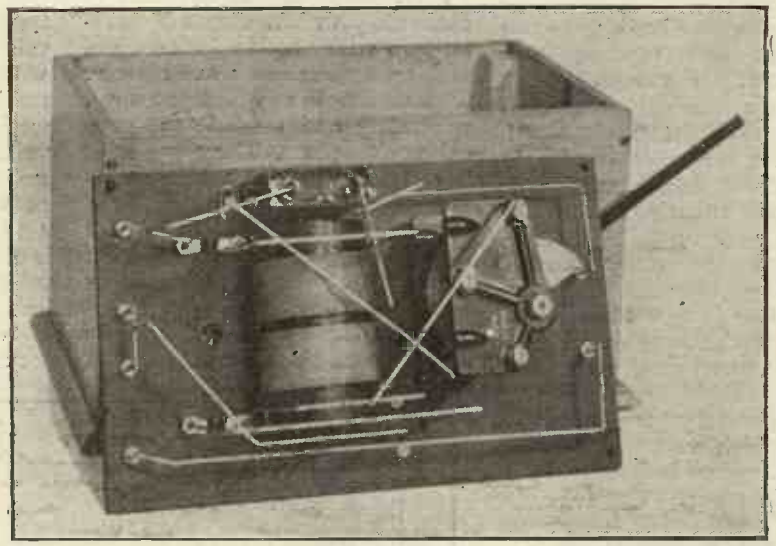
Quantity of No. 22 S.W.G.-d.s.c. wire.
6 terminals.
1 miniature tumbler switch.
1 Mansbridge condenser 0.5 μF.
Square busbar wiring.

The Circuit.

The circuit used is quite conventional, consisting of a tuned grid circuit with a plate inductance tightly coupled to it. A fixed condenser 0.5 μF is shunted across the telephones and both batteries. The telephone terminals are normally kept shorted, but are very useful when calibrating the instrument by comparison with another heterodyne. The two inductances are wound on an ebonite tube 2 in. in diameter and 3½ in. long. This ebonite tube is a commercial size and readily obtainable from the wireless dealer. The wire used for the inductance is No. 22 S.W.G.-d.s.c. and the 32 turns of each coil occupy an inch. The distance between the two coils is ¼ of an inch.



Approximate calibration curve for wavelengths generally used.



With stiff busbar wiring the instrument presents a very neat appearance.

To wind the coils, first of all drill 8 holes in the ebonite tube as follows:—Two transverse holes $\frac{5}{8}$ in. from one end, two more $1\frac{5}{8}$ in. from the end, two further holes ¼ in. from these, and the last two holes a further inch on. Take one end of the wire, push it through one of the holes at one end and back again through the second hole. Now wind on 32 turns and thread the wire through the second pair of holes; leave about an inch of wire at the end of this coil. Start again with the second coil. Be careful that both coils run in the same direction. Finish up by threading the end of the second coil through the two holes as before, again leaving about an inch for subsequent connection. Examine the coils carefully and see if the turns are touching everywhere; if they are not push them up tightly together. Now brush over both coils with a good shellac varnish, not too thickly, but sufficient to give a good even layer, and dry in a warm but not too hot oven. Two further holes will now be required in the former, 45 deg. round the circumference from where the other holes were drilled. These should be about ¼ of an inch from each end, care being taken that the two holes are on a line parallel with the axis.

The Valve.

The Myers valve used in this instrument is of very low capacity, having a special form of mounting, in which the plate and grid leads are brought out at the opposite end. This valve is very well known in America, and, now being manufactured in Canada, has recently been placed on the British market. It is somewhat cheaper than the V 24 low capacity valve, although it is more expensive than the Mullard Ora B. It has the advantage that with every valve is supplied a complete set of clips, screws, etc., together with a drilling template. Those who have the V 24 type of valve or the Ora B can, of course, use them equally well in this instrument.

The Condenser.

The variable condenser used in this heterodyne is the new Sterling Squarelaw condenser. The calibration curve of a heterodyne made with the ordinary type of variable condenser alters its curvature as we proceed up the scale, and in calibrating such a heterodyne it is necessary to take a large number of readings.

With the Squarelaw condenser, however, the plates are specially shaped so that the "curve" of calibration is a straight line. This means that we have only to take two or three readings on the condenser when calibrating it, and all the other readings can be easily found by joining the points marked with a ruler. Naturally the line is not perfectly straight on

the very shortest wavelength, but on all the wavelengths the ordinary experimenter is likely to use a straight line reading will be accurate. Fortunately, the makers supply with each condenser a drilling template. I wish all variable condenser makers would follow suit.

The construction of the instrument will offer very few difficulties. The tube carrying the two windings is secured to the panel by two long 6 B.A. metal screws passed through clearance holes in the panel and in the tube. The tube is held away slightly from the panel by two 4 B.A. washers, which were slipped over the 6 B.A. screws before the tube was put in place. The tube is held by a couple of lock nuts on the 6 B.A. screws. In placing the tube in position see that the short lengths of wire which terminate the two coils are on the side where the condenser is situated. The condenser itself should be mounted so that the moving plates come out in front of the instrument.

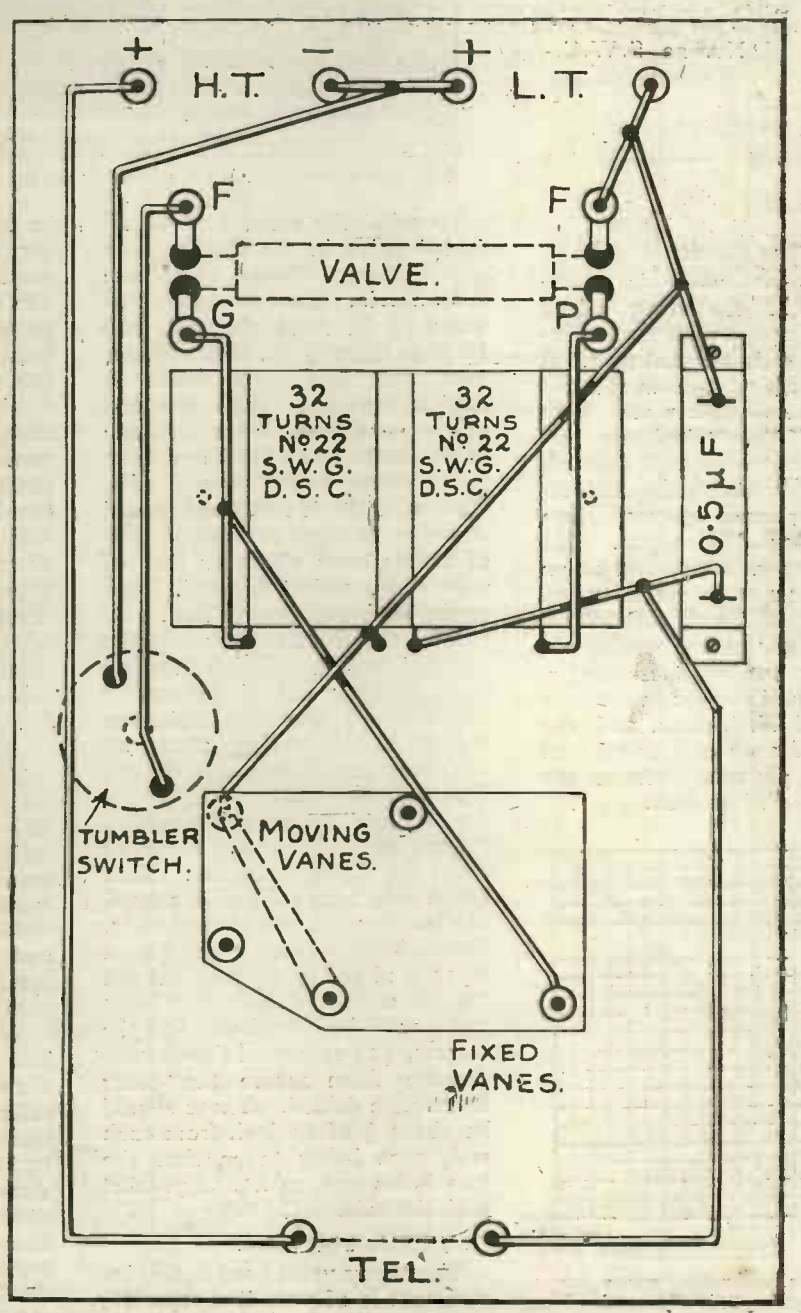
Wiring Up.

For wiring up thick square section busbar wire obtained from the General Radio Company was used. This wiring is strongly recommended here if it is desired that the calibration shall remain constant. The wires should be made to follow the paths shown if the results obtained with this instrument are to be reproduced. Cut and shape every wire carefully before you solder it up, and do not attempt to bend the wire to shape after one end has been soldered.

Using the Instrument.

The only really satisfactory way of calibrating this instrument is, of course, to check it up with another separate heterodyne, or with an accurate calibration wave, but owing to the fact that a Squarelaw condenser is used, so long as you can get a couple of readings, one on say 240 metres and the other on about 120, you will be able to plot out the rest of the wavelength quite easily. If the instructions in this article are carefully followed it will be found that the maximum wavelength is about 250 metres and the minimum much shorter than you will need to use in ordinary work. The approximate calibration "curve" is given in the figure. If you are not able to calibrate your instrument by comparison with another heterodyne, pick up some short wave signals, the wavelength of which you know accurately and mark it on your calibration chart. There is a faint harmonic of 2LO on half its wavelength, for example. An approximate calibration can then be made by drawing a line down the chart at the angle shown in the illustration.

Answering a query in advance it may be said that the instrument may be made up with the ordinary four-pin type of valve quite satisfactorily, although a low-capacity valve is better. The Myers valve will require about 40 volts high-tension, the V 24, however, will work with less than half this plate voltage. It will be noticed that no filament resistance is fitted, as the Myers valve works off 4 volts and a 4-volt accumulator is therefore required. If a V 24 valve is used, insert in the positive lead a fixed resistance of about $1\frac{1}{2}$ ohms and use a six volt accumulator.



Practical wiring diagram. Points which are soldered are shown with a black dot. The connections to fixed and moving vanes are important.

Broadcasting News

LONDON.—The 2LO Symphony Programme on Monday night, the 14th inst., was all that could be desired. Mr. Maurice Cole gave us an exceptionally fine pianoforte selection, and the rendition by the orchestra of Moussorgsky's "A Night on the Lonely Mountain" was positively thrilling, and equally good was the selection from Grieg. Mr. L. Stanton Jeffries is to be congratulated upon his very fine musical judgment, his ability as a conductor, and his discrimination in finding and organising such a splendid array of solo instrumentalists.

□ □ □

There seems to be a great deal of ill-informed rumours going about just now as to the location of future relay stations. In Leeds people have been anticipating a wireless station immediately and folk in Dundee have also been anxiously expecting. These good folks will be served in good time, but there are other districts at present claiming the attention of the engineers. Plymouth must certainly have the next relay station, and if the negotiations which are at present being held are successful, a suitable site should be obtained by the time this appears in print, and in less than two months the station should be operating.

□ □ □

In spite of the simplicity of the licensing regulations, there seems to be a considerable amount of evasion going on, and an unknown number of people, which from all indications seems to be very large, are listening to the B.B.C. programmes without licence of any kind; to put it mildly this is extremely unsporting.

Forthcoming Events.

JANUARY.

23rd (WED.).—5.30, Children's Concert. H.M. Grenadier Guards Band. Mr. J. Francis Mores, the African baritone (vocalist).

24th (THURS.).—Auntie Hilda and Uncle Humpty Dumpty will entertain the children. 7.30, "Alleged Humour," by Mr. Willie Rouse. Winifred Smith's String Quartette. Mr. John Huntington, baritone. 9, Mr. Arthur Melrose, the whistling entertainer, and Mr. Hector Gordon, the "canny" Scot. Dance Music.

BROADCAST TRANSMISSIONS

	Call-Sign	Wavelength
LONDON	2LO	365 metres
ABERDEEN	2BD	495 „
BIRMINGHAM	5IT	475 „
BOURNEMOUTH	6BM	385 „
CARDIFF	5WA	350 „
GLASGOW	5SC	420 „
MANCHESTER	2ZY	375 „
NEWCASTLE	5NO	400 „

TIMES OF WORKING.

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

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

25th (FRI.).—Uncle Rex and Uncle Jack Frost. 7.30, Burns Night Programme.

26th (SAT.).—Mr. John Henry and Mr. Fred Milner, entertainers. Dance Music.

27th (SUN.).—Mr. Arthur Bourchier, Talk on Robert Louis Stevenson. Orchestra. Concert Programme by Miss Daisy Kennedy, violinist; Miss Carmen Hill, mezzo; Miss Dorothy Howell, pianist; Mr. Chas. Hambourg, 'cellist.

28th (MON.).—Operetta, "The Dogs o' Devon," by Mr. William Bullock.

29th (TUES.).—Mr. Percy Fletcher. Amusing Interlude, "A Trial by Jury." Dance Music.

ABERDEEN.—An effort is shortly to be made to standardise the programmes at 2BD, so that each day of the week will come to be associated with a particular type of entertainment. Thus Monday will be devoted to an S.B. from London, Tuesday will be classical night, while dance music will hold sway on Wednesday. Opera will have its turn on Thursday, Friday will have its plays and literary contributions, while Saturday's programme will be replete with popular items.

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Another innovation that is sure to prove popular is the inclusion of a twice weekly feature, "Sunshine Corner," for children, in addition to the usual half-hour daily transmission for the young. Aberdeen listeners have been delighted with the operas broadcast from Covent Garden, the smooth working of the land-lines during the tempestuous weather giving much cause for satisfaction.

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Forthcoming Events

JANUARY.

23rd (WED.).—Dance Night.

24th (THURS.).—Classical Night.

25th (FRI.).—Burns Night. Songs, etc.

26th (SAT.).—Popular Old Songs and Airs.

27th (SUN.).—S.B. from Manchester. Beethoven Symphony Concert. Religious Address by Rev. G. Bartlett, M.A.

28th (MON.).—S.B. from London.

29th (TUES.).—S.B. from London.

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BIRMINGHAM.—Listeners in the Midlands will rejoice to know that following the recent visit of Mr. Percy Pitt to 5IT,

the whole of the station orchestra has been reorganised. The new orchestra, which will probably be playing by the time these notes appear, will be nearly twice as strong numerically as the old one. The City has been searched for talent, and the help of at least eight artistes from the Birmingham Symphony Orchestra has been secured.

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The improvement has been long overdue, and we may now look forward to orchestral music which should compare favourably with the best of that provided at the City concerts. The new orchestra will be conducted by Mr. Joseph Lewis.

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Forthcoming Events.

JANUARY.

23rd (WED.).—3.30, Paul Rimmer's Orchestra. 7.30, The First Radio Panto Revue, "Singbad the Wailer." 10.30, Morse Practice.
24th (THURS.).—3.30, Miss Eileen Barlow, soprano. 7.30, Popular Classics Programme.
25th (FRI.).—3.30, Paul Rimmer's Orchestra. 7.30, Station Orchestra. 8.45, Burns Anniversary Programme.
26th (SAT.).—3.30, Kiddies' Concert. 7.15, Station Repertory Co. 10, Miss Alice Couchman, solo pianist.
27th (SUN.).—Orchestra. Station Repertory Chorus. Miss Alice Vaughan, contralto. Mr. Bert Ashmore, tenor.

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BOURNEMOUTH. — From the music lover's point of view, the past week has provided a real treat, both vocally and instrumentally. The simultaneous broadcasts of Rutland Broughton's "Alcestis," "Die Meistersingers," and "Pagliacci" from London were well worth the licence fee for the year, and complaints of the poorness of other programmes could well be met with the retort that one has at least had a fair return on outlay.

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Of the purely local transmissions the French night on January 9 was very successful. Quite the brightest feature was Miss Mary Lohden's singing of a series of French songs. The Wagner night on January 12 was also extremely good.

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A rumour, which gained considerable currency in Bournemouth, that this station was to be closed, has been contradicted by the Director. It is a great pity that there are individuals who will start such unfounded tales. Bournemouth folk may rest assured that the B.B.C. would inform them if such a course was contemplated.

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Forthcoming Events

JANUARY.

23rd (WED.).—Orchestral Night.
24th (THURS.). — A Night of Memories by the Wireless Orchestra.
25th (FRI.).—Burns Night, S.B. from Glasgow.
26th (SAT.).—S.B from London.
27th (SUN.).—Organ Recital. Orchestra.
28th (MON.).—S.B. from London.
29th (TUES.).—Crystal's Concert Party. 7, S.B. from London.

CARDIFF.—The S.B. transmission of the Covent Garden Operas last week was very much appreciated. The quality of the transmission was excellent, except for an occasional grating noise, which at times completely drowned the reception.

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Forthcoming Events

JANUARY.

23rd (WED.).—Popular Night.
24th (THURS.).—S.B. from London.
25th (FRI.).—Burns Night. "The Immortal Memory," proposed by Mr. J. M. Hogge.
26th (SAT.).—S.B. from London.
27th (SUN.). — Rev. T. Madoc Jeffreys and Station Symphony Orchestra.
28th (MON.). — Oakdale Colliery Band.
29th (TUES.).—S.B. from London.

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DUBLIN.—The strictures in the Irish press anent the unnecessary long delay in issuing licences to Irish Free State listeners is having good effect. Five firms have now offered to

Our photograph shows the Archbishop of Canterbury broadcasting his 1924 Message to the Nation from 2LO.

supply the service for five years, paying a royalty of £50 yearly for each station they instal. The agreement provides that they are to be recompensed by from 75 per cent. to 90 per cent. of the licence income. It seems a hardship that Irish listeners and constructors alike may pay £1 per year licence fee, even though the Post Office stated that it does not wish to make any profit from the enterprise. Further, the station will be in Dublin itself and not in Terenure, as announced by the *Irish Radio Times*. There is magnificent musical and dramatic talent in the Dublin district, and listeners in Great Britain will benefit by the Irish station.

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GLASGOW.—A keen controversy is being waged at present in the West of Scotland over the merits of the broadcasting of "highbrow" and "lowbrow" programmes, and opinion seems to be pretty equally divided on the subject. The "lowbrow" brigade urge that they listen-in primarily for entertainment, not for education in any sphere of study. They admit quite frankly that they fail to see any beauty or glorious melody in "The Meistersingers," for instance, and declare that they never want to be counted in the number of the select few who can go into raptures over a whole evening of Mozart or Wagner. For them the jazz and the singing of popular songs constitute the favourite programme. The "highbrows," on the other hand, contend strongly for the classical programme as a means of raising the musical culture of the people, of inculcating a love of the best and most beautiful in the realm of music. Mr. Carruthers, the Director of 5SC, aims, however, at giving as varied a programme as possible.

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Forthcoming Events

JANUARY.

23rd (WED.).—Schubert Night.
24th (THURS.).—Popular Orchestral Concert.
25th (FRI.).—Burns Night.
26th (SAT.).—Kilsyth Male Voice Choir.
27th (SUN.).—The Rev. J. A. C. Murray.
28th (MON.).—S.B. from London.
29th (TUES.).—Popular Orchestral Night.

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MANCHESTER.—A fund has been started in Manchester for providing wireless sets for the Manchester Royal Infirmary. One valuable set has already been presented by a prominent local wireless expert in appreciation of the Sunday evening talks to young people given by Mr. S. G. Honey, Assistant Director of the Manchester station.

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Forthcoming Events

JANUARY.

23rd (WED.).—3.30, Concert. 6.30, Organ Recital. 8, Salford Vocal Society. 8.45, Talk by Mr. W. R. Stokes on "The New Astronomy." Mr. T. H. Morrison, solo violin. The Sirfessor. 10.10, Spanish Talk.

24th (THURS.).—11.30, 2ZY Trio. 6.30, Girl Guides' News. 6.40, German Talk. 7.30, S.B. from London. 10, Dance Music.

25th (FRI.).—3.30, Concert. 6.40, French Talk. 6.30, Keyboard Kitty. 8.15, Shakespearean Excerpts, by Mr. J. Bernard. Miss Betty Wheatley, soprano. Mr. J. Worsley, dialect entertainer. 10.10, Spanish Talk.

26th (SAT.).—3.30, Oxford Picture House Orchestra. 6.30, Organ Recital. 7.45, 2ZY Orchestra. Mr. Victor Smythe. Miss Sybil Gordon, mezzo-soprano. 8.45, Talk on "The Atmosphere," by Mr. G. W. Thompson.

27th (SUN.).—3, Eleventh Symphony Concert by 2ZY Augmented Orchestra. Mr. Klinton Shepherd, bass. Miss Amy Buxton Howell, elocutionist. 5, Children's Talk, S.B. from London. 8, Talk to Young People, by Mr. S. G. Honey. 8.35, Rev. T. Wilson, M.A. 8.50, Denton Male Voice Choir.

28th (MON.).—3.30, 2ZY Orchestra. 6.35, Boys' Brigade News. 6.40, French Talk. 7.30, S.B. from London.

29th (TUES.).—Concert. 8, Concert by Don Heyden String Quartette. Mr. Percy Phlage. 10.15, S.B. from London.

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NEWCASTLE.—Those who prefer popular music to the classical were excellently catered for in the Irish Evening provided this week. Mr. Lambert Harvey, 5NO's popular tenor, was at his best, and Mme. Evelyn Longstaffe, another Newcastle favourite, was also in excellent voice. We believe that this type of concert will be highly appreciated.

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Forthcoming Events

JANUARY.

23rd (WED.).—3.45, Bijou Orchestra. 7.30, Orchestra. Miss Anita Harrison, piano. Mr. Kemp Jordan, baritone. Mr. Geo. Hodgson, tenor. Miss May Jobson, contralto.

24th (THURS.).—3.45, Mr. J. Burgess, tenor. Mr. Martin Henderson, concertina. 7.30, Orchestra. Mme. Edna Sheard, contralto. Mr. Ernest Sharp, violin. Mr. Jack Todd, tenor.

25th (FRI.).—3.45, Mr. Ralph Elliott, piano. Miss Bessie Hindmarsh, contralto. Mr. J. Martin, baritone. 7.30, S.B. from Glasgow and Newcastle.

26th (SAT.).—3.45, Terchak's Orchestra. 7.30, Palmer's Works Band. Mr. W. J. Taylor, baritone. Miss E. M. Stanley, mezzo-soprano. S.B. from London.

27th (SUN.).—8.30, Mlle. Lucien Marchant's Quintette. Miss Erica King, soprano. Rev. R. Cleminson, Address.

28th (MON.).—3.45, Miss Annie Armstrong, pianist. Miss Norah Allinson, soprano. Mr. Ernest Fletcher, 'cello.

29th (TUES.).—3.45, Miss Dorothy Purvis, contralto. Mr. A. Robins, cornet. 7.20, Mr. F W. Dandy, Talk on Old Northumberland. Orchestra. Mr. J. W. Smith, tenor. Mme. Phyllis Howe, soprano.

□ □ □

Simultaneous Broadcasting Events.

JANUARY.

23rd (WED.).—B.B.C. Dramatic Critic.

24th (THURS.).—B.B.C. Music Critic. Talk by the Radio Society. 10, Savoy Bands.

25th (FRI.).—B.B.C. Film Critic. Burns Night. 10.10, "Siegfried," Act 2.

26th (SAT.).—"Hansel and Gretel," Acts 1 and 2. Savoy Bands.

27th (SUN.).—Symphony Concert from Manchester at 3 p.m. 5 p.m., Children's Concert from Manchester.

28th (MON.).—Light Opera Evening (all stations except Cardiff).

29th (TUES.).—Savoy Dance Bands.

A Robust Crystal Detector

EXPERIMENTERS who use a two-crystal detector, such as bornite-zincite, bornite-copper pyrites, or any of the other good crystal combinations, will find the following detector well worth making up.

First of all obtain a piece of 1 inch solid ebonite rod 2 ins. long, and drill a half-inch hole right through it from end to end. Having done this, drill a 9/16 in. hole ½ in. in from both ends and tap this hole with a ⅝ in. thread.

The ebonite rod will now have the appearance of Fig. 1. Next turn up two brass plugs to the dimensions shown in Fig. 2, making a saw cut across the end of *one only*, and by means of this saw cut screw it well home into one end of the ebonite tube. Now take the other brass plug and drill and tap a 4 B.A. hole through the centre, so that an inch length of 4 B.A. studding may be screwed through. Before inserting this plug in the tube break up two pieces of crystal of such a size that they will pass easily through the ½ inch hole down the ebonite tube.

Having placed the crystals inside the tube screw in the other brass plug by means of two flats filed on the outside rim and by means of the 4 B.A. stud, screw the two crystals together with a light contact, as shown in Fig. 3. We now have a completely dust-proof detector, which may be mounted on clips, or terminals may be fixed to the brass plugs.

Contrary to what, perhaps, might be expected, the sensitive points are very soon found, and the detector will remain in adjustment for an almost indefinite period of time.

Fig. 4 shows a simple but very handy clip mounting. The clips are cut from sheet brass. That on the left is bent in the way shown, so that it will fit into the saw-cut in the end plug. In the other is drilled a 4 B.A. clearance hole to allow the adjusting screw to pass through.

R. W. H.

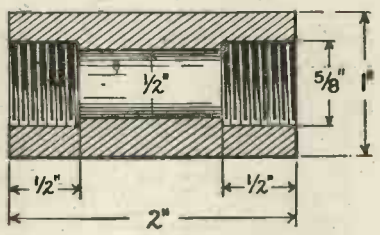


Fig. 1.—Details of the ebonite rod.

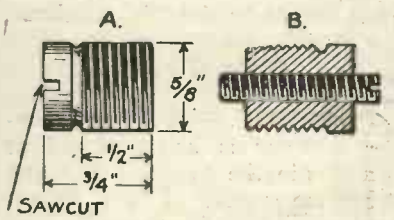


Fig. 2.—Dimensions of brass plug.

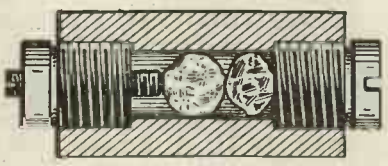


Fig. 3.—The crystals in position.

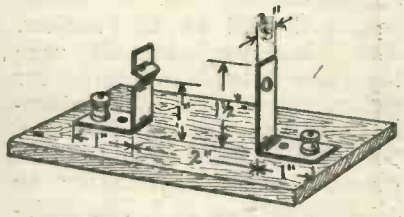


Fig. 4.—The mounting.

HINTS ON FRENCH POLISHING

By a Professional French Polisher.

FOR the benefit of aspirants to the art of french polishing I propose giving such hints as will enable the beginner to obtain very presentable effects. In doing so, I will deal only with the polishing of woods which are free from any treatment other than the preparation of surface.

There are three distinct operations which have to be performed, and are known as "Filling," "Bodying In" and "Spiriting Off." The article to be polished should be placed in an easily accessible position, where there is abundant light. The piece having been stained to the required colour (if this is necessary) and any defects in the woodwork "stopped" with wax stopping, which can be obtained in various colours from most colourmen, the operator should proceed to "fill" the grain.

For small work, the polish itself will serve, and can be laid on with a camel-hair mop, and each successive coat must be cut down with No. 0 glass paper. In doing this, care must be taken in order not to remove any stain, otherwise the finish will be patchy. For larger pieces of work where the above process would be too expensive, Youngs' patent size is excellent. Thin liquid glue and plaster of Paris are sometimes used, as also are various other preparations. The chief aim, however, is to render the wood non-absorbent, and when this has been accomplished, one can proceed with the next operation.

"Bodying In" is merely the application of polish on which to obtain the glass-like finish. Proceed as follows: Take a piece of cotton wool and moisten evenly with french polish, but on no account should the wool be wringing wet. Cover this with a piece of fine linen rag, preferably double thickness, the corners of which are gathered over so as to form a neat pad, with something of a point which will be useful for negotiating corners of panels, beadings, etc. A spot of linseed oil should be put on the pad, which is now ready for applying to the work, which should be done with a circular motion.

It is important never to allow the pad to remain at rest in contact with the wood, as this will cause it to stick and rip off what polish has been laid on. Do not worry about the pad marks, as these will be taken out later. Continue to cover and recover the work with the pad, not forgetting a drop of oil now and then. It is as well to allow a few hours to elapse between the initial and final "bodying in" work, to permit the shellac to harden properly.

Another important point to remember is the temperature of the room, which must on no account be very low, as this induces rapid contraction of the shellac with an accompanying milky appearance. Quick recourse to the fire, a hot iron, or a piece of burning newspaper held near the affected area will often remedy the trouble.

Next comes the final operation known as "Spiriting Off." It is this which presents most difficulty to the beginner. Personally, I prefer the interval of an hour or two between the "bodying in" and "spiriting off." I believe this renders the finish more durable and brilliant. The methylated spirit is applied in the same way as the polish, but the greatest care should be exercised to prevent the pad being made too wet, as this would cause the shellac to redissolve and impart a dullness to the surface instead of brilliancy.

Roughly speaking, the spirit has to gradually supersede the polish in the pad. Should the spirit appear somewhat too active in its power as a solvent of the shellac, exposure to the atmosphere will tend to reduce its "bite." All traces of oil must be removed, and finally a soft rag, with a drop or two of methylated spirit on it, applied in long sweeps the way of the grain, will remove every defect and leave the surface clear and brilliant.

Inaccessible work, such as fine mouldings and carvings, should be treated with polish by means of the camel-hair brush. Spirit varnishes give pleasing results for such awkward parts, but on no account must one place be touched twice while wet. I strongly advise beginners to practise on odd pieces of wood, properly smoothed down.

F. E. S.

A ROTARY POTENTIOMETER FOR TWO SHILLINGS

THE rotary potentiometer to be described is about as inexpensive to make as a potentiometer could possibly be, the only items to be purchased being about an ounce of No. 32 S.W.G. enamelled Eureka resistance wire, a knob and a standard 2B.A. bush. All the rest can be made up from workshop scraps.

Begin by cutting out sufficient pieces of cardboard of the shape and size shown in Fig. 1, to make when fixed together a ring ½ in. thick. Dress each with shellac varnish and fix them together by means of this adhesive, pressing them well down with a heavy weight until the varnish has set hard. Now anchor the wire in the usual way by piercing two small holes, threading the end once or twice. Then wind on the wire, which must be upon a small reel to be able to pass through the central hole, keeping the turns as close together as possible on the inside. At the points where the three holes for the fine screws, which will afterwards fix the ring to the panel, are shown, the wires must be separated in order to allow room for the screw heads. This can be done by crowding them together towards the outside before the hole is reached and after it is passed. When the wiring is finished anchor the far end as before.

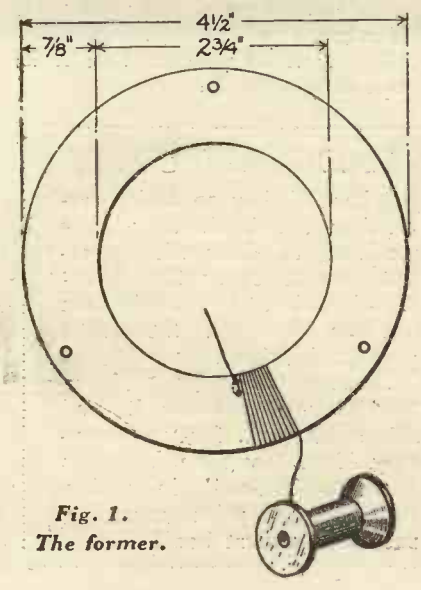


Fig. 1.
The former.

Fix the ring to the panel with screws, and from a short length of 2B.A. screwed brass rod make up a spindle as shown in Fig. 2. The arm, which will have a radius of 1¾ in., is made of three layers of thin, springy sheet metal. The ends which are to form the brushing contact must be made perfectly smooth with emery paper, so that the thin wire may not be damaged by them; the corners must also be rounded off. Stop pins must be fixed so that the arm cannot overrun the windings at either end.

Bend the arm so that it makes a decided but not too hard a contact with the turns of wire. Wrap a strip of fine glass paper round its end and turn it backwards and forwards once or twice over its full travel, so as to bare the wire along its path. The potentiometer is then finished,

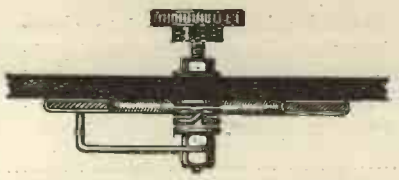


Fig. 2.—The finished potentiometer.

the only additions desirable being a pointer which can be cut from sheet brass, and a circular scale to be mounted on top of the panel, which can be obtained for about 4d. from advertisers in this Journal.

The same design may be applied with excellent results to the making of rheostats for use with dull-emitters. These should have a maximum resistance of not less than 35 to 40 ohms if a 6-volt battery is used.

R. W. H.

Preventing Self-Oscillation

Various methods have been suggested from time to time for the prevention of undesirable self-oscillation. The results, however, in many cases, are very disappointing. Even the capacity neutralising methods have proved difficult of operation, and the old methods involving grid damping through the establishment of a grid current are far from desirable.

When grid current damping is introduced, it is impossible, in the first place, to give the grid of the high-frequency amplifying valve a negative potential, for the simple reason that the damping effect is only produced when the grid becomes positive with respect to the filament. When amplifying high or low-frequency currents, it is desirable to operate the valve about halfway along the steep portion of its characteristic curve, and this curve should preferably be kept completely to the left of the ordinate passing through zero grid volts on the characteristic curve connecting grid potential and anode current.

Rectification is bound to occur when the grid current damping is introduced, but in the method described below no such disadvantages occur.

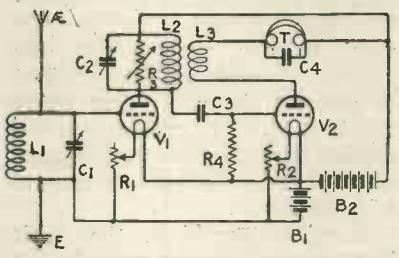


Fig. 1.—Controlling reaction with a damping resistance.

In Fig. 1 is shown the ST34 circuit, modified by the connection of a variable 100,000 ohm resistance R3 across the inductance coil L2. This resistance should be smoothly variable, and should

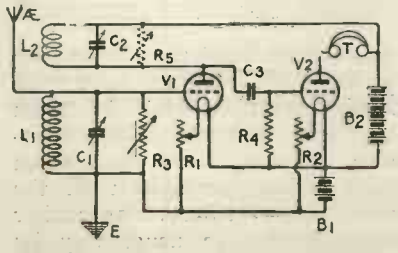


Fig. 2.—Showing how a damping resistance may be connected when reaction upon the aerial is used.

at least cover a range of from 50,000 to 100,000 ohms. Suitable resistances are manufactured by Lissens, Watmels and others.

A little experience with this variable resistance will soon indicate how invaluable it can be in a circuit of this description, and the finest adjustment of reaction is possible without any alteration of tuning, which, of course, cannot be said for the ordinary method of moving the coil L3 further away from, or nearer to, L2.

Another Arrangement

Another arrangement adapted to another type of circuit is illustrated in Fig. 2. This time the 100,000 ohm variable resistance is connected across the grid circuit, and once again a beautiful control of reaction, whether this reaction is desired or not, or of the intentional or unintentional kind, is obtained.

In Fig. 1, of course, an additional 100,000 ohm resistance could be connected across the grid circuit as well as the anode circuit, but this should not ordinarily be necessary.

In Fig. 2 the arrangement might be modified by connecting the resistance R5 across the variable condenser C2, as shown by the dotted line, instead of having R3 across C1.

In both figures, the resistance is shown with an arrow-head through it to indicate that it is smoothly variable.

"ELEMENTARY TEXT BOOK ON WIRELESS VACUUM TUBES."

It is regretted that the list of books published in the last issue under the heading "*Wireless Weekly* Free Gift Scheme" was incomplete, in that the above text book by John Scott - Taggart, F.Inst.P., was omitted. This book is, of course, included in the Gift Scheme, and represents probably the greatest attraction of the Scheme, since its normal price of 10s. makes the half-price terms especially advantageous to the purchaser. There is thus a saving of 5s. in the purchase of a handsome text book, a new enlarged edition of which has recently been published.

It is, of course, the standard text book of valve theory and practice, and any readers who were misled by its omission from last week's list and ordered some other book are invited to exchange their purchase if they so desire, returning the book they have received, together with a remittance to cover the difference in price. From this sum can be deducted the extra postage involved.

Some may prefer to keep the book first ordered, and also send again for "Elementary Text Book on Wireless Vacuum Tubes," in which case the full price must be paid for the first book.

Apparatus we have tested

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

The O.T.B. Crystal Set

Messrs. Harding, Holland & Fry, Ltd., have submitted for test samples of their O.T.B. crystal sets, types A and B.

Type B is an exceedingly neat little instrument, enclosed in a polished hardwood turned box, some 4½ ins. diameter by 2½ ins. deep. On removing the lid, the knob and scale of the tuning device, and the crystal-detector, are exposed to view, as well as the necessary terminals, all mounted upon an ebonite panel.

The tuner (apparently a very compact form of variometer) covered well over the extended broadcast range of from 350 to 495 metres, when tested on a P.M.G. aerial.

The detector, fitted with Talite crystal and galena, was found to work smoothly and to be easy to adjust. The efficiency of the crystal fitted proved high, on actual measurement on 2LO's carrier wave, and in the same test the effectiveness of the tuning device was shown to be quantitatively an unusually high percentage of the standard. The tuning was also sharp.

In actual reception the results obtained confirmed those of more formal tests, excellent reception of local broadcasting being obtained.

The external finish and workmanship are good. We should like especially to commend the general style and compactness of this receiver, combined with real effectiveness. It marks a genuine advance in the direction of the refined home receiver for everyday use.

The type A resembles the type B in general appearance and characteristics, but has, in addition, an internal lightning-arrester, and has plug-in terminals on the sides, so that the lid can be closed down without removing wires from terminals—a good point.

Moderate-Priced B.B.C. Crystal Set

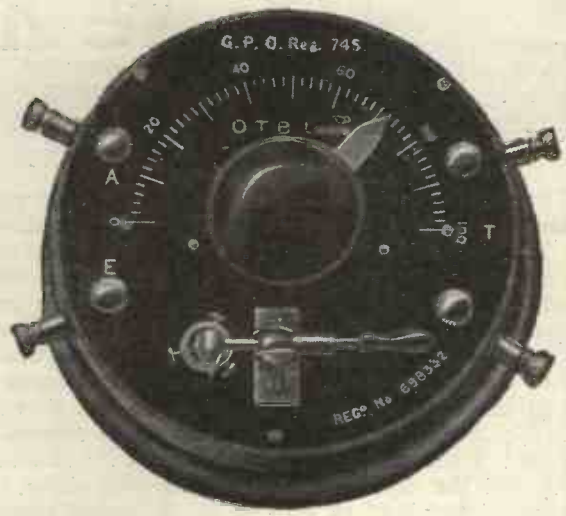
Messrs. Ward & Goldstone have submitted for test a sample of their "Claristal" crystal receiving set with the B.B.C. stamp, which is marketed at an exceptionally modest price.

This takes the form of an inductance with slider on a vertical wooden bobbin mounted on a turned wooden base, a composition panel on the top carrying terminals and crystal-detector. The adjustment of the slider is by a fine screw, giving convenient and steady action.

In the sample submitted the cat's whisker was missing and two terminals were loose. On rectifying these small matters it was found to tune from below 300 to some 740 metres on a P.M.G. aerial, and when tried in a distant suburb the local broadcasting was quite clearly audible.

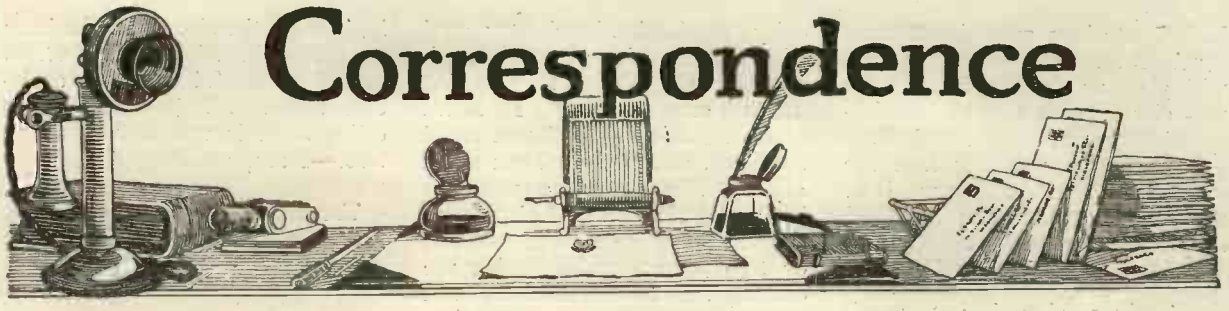
The crystal is readily replaceable—a good point—and proved sensitive and easy to adjust.

It is difficult to see the purpose of the composition panel, as the terminals pass through the flange of the wooden bobbin, and the insulation resistance of the dry wood was about 25 megohms when tested, and is therefore quite adequate.



The O.T.B. Crystal Receiver.

Referring to the Baty condenser reported upon in Vol. 2, No. 21, the minimum value of this condenser should read 0.00002 μF, and not 0.0002 μF as stated.



Correspondence

THE N.C.U.

SIR,—I enclose you a cutting from the *Bournemouth Times and Directory* concerning the ridiculous proposals that have been put forward by the N.C.U.

This body is supposed to uphold the rights of citizens, while now it is doing the very opposite, or, in other words, interfering with the liberty of the subject.

I feel sure I am voicing the feelings of many, and it is very essential that a move of this kind should be quashed right away, as a salutary warning to others.

If a man wishes to have an aerial for legitimate enjoyment, let him have it, and jolly good luck to him.

Resolution from National Citizens' Union

"Members of the Southbourne branch of the National Citizens' Union have viewed with disfavour the increase in the number of outdoor radio aerials in that part of the borough on the ground, apparently, that they are a disfigurement to the neighbourhood.

"The branch has gone to the length of communicating with the Town Hall on the subject, as witness the letter before this week's meeting of the last-named body enclosing the copy of a resolution calling attention to the large number of outdoor radio aerials making their appearance and suggesting that means should be taken for the regulation of them.

"The Town Clerk reported on the matter and received certain instructions, the nature of which were not disclosed in the General Purposes Committee's report."

I am, etc.,

J. P. J. CHAPMAN.

Bournemouth.

RESULTS

SIR,—I am getting marvellous results with the ST100. All the

B.B.C. stations come in at comfortable strength. I hope you will give us further articles on this circuit with regard to additional stages of H.F. and L.F.

It is rather puzzling that the addition of an ordinary L.F. panel only produces a howl.—I am, etc.,

V. W. ALLEN.

[Howling should not result when the "feed-back" L.F. transformer is connected in the aerial circuit as in the improved ST100 circuit. Numerous hitherto unpublished modifications and developments of ST100 will appear in a new book entitled "More Practical Valve Circuits."—ED.]

ST100

SIR,—I have not noticed in *Modern Wireless* or *Wireless Weekly* any letters from this area of appreciation of ST100.

I finished the wiring of this instrument and without any difficulty received Manchester and Birmingham with great strength and purity of tone. At 10.30 one evening I heard another station with almost equal strength, and it turned out to be 2LO. These stations were so loud and clear that I have no doubt that when I have had one or two more evenings with the circuit, the other stations will come in equally satisfactorily. My aerial is a poor one, with the down lead from the centre, and is badly screened by the house itself from both Birmingham and London.

You laid emphasis on the components being of good quality, and you were right. I wired up ST100 three weeks ago and have been struggling to get results ever since. Several times I nearly wrote to tell you my private opinion of your circuit. Then I traced my trouble to two cheap transformers of unknown make—mirror galvanometer tests of these told the tale. I changed them for two Radio Instrument transformers, and ST100 has come into its own.

I am now looking forward to improving the circuit on the lines suggested in *Modern Wireless*, and if successful will have a circuit which will be difficult to eclipse. It is wonderfully selective.—I am, etc.,

C. E. HUSSEY.

Trentham.

FLEWELLING

SIR,—I am sure you and your readers will be interested to hear of the wonderful results obtained from the excellent Flewelling super circuit published in *Wireless Weekly* (July 25).

My aerial is a poor one. It consists of three wires, 35 ft. in length, height 25 ft., very badly screened.

By the addition of one note-magnifier all B.B.C. stations can be heard on a loud-speaker after dark.

I have heard no fewer than four American Broadcasting stations between 2.30 and 3 a.m. on this receiver.—I am, etc.,

W. S. WATKINS.

London, W.12.

Information Department

V. C. H. (NOTTINGHAM) asks for a wiring diagram of a five-valve receiver having switches to cut in and out all of the valves independently, to enable a crystal detector to be used instead of the valve, to place the aerial condenser in series or parallel, and to enable single or double circuit tuning to be used, also to enable reaction to be used either upon one of the tuned intervalve circuits or upon the aerial.

We publish this query as an example of the kind of question which we cannot in honesty answer. Although we could undoubtedly draw out on paper a circuit of this nature, which might look quite practicable and effective, nevertheless we feel that it would not be fair to our readers to do so, since such a set could not possibly be expected to give really satisfactory work. A receiver employing so many valves requires very careful design, which must be checked by the actual construction of the set, and, furthermore, the provision of so many switches would complicate the wiring to a degree that would seriously impair the efficiency of the set. Such complication of wiring in a multi-valve set may be expected to produce so much interaction between circuits as to make the receiver practically uncontrollable. Where readers desire to construct multi-valve sets of high sensitiveness, they are strongly advised to select from back numbers one of the designs which have been given as the result of the necessary experimental work on the part of an expert designer.

H. C. (NORFOLK) asks upon what wavelength it is desirable to use a separate heterodyne for the reception of continuous waves.

Upon the long wavelengths, above about 5,000 metres, the use of the ordinary self-heterodyne method of receiving continuous waves is extremely inefficient, since to produce a beat note with the incoming signals, the receiving set has to be detuned from the true wavelength by several hundred metres. From the point of view of signal strength, therefore, it is exceedingly desirable to use a separate heterodyne on the longer

waves, since one can then tune the receiving set exactly to the desired wavelength and use reaction simply to increase signal strength rather than to produce local oscillations. The reaction, it should be explained, is so adjusted that the set is brought almost, but not quite, to the self-oscillating condition. A separate heterodyne has also the great advantage of greatly increasing the selectivity of the receiver upon the congested longer waves. Upon the intermediate wavelengths between 600 and about 5,000 metres the use of a separate heterodyne has less to recommend it. It gives very little increase in signal strength, and the power of eliminating interference which it confers is less necessary upon these waves. Upon the short wavelengths, below about 500 metres, it is extremely desirable to use a separate heterodyne for continuous wave reception from motives of consideration for one's neighbours. Little, if any, increase in signal strength is obtained by its use, but it enables one to very much minimise the amount of radiation which takes place during reception, and it should be remembered that this radiation upon the shorter waves becomes very serious from an aerial of the normal amateur size.

J. C. (BRISTOL) asks what is the meaning of the expression "tune stand-by switch"?

This expression dates from the use of certain commercial receivers, upon which there was a change-over switch, whose two positions were marked respectively "tune" and "stand-by." When in the "tune" position, a loose-coupled tuning system was employed, giving selectivity and freedom from interference, while upon the "stand-by" side, a single-circuit tuner was used whose tuning was less sharp, and was consequently employed by the operator when standing by for signals, since it made the picking up of the call more certain. A similar switch is useful in any receiver which possesses a loose-coupled circuit, since it enables one to switch over to the simpler direct-coupled arrangement to pick up distant stations. When the station has been accurately tuned in upon the primary circuit one can change over to the loose-coupled arrangement and tune in upon the secondary circuit.

T. G. (BRIXTON) asks why tuned anode coupling is used when a high-frequency transformer can be wound with more turns upon the secondary to give a step-up effect, which is surely more efficient.

There is a fallacy contained in our reader's argument. Although it is quite possible to put more turns of wire on the secondary of a high-frequency transformer, it must not be assumed that a step-up effect similar to that which takes place in a power transformer is obtained. Experiment shows that the best design of high-frequency transformer, with any ratio which one may care to try, does not give results superior to those of a good tuned-anode circuit, and hence it has been argued that no transformer action really takes place. It is suggested that the transference of energy from the primary to secondary takes place almost wholly through the capacity between the two windings, and not by electro-magnetic induction.

WIRELESS WEEKLY SMALL ADVERTISEMENTS

PREPAID Advertisements are accepted under this heading for Wireless Apparatus and Parts WANTED or FOR SALE, etc., at the rate of 1s. 6d. per line, MINIMUM THREE LINES,
Advertisements should reach Scheff Publicity Organisation, 125 Pall Mall, London, S.W.1, LATEST by first post FRIDAY preceding date of publication.
The publishers are not responsible for clerical or printers' errors, but every care is taken to avoid mistakes.

WATCH this space for Special Bargains.—A neat Tumbler Switch in black and nickel, an all purpose gadget for any panel, 2/–, post free. See below.

"RADIOHM," No. 1. Crystal Receiving Outfit, complete with Headphones, etc., the same quality and good reception you can pay 6 Guineas for. We charge 52s. 6d., and return your money if not satisfied. We've never had to do it yet.—Sparks' Radio Supplies, 43, Great Portland Street, W.1. 'Phone: Langham 2463.

NOT A SUPER SET, but distinctly Superior—"Radiohm" C.-V. Type 1. A Crystal-Valve set "hooked up" to give better results than many 2 or 3-valve sets. Makes you forget a gramophone. £10 17s. 6d. complete, with Headphones, Batteries, etc.; deferred payments arranged.—Sparks' Radio Supplies, 43, Gt. Portland Street, W.1. 'Phone: Langham 2463.

A GOOD AERIAL means good reception. "Radiohm" Strip Ribbon Aerial, 25 per cent. better than wire. *Fact!* 100 ft., 3s., plus post. Trade supplied.—Sparks' Radio Supplies, 43, Gt. Portland Street, W.1. 'Phone: Langham 2463.

THE YANK KNOWS! Look behind the panel of the best American sets. They use square tinned copper rod for wiring——? We sell it. 2 ft. lengths, 3s. doz. Trade supplied.—Sparks' Radio Supplies, 43, Gt. Portland Street, W.1. 'Phone: Langham 2463.

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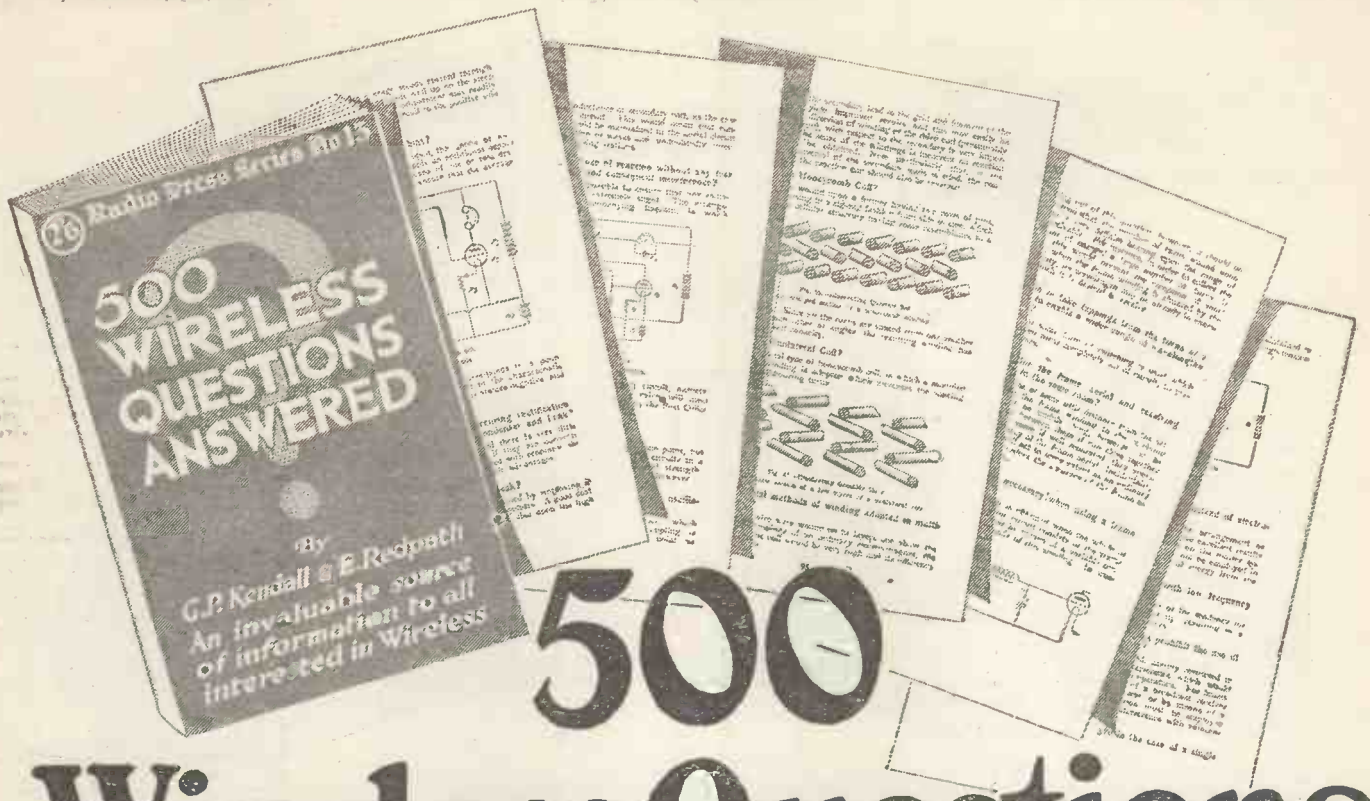

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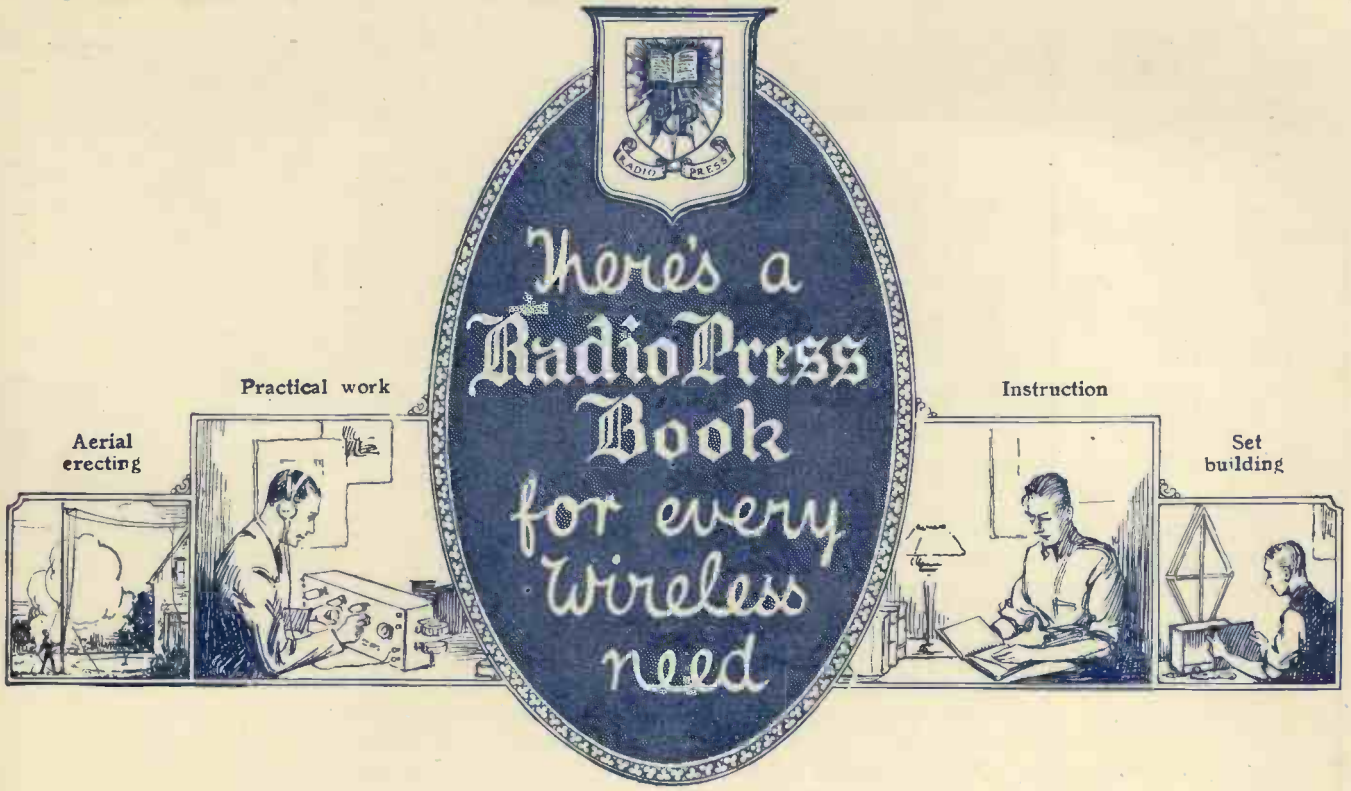

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Wireless Weekly

and The Wireless Constructor.

Vol. 3.
No. 8.

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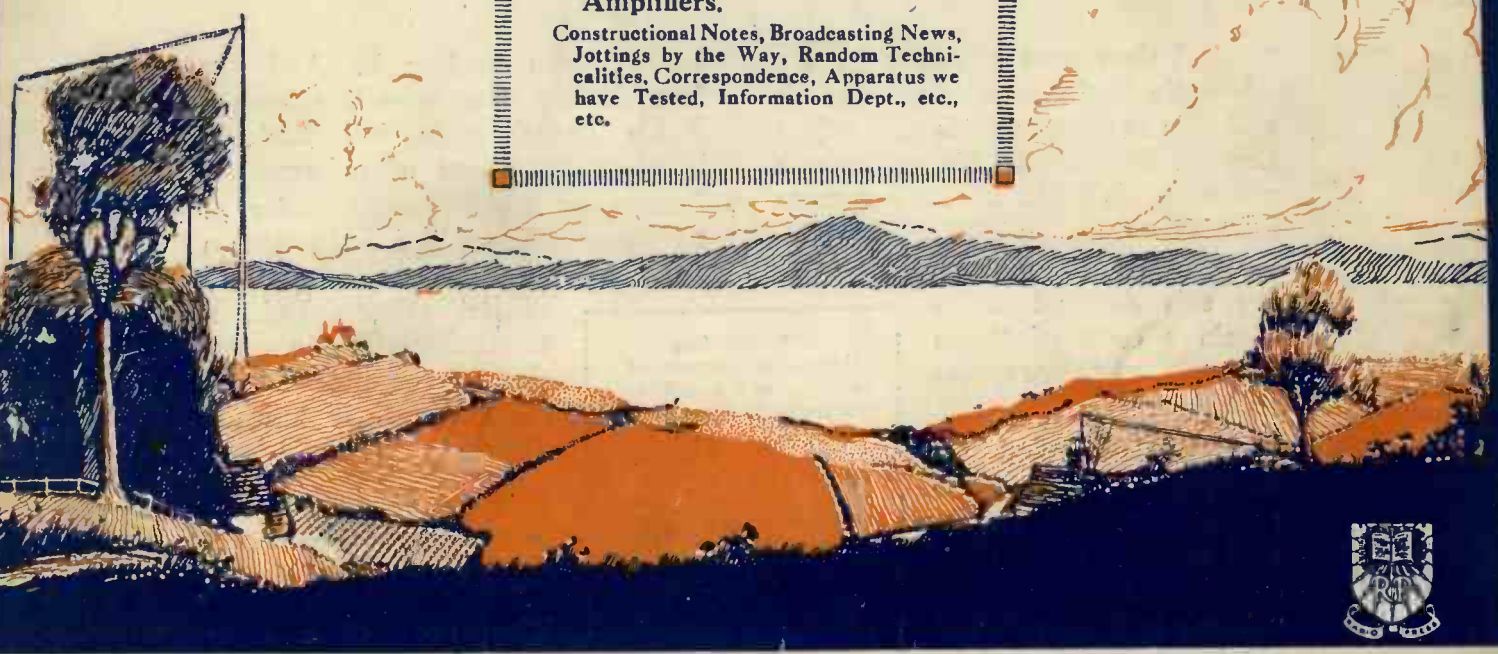

A Reflex Ultraudion Circuit

By A. D. COWPER, M.Sc.

500 Wireless Questions

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Wireless Weekly

Vol. 3, No. 8
Jan. 30, 1924.

CONTENTS

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

Assistant Editors { E. REDPATH. P. W. HARRIS.

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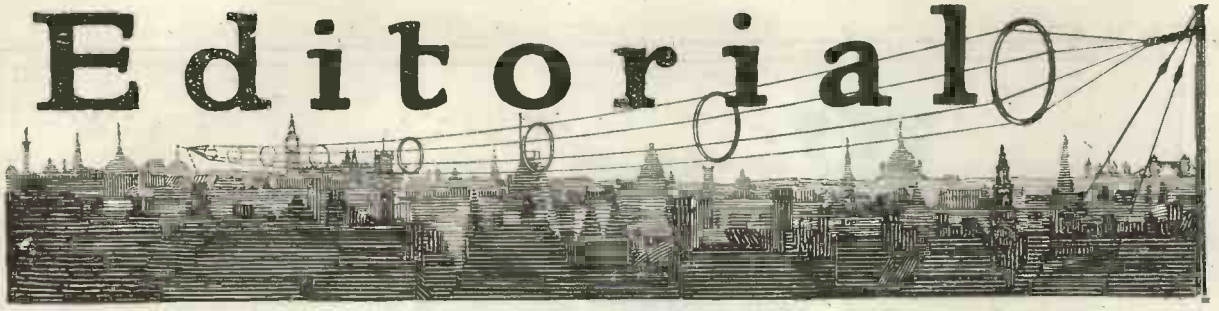
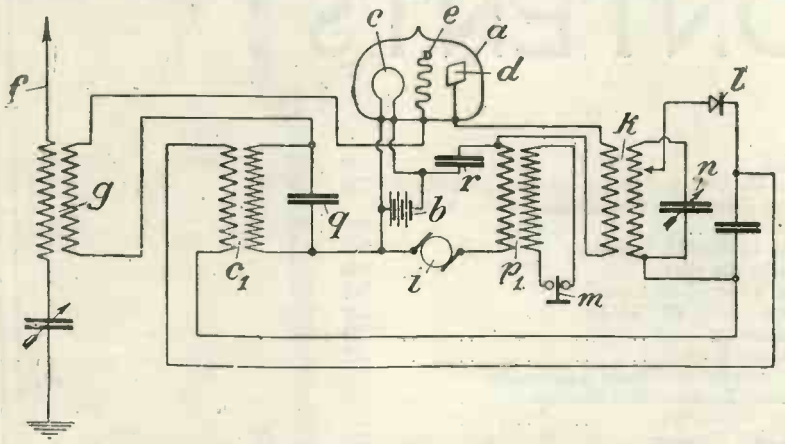
Editorial



Mr. Shaughnessy finds us out.

WE have been found out. At last we are exposed and deception is no longer possible. The cold, hard light has been directed on to us, and by no less a person than Mr. Edward Shaughnessy.



The first dual circuit, which is a facsimile reproduction from the 1913 patent.

Speaking at an informal meeting recently, he took advantage of his position in the chair to make some irrelevant remarks which he has apparently been burning to voice. He referred to a " much-lauded " circuit, which he would not draw, but which involved two valves and a crystal and the principle of dual amplification. He suggested that details of such a circuit were contained in a patent specification of 1913, which he held in his hand, yet this circuit was being made much of in the popular technical Press by people who claim to have discovered it.

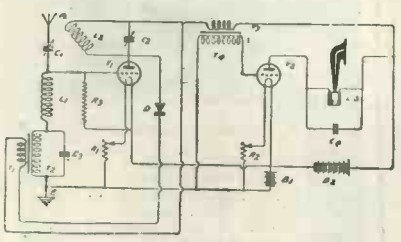
At last the truth is out, and we are covered with confusion and shame! How are we to face our readers? Of course, the reference is obviously to the ST100 circuit. No, not a word as to its effectiveness and popularity—just the terrible, bitter, scathing, scalding suggestion given above.

Dear, dear, what shall we do? While we are flattered that so important a personage as Mr. Shaughnessy has deigned to hear of the ST100 circuit, and even to comment on it, yet we are surprised that he has not noticed the repeated references to his wonderful discovery of the 1913 invention in our articles and in the British Association paper referring to the ST100 circuit. His jubilation will evaporate when he turns to our back numbers. It would be mere silliness for anyone to suggest we had ever made any claim to dual amplification. To claim a special and specific (and, we are told, a highly efficient) arrangement of a dual circuit is a different matter. Nevertheless, we are accustomed to the comments of people who find their pleasure in belittling the work of others on the score of originality—a matter of opinion which can never be adequately dealt with except by the Court of Chancery. Such criticism usually comes from those who feel secure against this kind of criticism themselves, for the very simple reason that their talents do not lie in an inventive direction.

Perhaps Mr. Shaughnessy pictures us as preening ourselves in a blaze of undeserved limelight thrown on us by two powerful searchlights. Let him disabuse his mind of the thought. An editor who is not merely an arranger of the articles of others is always open to a certain kind of criticism. We work far too hard for these journals, and are quite humble-minded, really; we also possess a little sense of humour. If Mr. Shaughnessy takes too much interest in us, there is a danger of us becoming *really* conceited!

We do not propose to touch on the question as to whether it is dignified for Mr. Shaughnessy, while holding his present offices, to indulge in ill-considered comment which might, by some, be interpreted as indicating a feeling almost of ill-will, or, at any rate, of exuberance of spirits.

Public servants, moreover, do not generally make comments of a personal nature, and we think Mr. Shaughnessy could devote his time more profitably to discovering (and eliminating) Leafield's harmonics instead of making belated discoveries of 1913 patent specifications.



The ST100 circuit.

From our previous experience, we are not sufficiently optimistic to hope that Mr. Shaughnessy will refrain from making gratuitously disparaging comments.

Perhaps, however, he will confine his remarks in future to a more intimate circle.

Notes on the Design of Low-Frequency Amplifiers

By PERCY W. HARRIS, Assistant Editor.

Useful Hints to the Home Constructor.

The Design of Low-Frequency Amplifiers

The chief trouble experienced by the beginner when building up note-magnifiers or low-frequency magnifiers is the trouble due to instability and howling. Howling with single-valve note-magnifiers is comparatively rare, but even here it may occur if leads are unduly lengthy and run parallel to other circuits. With two stages of note-magnification, however, it is quite frequent to hear of cases where there is considerable distortion, self-oscillation and loss of signal strength. A bad lay-out may give rise to all these faults.

Differences between Transformers

A beginner may well be frightened at the array of inter-valve transformers offered to him when he desires to build a note-magnifier. The prices charged for these components range from 10s. to 30s. or more. At first it may seem that it is a simple matter to design and manufacture an inter-valve transformer, seeing that it consists merely of a laminated iron core with two bobbins of wire (one the primary and the other the secondary winding) slipped over this core. Actually, however, unless the wires and the core are carefully proportioned, the results may be very poor indeed. Cheap transformers are usually scamped in the wire used and, owing to the slipshod method of winding, have a very large self-capacity, which may give rise to howling and absence of amplification. It is also a simple matter to make a transformer which will give a good deal of amplification on one frequency and poor amplification on others. The ideal inter-valve transformer should give good amplification of equal value on all the frequencies likely to be handled by it.

The iron core must be properly proportioned and must have sufficient iron to avoid magnetic saturation with strong signals. A good transformer is most carefully made and proportioned, the wire used in such transformers being so expensive that it is absolutely impossible to place them on the market with reasonable profit at the price at which some of the cheap variety are sold. From 17s. 6d. to 25s. many good transformers are obtainable, and some of those sold at 30s. are well worth the extra money.

"Army" type of L.F. Transformer.

Another point to bear in mind when choosing a transformer is that it should be able to stand the voltage you are likely to impress upon it without "burning out." Actual burning out is rarely the cause of a breakdown, but as this title is generally given, it is used here. If you make experiments with the size of wire used in a good inter-valve transformer, you will find that it will carry far more current than is ever likely to be passed through it, without fusing, but a transformer will break down long before this figure is reached owing to the mechanical stresses set up by the magnetism breaking the wire. In many note-magnifiers it is desirable to use 100 to 120 volts on the valves to get good amplification, and at times, particularly in power amplifiers, a much higher voltage than this is used. The cheap transformers will break down if anything more than 70 or 80 volts is placed upon them, quite apart from the fact that their reproduction will be unsatisfactory from the point of view of distortion.

Using Different Transformers

It is often a good plan, in making up a two-valve note-magnifier, to use different makes of transformers in the two stages. To give the best possible results, the primary winding of the second transformer should be somewhat different from that of the first, and, indeed, a few makers are now selling transformers marked "first stage" and "second stage," so that the best results can be obtained.

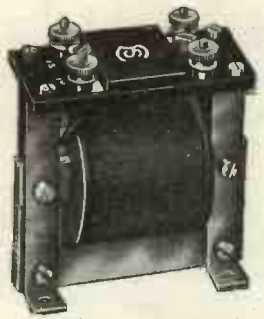
If inter-valve transformers are placed very close together, with their windings in the same plane, there may be inter-action and consequent howling. Try and arrange the inter-valve transformers to be well spaced, with their windings at right-angles to one another. It is usual to recommend that the O.S. terminal be connected to the grid, and the I.S. to filament, but sometimes improved results will be given by changing the connections round. O.P. to plate, I.P. to positive, O.S. to grid and I.S. to filament is a good general rule, but where the makers indicate any other arrangement, this should be followed.

Long Wires

It should not be imagined that long wires do not matter in low-

frequency circuits; any wiring which tends to give inter-action between the two circuits in a double note-magnifier is to be avoided. Very often a note-magnifier will work perfectly satisfactory until switches are introduced, whereupon the coupling introduced by the switches will frequently set up a howl. If, after taking precautions in spacing the transformers and keeping the leads as short as is possible with such spacing, howling is still occurring, there are two methods which often prove very satisfactory. The first is to connect the two cores of the transformer together and to earth, and the other is to connect them to the positive high-tension lead. If a separate accumulator is used with note-magnifiers, it may be found advantageous to earth the negative of the second accumulator.

A fault often found in note-magnifiers, and one which the inexperienced builder may not at once identify, is self-oscillation at radio-frequencies. It sometimes happens that, on trying the first note-magnifying valve, satisfactory amplification is obtained, but on switching on the second valve there is no further amplification, but a certain amount of distortion. To test whether self-oscillation at radio-frequencies is occurring, and thus reducing the amplification at audio-frequencies, touch the grid terminal of the



A modern transformer.

valve with the finger. If self-oscillation at radio-frequency is taking place, there will be a sharp thud in the telephones when the finger is placed on the terminal and when it is taken off again. The sound is exactly the same as when the grid terminal of the high-frequency valve is touched when this is oscillating. If such oscillation is taking place, one of the precautions already mentioned will probably stop it.

The first transformer of a note-magnifier should be shunted by a fixed condenser of about 0.001 to 0.002 μF, except in those cases such as the Reinartz circuit or some of the dual amplification circuits such as the ST100, where such capacity is harmful. There is no need to shunt capacity across the windings of the second transformer, and in practice it is rarely found with modern telephones that a telephone condenser is really necessary. A large fixed condenser of a value of, say, 0.1 to 1 μF, is recommended to be placed across the high-tension battery, particularly when this is serving for both high- and low-frequency valves. Such a condenser will often reduce or stop howling and self-oscillation, and, in any case, is conducive to quiet work, as it compensates for any slight irregularity in the discharge of the high-tension battery.

AMERICAN BROADCAST RECEPTION

Our photograph shows

Mr. H. E. BOURNE

seated at his home-made receiving set. This enthusiastic amateur reports that the reception of American broadcasting is frequently accomplished on the apparatus illustrated.

C.W. and Telephony Transmission Using Valves

No. III.

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

This is the third of a series of articles which began in Vol. 3, No. 6, dealing with the principles of valve transmission and radio telephony.

Separating Direct and Oscillating Current Circuits

IN various regenerative and self-oscillating circuits it is frequently desirable to have the oscillatory circuit separated from the direct current anode circuit. In Figs. 1 and 2, the anode coil is connected so that the steady anode current passes through it. In Fig. 3 we show a circuit similar to Fig. 2, except that we now have a separate D.C. anode circuit, the plate Z, B2 filament, through which passes the steady anode current of the valve. Across the anode and filament is the oscillatory circuit L2 C1, which is connected to the output side of the valve through the coupling condenser C2. The anode circuit contains a choke-coil Z; this choke-coil may have an iron core, but is usually an air-core coil having a large number of turns. The natural frequency of such a choke-coil is often made equal to the frequency of the oscillations.

Owing to the choking effect of the coil Z, the high-frequency currents generated in the output circuit of the valve pass through the condenser C2 and energise the oscillatory circuit L2 C1. Instead of a choke-coil Z, a resistance of high value is occasionally used, but since it lessens the steady anode current, it is not as desirable as the choke-coil, which usually has a low resistance. The regenerative and self-oscillating action of the Fig. 3 circuit is exactly the same as that of Fig. 2.

Single Circuit Oscillators

In the three circuits already given we have obtained regenerative action by means of separate coils in the grid and anode circuits of a three-electrode valve. We can, however, produce oscillations, or obtain a reaction amplification effect when there is only a single oscillatory circuit. This oscillatory circuit must be

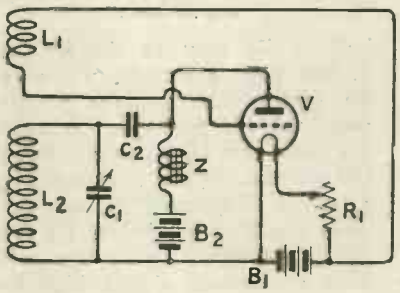


Fig. 3.—Use of iron or air-core choke.

connected in or be coupled to the anode circuit of the valve, and potentials must be derived from it and caused to influence the grid of the valve. Moreover, the potentials on the grid must be of such a phase with respect to the anode current that the energy liberated in the anode circuit is such as to tend to maintain or

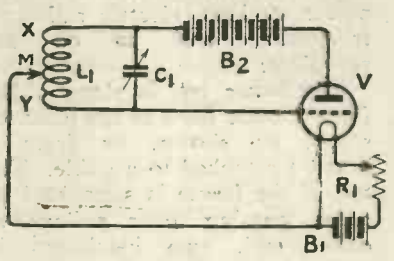


Fig. 4.—A self-oscillating system employing a single circuit.

strengthen oscillations. In the circuits of Figs. 1 and 2, if we turn the coils L2 round the reverse way with respect to the coils L1, or reverse the connections to these coils, the energy transferred from the anode to the grid circuits would be such as to damp out and oppose the original oscillations. There would thus be no reaction effect. As a broad principle, we must see in the case of valve circuits where there is to be a regenerative action, that the grid potential variations are such as to liberate energy in the anode circuit at the right time. This will be accomplished if, when we make the grid positive, the anode is negative and vice versa.

In Fig. 4 we show a very simple circuit for producing continuous oscillations. A single oscillatory circuit L1 C1 is provided; this circuit is energised by the flow of current pulses in the anode circuit of the valve. The anode current flows from the filament to the anode through the battery B2 through the portion XM of the inductance L1, and back to the filament. It is to be noted that the anode current need never flow through the whole of the inductance of an oscillatory circuit; it is sufficient that there is a flow through a part of the inductance. The point Y at the foot of L1 is connected to the grid. The filament is connected to a point M, preferably half-way along the inductance L1. This point, however, may be adjustable, but must lie between the extremities, X, Y, of the coil L1. If we consider the oscillations flowing in the circuit L1 C1, we will readily appreciate that the ends X, Y will be of opposite potential sign with respect to the filament. If, for example, there is a flow of electrons from X to Y due to the discharge of the condenser C1, the point X will be negative with respect to the filament, and the point Y will be positive with respect to the point M, and,

therefore, with respect to the filament.

At any given instant the anode and grid will have potentials of opposite sign with respect to the filament; a retroactive or regenerative effect is, therefore, possible, and self-oscillation may be obtained. The circuit fulfils the conditions stated above, that the grid potential variations with respect to the filament should be of such phase and sign as to liberate variable anode currents which will flow through the oscillatory circuit or a portion of it, at the right moment to assist the existing oscillations in the circuit.

The battery B2, in Fig. 4, is shown connected between the point X and the anode of the valve. This position of the anode battery is useful in some ways—for example, it does not affect the normal potential of the grid which is about zero volts; on the other hand, it is at a point of high-frequency potential with respect to the filament, and, therefore, with respect to earth. It has been pointed out that batteries and other apparatus which possess capacity to earth, or which are liable to produce leakage should always be connected next to the filament, and the additional advantage of doing this is that the circuit may be used with a number of other valve circuits, all working off the same anode battery and filament accumulator.

If, however, we connect the

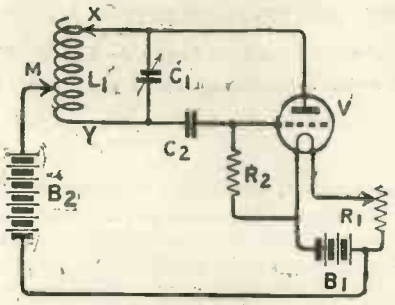


Fig. 5.—A rearranged circuit using a grid leak.

battery B2 next to the filament in the Fig. 4 circuit, we would be giving the grid a positive potential of, perhaps, 50 volts. To avoid this high positive potential we can use the circuit of Fig. 5, which illustrates the use of a fixed blocking condenser C2 connected in series with the grid. This condenser allows high-frequency potentials to be communicated to the grid, but prevents the steady positive potential of the anode battery having any effect.

To prevent an accumulation of electrons on the grid, a leak R2 is connected as shown. This use of a grid condenser and leak is to be distinguished from its use for leaky grid condenser rectification. The usefulness of a grid condenser for this purpose is very great in numerous circuits, and should be remembered. In oscillating circuits the leak may frequently be connected directly across the condenser C2, but there is always a tendency for the positive potential of the anode battery being communicated to the grid through the leak to a certain extent; as a general principle, therefore, the gridleak should be connected directly across the grid and the negative side of the filament. The negative side of the anode battery should preferably be connected to the positive side of the accumulator, so that the volts across the accumulator add to the anode voltage.

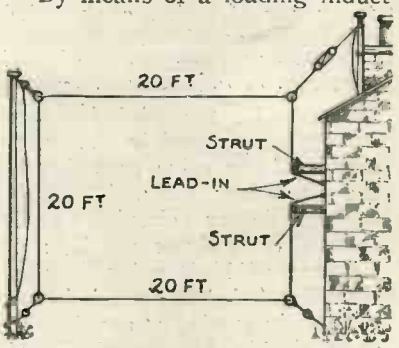
(Next week No. IV of this series.)

An Outdoor Frame Aerial

THOSE who have not sufficient room to erect an aerial of the ordinary type with a respectable length, or who are troubled by interference from coastal and other stations, may find it worth while to try the outdoor frame aerial, seen in the sketch. The greatest length required is 20 ft., which can be managed by most people, even though their houses are in very shut in positions. A very high mast is not necessary, though it is desirable that the aerial should be as little screened as possible. It is much more directional in its action than any form of open aerial. Hence its direction can be arranged to point directly towards the broadcasting station from which it is desired to receive, with the result that the bulk of interference will be cut out. Should it be desired to receive more stations than one, two or three simple masts may be erected so that the distant end of the frame may be suspended from any one at will. Further, as it has no earth connection, it is much less susceptible than the ordinary aerial to induction. Hence it can be used with advantage where noises due to nearby power stations, electric railways, tramways, and so on are prevalent.

The house end is slung either from a mast fixed to the chimney stack, as shown, or from a bracket attached to a gable. The top of the frame is supported by ropes passing over pulleys at either end, two insulators in series being fixed between the supporting rope and the wire. At its lower end short, stay-ropes, insulated as before, are provided. These serve to keep the aerial properly stretched. The two leads may be taken from the lower part of the perpendicular side nearest the house. These should pass through insulators attached to the ends of struts, the purpose of which is to keep the wires from touching the walls. Both leads must be taken into the house through insulated tubes, the method of making which has already been described in these notes.

By means of a loading induct-



How the aerial is supported.

ance upon the set the wavelength may be considerably increased if desired, and if such an inductance is used it enables reaction to be coupled directly to the aerial circuit, which makes for greater efficiency. You need have little fear of causing interference by so doing, for a closed aerial of this kind radiates but very feebly.

R. W. H.

A Cheap 10-watt H.T. Supply

By. 5QM.

In view of the trouble often experienced in maintaining a satisfactory H.T. supply, the following article is of especial interest.

TO the amateur residing in a house where there is no supply of power from the town mains, the question of H.T. for his transmitter often affords considerable difficulty. Unless volunteers willing to supply the motive power are forthcoming, a hand generator is liable to distract one's attention from the experiment in hand. A rotary transformer would undoubtedly be most satisfactory, but since a reliable make costs some thirty pounds and suitable accumulators and rheostats perhaps another ten, few amateurs would be prepared to go to this expense.

After consideration of the question, the amateur will probably find that dry batteries are the solution; he may, in fact, spend several pounds upon a 600-volt battery without realising that even should he obtain the very best out of a good make, it will not work his 10-watt transmitter for more than approximately 0 hours, and giving the cost of his battery at £7, his H.T. is causing an expenditure of about 1s. 5d. per hour.

A good solution appears to be found in some form of spark coil working off the L.T. supply, which only costs about one-third of a penny for 10 watt-hours. The most reliable coil for this purpose is, in the writer's opinion, the Ford unit, which will run for hours without attention. A very important point is that a new set of contacts may be obtained at any garage for a shilling.

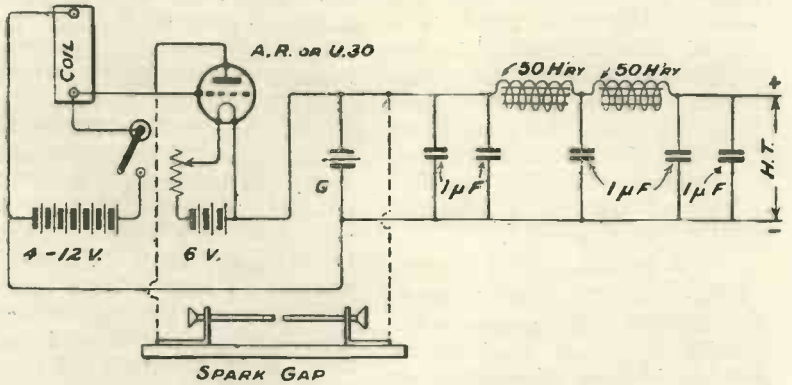


Fig. 1.—The connections of the complete supply circuit.

Using the circuit shown in Fig. 1 with 1 μF mica condensers (ex Government at 7s. 6d.) and 50 henry hedgehog chokes (ex-Government at 4s.), the results tabulated below were obtained, using a double-wire aerial, 42 ft. high and 45 ft. long, employing a Mullard O.20 valve and a 10,000-ohm leak.

The D.C. output was measured at the anode of the transmitting valve. G is a safety gap consisting of two smooth metal plates separated by a piece of thin waxed paper. This should break down before the mica smoothing condensers, and thus protect the latter from very high voltages which may build up through a break in the H.T. circuit of the transmitter.

The first cost of this apparatus to give 10 watts with an input of 1.5 amps at 12 volts is as follows:—

	£	s.	d.
Coil	0	10	0
3 6-volt 180 amps. accumulators (Disposals Board) ...	6	15	0
1 U.30 valve	1	8	0
5 mica condensers	1	17	6
2 chokes	0	8	0
Valve panel and rheostats ...	1	0	0
Oddments	0	1	6
	£12	0	0

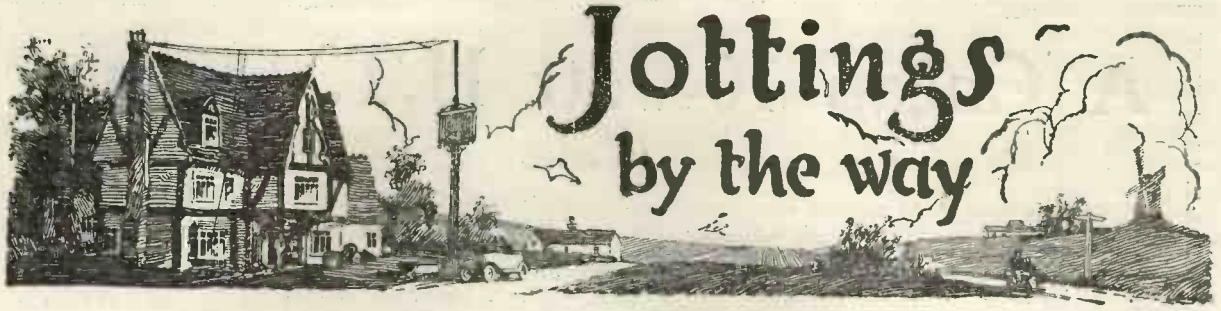
Running Costs for 100 hours.

11 accumulator charges at 1/-	0	11	0
Wear and tear of valve ...	0	7	0
1 set of contacts	0	1	0
Wear and tear of accumulator	0	1	6
	£1	0	6

(Or about 2½d. per hour as compared with 1/5 per hour with dry batteries.)

(*Concluded on page 245.*)

Input.			*D. C. Output.*				
Volts.	*Amps.*	*Watts.*	*Milli-amps.*	*Approx. Volts.*	*Approx. Watts.*	*Radiation on 200 Metres.*	*Approx. Efficiency.*
4	0.5	2	6	125	0.75	0.10	38
4	1	4	9	180	1.6	0.15	40
4	1.5	6	10	220	2.2	0.17	37
6	0.5	3	8	150	1.2	0.12	40
6	0.75	4.5	4.5	200	2,0	0.16	44
6	1	6	11	230	2.5	0.19	41
2	2	12	14	320	4.5	0.25	38
8	0.5	4	9	180	1.6	0.15	40
8	1	8	12	330	4.0	0.23	50
8	1.5	12	15	370	5.5	0.27	46
8	2	16	16	420	6.75	0.30	42
10	0.5	5	11	230	2.5	0.18	50
10	0.75	7.5	12.5	320	4.0	0.23	53
10	1	10	15	370	5.5	0.27	55
10	1.5	15	17	440	7.5	0.33	50
10	2	20	19	520	10.0	0.36	50
12	0.4	4.8	10	200	2.0	0.16	42
12	1	12	16	420	6.75	0.30	56
12	1.5	18	19	520	10.0	0.36	55
12	2	24	20	600	12.0	0.40	50



Jottings by the way

Was it Revenge ?

SOMEONE I see has been engaged in the entirely new pastime of aerial slashing in the granite city of Aberdeen. His *modus operandi,* it appears, is to sally forth at dead of night armed with great cunning and a pair of powerful wire cutters. He notes a flimsy mast which the taut aerial is straining into a curve. He stops. He looks. He listens. The coast is clear. The night is dark. The stage is set in the most approved style for dirty work. Out come the wire cutters; a single snip breaks the silence and down comes the mast into the greenhouse or the hen run, causing havoc enough to fill the most criminal soul with unholy joy. Much has been written on the psychology of those who shear off the tresses of unsuspecting flappers, or splash priceless gowns with the murky stains of ink. We are familiar with the handiwork of those who test the edges of their new carving knives upon the cushions of railway carriages. But the wireless slasher is something entirely new, and his mental complexes have still to be investigated in the best Freudian manner

Myself, I think that there are only two possible alternatives. As an eminent person, whose name is a household word (though for a moment I cannot recall it), has well said, "Of two things one." Either he is a disappointed man whose home-made set refuses to function, or he is some poor soul who has become demented through the activities of those who nightly tear the ether to shreds with their howling. The wireless man into whose nature the gall and bitterness of disappointment have entered is a very terrible fellow. His neighbours receive WGY on one valve, but he cannot even get his local station on six. The fact that in the frenzy of construction he has connected his grids to H.T. + and his plates to L.T. – escapes his notice. All that he knows is that he is very deeply wronged and that his neighbours have no right at all to the excellent reception which they obtain. Upon his bench is a pair of wire cutters. In the neighbouring gardens are flimsy aerials. Shall he miss the opportunity of teaching the supercilious a lesson? Is the time not ripe for action? Yes, a thousand times yes, and no, a thousand times no, or vice versa.

A Fellow-Feeling

When a man has been driven to the borders of semi-criminal insanity by what Shakespeare possibly had in mind when he wrote "these exhalations whizzing in the air," he has my fullest sympathy. As I think I told you before, I have had some; in fact, I am still having some. If there is anything more utterly maddening than to have a really good broadcast item, such as an opera transmitted from Covent Garden, spoilt in this way, then I would like to know it. I don't mind the fellow who gives a squeak or two when he is tuning in. I am sorry for, but not wroth with, the man whose set is so unstable that it howls when he unthinkingly crosses his legs. I am not seriously annoyed by the enthusiast who squeaks and chirps away all through a five minutes interval in a wild endeavour to pick up a transmission which, not having heard a word of what the announcer has said, he thinks he has lost for good and all. None of these does any great harm. The scoundrel who rouses my ire, gets my rag out, stirs me to the basest depths of my nature and drives me to distracted profanity, is he who sits for long hours before his set giving a tweak now to this and now to that. He is never quite content, but must always needs be trying to get that little more which seems so much.

These people suffer apparently from a kind of specialised form of St. Vitus' dance. Their hands are for ever twitching and fluttering over the knobs. They cannot behold a handle or a knob without being filled with the desire to move it. And there they sit twisting and twiddling, and twiddling and twisting, whilst the rest of us bestrew the floor with handfuls of ill-spared hair and cry aloud in a rage. Let the Oscillators of Little Puddleton be warned. I have a large pair of wire cutters. The nights are as dark and masts as flimsy here as they are in Aberdeen. If two of them, whom an equally demented friend and I have tracked down, persist in their evil doing, then you will read more of the activities of the modern Crack the Snipper, for we shall fare forth and do them in in this delightful way.

Dull-Emitteritis

The latest malady to befall wireless men is the disease known in Harley Street circles as dull-emitteritis. The first symptoms of the disease are to be found in visits by the patient to every wireless shop within reach. He enters with his breast pocket bulging with Fishers and leaves slimmer in the region of that pocket, but with very pronounced bulges in the neighbourhood of most of his others. Whilst passing through crowds he continually cries, "For heaven's sake don't push." In trains he produces various silvery valves from his pockets and plays with them during the journey. Do not if you value your sanity enter into conversation with any fellow passenger who is observed behaving in this way.

Once the valves have been fitted to his set the second set of symptoms manifest themselves. There is a pronounced swelling of the head accompanied by a tendency to inform all and sundry of the incredible length of time that his accumulator lasts without being recharged. He may even fling his accumulator into the dustbin and announce to all the world that he has gone as dry at the United States are reputed to be. But the victim of this terrible disorder is at his worst when he inadvertently moves the knob of his mighty rheostat with one great sweep to the wrong end. His erstwhile dull emitter becomes a singularly bright emitter for a few brief moments and then expires. He runs about the room waving wild hands and searching vainly for appropriate words. Do not choose that moment for reminding him that such a little accident would have cost *you* but 12s. 6d. If you make such tactless remarks you will probably witness the phenomenon of spontaneous combustion, the luckless man going up in a blue flame, even as his treasured valve did.

Peace, Perfect Peace

Now that the lads are safely back at school we can straighten out the fearful and wonderful circuits that they have contrived with the wireless apparatus and get back to serious work once more. My friend Judkins asked me round last night to see the havoc that had been caused during the holidays upon his wireless bench. His erstwhile tidy table reminded one of a cross between a telephone exchange that had been struck by lightning and a wire entanglement after an intensive bombardment. It appeared that his young hopefuls had been engaged just before they left in making up a set which was a combination of the Armstrong, the Flewelling, the Neutrodyne and an intelligent anticipation of six other circuits of twelve months hence. Judkins and I have decided that in future high tension periods, school holidays to wit, we will provide our offsprings with a medley of discarded apparatus and turn them loose upon it to do their worst.

A Sad Prospect

What will become of the boys themselves I shudder to think. You and I had a sheltered upbringing at school. When we returned at the beginning of the term conversations were quite harmless. "How many theatres have you been to?" "I went to four." "Oh, that's nothing, I've been to six." You remember the kind of thing. Possibly there would be a heated argument about the merits and the horse-power of motor cars owned by the parents of rivals. But all these things merely establish the spirit of manliness which has made us what we are. Now all is changed. The boy with a mere crystal is despised by the owner of one valve, whilst he again must give pride of place to the fellow whose sire has installed a multi-valve "Welkinrender." You will hear from the apparently innocent lips of Smiffkins minimus a dissertation upon the stability of tuned-anode coupled high-frequency amplifiers. He will assert that they are excellent in skilled hands, whilst young Snooper will maintain that for all round efficiency they are not to be compared with aperiodic transformers.

What can happen when the atmosphere is such as this? You and I despite our healthy surroundings whilst at school were badly infected with the germ of radiomania. But these poor lambs who have been accustomed almost as soon as their lips could lisp to commune together over the hysteresis factor in audio-frequency transformers must develop into terrible cases of the malady long before they are out of their teens.

WIRELESS WAYFARER.

A CHEAP 10-WATT H.T. SUPPLY.

(Concluded from page 243.)

The amateur of more limited means who already possesses a transmitter might run the coil off the 6-volt filament L.T. and rectify with any hard-receiving valve, i.e., A.R.

Another method of rectification which makes use of the higher voltage pulse at the break than at the make of the coil, consists of a small spark gap, the electrodes of which are made of No. 12 or 14 copper wire. This is shown in the diagram and connected by dotted lines across the rectifying valve and its filament battery. The valve and its battery should be removed.

With this method of rectification the coil works best on 8 volts and takes about 2 amps. If the break of the coil is not screwed up too tight and the spark gap is in correct adjustment, about 4½ watts of D.C. may be obtained, this giving about 0.25 amps in the aerial on which the above results were obtained.

With the values of condensers and chokes given, the wave emitted is very pure and the hum of the coil only just audible on a valve receiver at less than a quarter of a mile, while, of course, the speech is deafening.

In conclusion, a few precautions will not be out of place. Always use the safety gap G. See that both transmitting and rectifying valves are at proper brilliancy before switching on the coil. Always use a compensating wave or absorbing circuit when working C.W. Occasionally clean the contacts of the coil with emery cloth to keep results up to standard. Never screw the break down so tightly that it splutters. It may, however, be slackened away to reduce power. This is how the various powers given in the table were obtained. See that the L.T. to the coil is the right way round. If these precautions are taken, the apparatus described will be found to be a very cheap and efficient source of high tension.

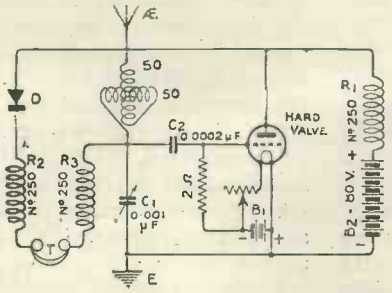


Fig. 1.—A single H.F. amplifying circuit employing the Ultraudion principle.

A Dual Ultraudion Circuit

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

VALVE - crystal circuits have already been described in which the crystal is placed directly across the aerial - tuning inductance, the high - frequency voltage across this inductance being at the same time applied across the grid and filament of an ordinary H.F. amplifying valve, and the amplified H.F. impulses being used to supplement the directly-applied signal-voltage on the crystal by means of a reaction-coil connected in the plate circuit of the valve, and coupled magnetically with the A.T.I. It is an obvious further step to apply the principle of dual amplification, and to feed via a L.F. transformer the L.F. impulses from the crystal on to the grid of the valve, in one of the well-known methods used in standard dual-amplification circuits.

In the De Forest Ultraudion circuit, in its various modifications, there is only one inductance, which is of course connected in the aerial circuit; reaction being obtained in the most direct manner by connecting the top of this inductance *directly* to the plate of the valve, and controlling this essentially unstable circuit by means of a variable condenser placed across the filament and on end of the A.T.I. In one effective version of the circuit, this condenser is placed in series with the A.T.I., and therefore between the grid and earth-filament connection. It seemed of interest to try the effect of putting also a crystal, in series with the telephones, across this inductance, so as to obtain the most direct possible H.F. amplification effect. The resulting circuit is shown in Fig. 1.

The high-tension battery is connected through a radio-choke, a No. 250 coil or similar inductance, to the plate; the grid is necessarily isolated as far as the D.C. voltage of the H.T. battery is concerned by a small grid-condenser, and as is usual in H.F. amplifying valves, its potential is kept a little on the negative side by a grid-leak connected to the L.T. negative; the filament resistance is connected in the negative lead so as to assist in this task.

As the telephones are connected at a point which has a H.F. potential relative to earth and the observer, they must be isolated for H.F. by radio-chokes in both leads; these are of the same type as that in the plate circuit. The A.T.I. is a variometer of the ordinary type, but with enough turns to tune over the desired range when used with a fairly small series condenser, i.e., with some 50 turns of wire on both stator and rotor of ordinary dimensions.

On actual trial of this circuit, after tuning to the broadcast transmission with the telephones in the plate circuit in the usual way, and with the crystal detector out of action, the grid-leak being taken temporarily to the L.T. positive lead, thus giving an ordinary valve - detector Ultraudion circuit by adjustment of the variometer and the series condenser the circuit was brought up to just below the oscillation point, giving loud signals. The crystal detector was next switched in, by lowering the cat's whisker, whilst the telephones were transferred to the crystal circuit, the grid-leak being changed to the L.T. negative lead. With this arrangement considerably more reaction

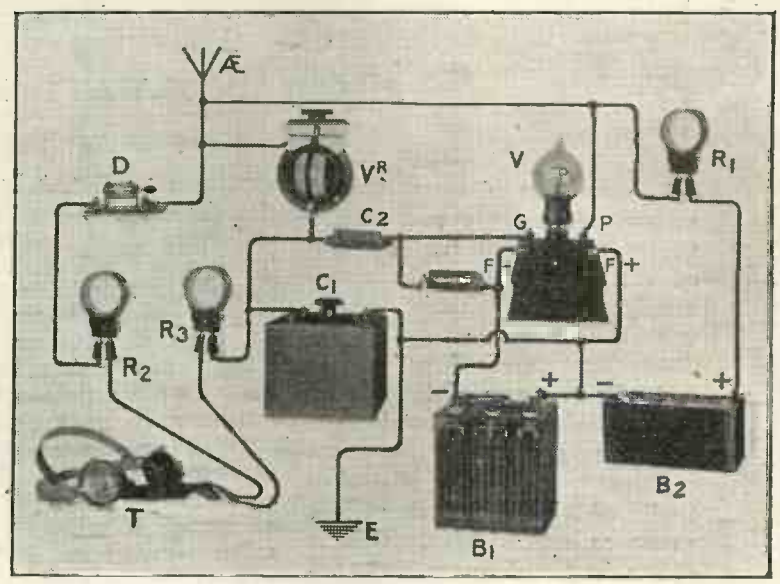


Fig. 2.—The circuit of fig. 1 shown pictorially. The coils R1, R2, and R3 are the radio chokes, and may be ordinary plug-in coils.

To those readers who experiment with circuits of uncommon type, the following article is of especial interest.

could now be brought to bear by adjusting the variometer and the series condenser, on account of the severe damping introduced by the crystal. By simply turning the valve-filament on and off, the amount of amplification introduced by the H.F. valve could be observed, this being a simple crystal circuit when the valve is out of action. The tuning is extremely flat, also on account of the crystal damping.

The last stage of the experiment was to connect a L.F. inter-valve transformer (with a 5 to 1 step-up ratio) in place of the telephones, and to place the latter again in the plate circuit, between the H.F. choke and the H.T. battery. With this arrangement the low-frequency impulses are introduced behind the grid-condenser in a manner that has been frequently described, via a radio-choke of the same type as the others already in use, the I.S. being connected to the most negative point of the L.T. circuit, or preferably to this point through a grid-bias battery of one or more cells. The resulting circuit is given in Fig. 3. On actual trial, using a small internally-wound variometer for A.T.I., galena crystal, Pye L.F. transformer (No. 1), good French R valve, and 80 volts H.T., a most prodigious noise was obtained from the local station at 13 miles, and with a good suburban aerial. Good signals were obtained also from an absurdly small indoor aerial. Other stations at 70 miles or more were readily picked

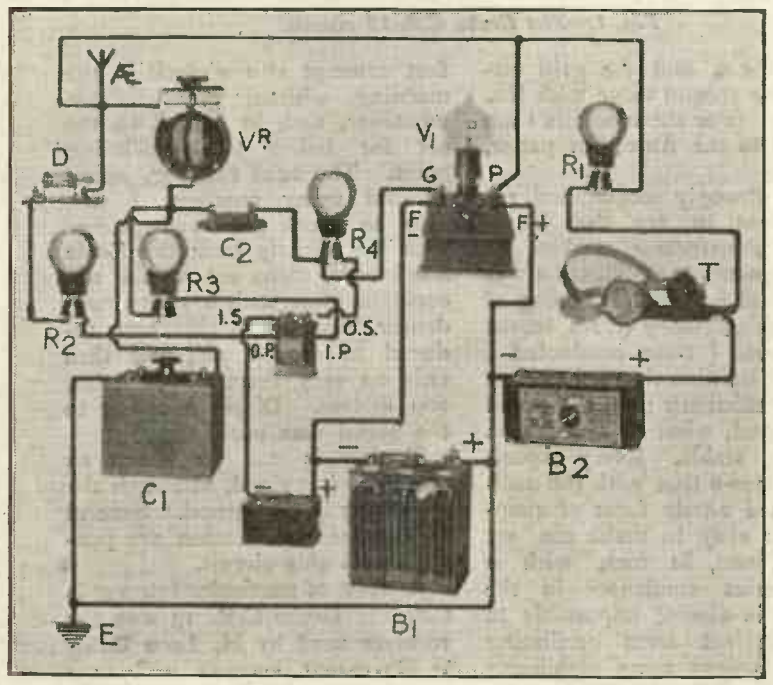


Fig. 4.—How the components are actually wired to form the circuit of Fig. 3.

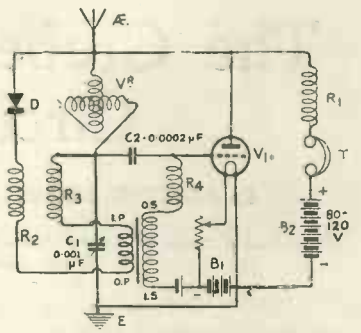


Fig. 3.—The circuit with the addition of a low-frequency transformer to give reflex amplification.

up in the interval of the local station, the circuit being quiet and controllable for searching purposes so long as the crystal-setting remained good and one did not handle terminals; the lack of selectivity, however, prevents much distance work. No trouble was experienced from A.C. electric-light mains close to the receiver, with the L.F. component introduced in this manner behind a grid-condenser.

There is no reason why a note-magnifying valve should not be added, if desired, making an excellent loud-speaker circuit for reception of local broadcasting. A small power-valve, and plentiful H.T. with proper grid-bias would be required to avoid distortion.

Some little experience of the Ultraudion circuit, with its curious two-handed simultaneous control of A.T.I. and series A.T.C. is necessary before good results can be expected from this more complex circuit, as serious interference with neighbours, as well as strange howls in one's own telephones, will follow unskilful handling of the circuit. It is recommended, therefore, only to those with some experience of valve-reception and the recognition and control of oscillation.

In this connection it must be emphasised that in this circuit, and in all others wherein reaction upon the aerial is used, an audible beat-note from a carrier wave indicates that interference is being caused to other listeners. It may be occurring at other times also, but a beat-note is a certain indication.

The Grebe C.R. 13 Circuit

By PERCY W. HARRIS, Assistant Editor.

Practical details of a new circuit of great value in short wave work.

A VERY interesting new receiver known as the Grebe C.R. 13, manufactured by Messrs. A. H. Grebe & Co., has recently been placed on the American market. It is one of the few receivers specifically designed for short-wave amateur use, and not for the more popular broadcast band of wavelengths. It includes one stage of high-frequency, followed by a detector valve, it being optional to add stages of note-magnification if required. The actual circuit is shown in Fig. 1. Its main points of interest are as follows :—

(1) Aerial Tuning

Aerial tuning in the Grebe C.R. 13 is carried out by means of a variometer, the centre of which is tapped and taken to the aerial. The ordinary earth connection is used. A variable condenser having a value of about 0.00025 μF is necessary in this set, and this, combined with the centre tapping scheme, tends to make the aerial semi-aperiodic. As only part of the variometer is in the aerial circuit, more inductance than could otherwise be used is obtainable in the grid circuit.

(2) Stability Control

In place of the more usual potentiometer control a series resistance is incorporated in the grid circuit in the position shown. This has a value of several hundred ohms, and is best non-inductive.

(3) High-Frequency Coupling

The method of high-frequency coupling is the much-neglected, loose-coupled transformer method, the secondary (grid circuit of the second valve) being tuned and the primary (plate circuit coil) untuned. The secondary circuit is also variometer tuned, and the primary or plate coil is fairly loosely coupled to it with a fixed coupling. In practice the anode coil is made by winding about 15 turns of wire on to a tube placed over the variometer former. As the receiver is particularly designed for short-wave working, both variometers are wound with very thick wire, the aerial with No. 14 d.c.c. and the grid circuit of the second valve with No. 16 d.c.c. (For these details I am indebted to the American paper, *Q.S.T.*)

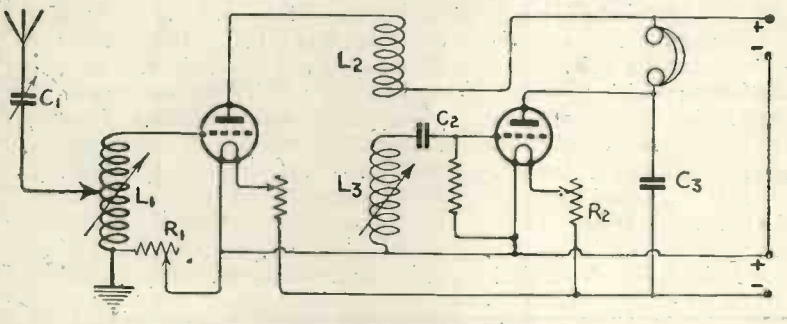


Fig. 1.—The Grebe C.R. 13 circuit.

I can strongly recommend experimenters to try the loose-coupled transformer method of high-frequency amplification. It has several advantages, being of very high efficiency (from recent experiments I have conducted I am of the opinion that it has even a higher efficiency than the tuned anode), and, what is more, it is extremely stable. Every experimenter knows that with the ordinary tuned anode form of coupling it is easy to make the set oscillate, and, in fact, with a small series condenser in the aerial it is almost impossible to keep the set from oscillating violently unless some stabilising device is used. If the loosely-coupled transformer method with tuned secondary is tried, it will be found that the set is extremely stable, and does not need any potentiometer or similar device to stabilise it.

I found a distinct improvement by making the coupling variable. A two-coil holder served excellently here, the primary coil being best (according to my own experience) about one or two sizes smaller than that necessary to tune the grid circuit. The grid circuit can be tuned by a condenser in the usual way. An optimum coupling will be found and appears to vary to some extent with the wavelength, as might be expected. In a set rapidly run together with variometer tuning for the aerial (not with any centre tapping, but tuned in the ordinary way), a two-coil holder for the transformer coupling and a condenser across the grid coil of the second valve followed by one note-magnifier, I was able to pick up WGY at my first attempt at 1 o'clock in the morning without any reaction whatever, and, in fact, with the set far below the oscillating point. The next evening, again without using reaction, I was able to work the loud-speaker with the signals from the Ecole Supérieure. The set would not oscillate even with a series condenser, save when this was reduced to 0.0001 μF, and then only on very short waves below 200 metres. Direct coupling to the aerial was used.

Tuning is not so sharp as might be imagined, although the selectivity is quite good. Several applications of reaction are possible with this circuit.

A point of particular interest is that the Grebe C.R. 13 was the receiver used by M. Leon Deloy in his recent success with two-way communication across the Atlantic. The C.R. 13 was also used at the same time on the other side of the Atlantic.

"Broadcasting"

Some interesting notes upon Broadcasting from a variety of view points.

AT a recent Informal Meeting which was held for the purpose of discussing the subject of broadcasting in its general and practical aspects, an official of the Post Office opened the proceedings, and gave an interesting account of the view point of the postal authorities. Referring to the original broadcasting scheme decided upon by the Post Office, he remarked that some people knew more about it than the Post Office, and a deadlock was the result. Outlining the course of the subsequent negotiations between the B.B.C. and the Post Office, he said that the Broadcasting Committee made no tangible proposals after their lengthy deliberations, but nevertheless their report so cleared the air that the licence question could be settled by agreement between the P.M.G. and the Broadcasting Co. The Postal authorities firmly believed in the honesty of the public (although they sometimes use their stamps twice !), and justification of this belief was to be found in the fact that as soon as the licence question was settled, the number of licence holders increased in the course of a few months from 150,000 to 500,000.

Justifying the present broadcasting arrangements, against which the cry of "monopoly" has sometimes been raised, he adduced a number of advantages which would not have been possessed by any other scheme. Firstly, the pooling of all the transmitting patents held by the various members of the Company put that Company as a whole in an exceedingly strong position, so strong, indeed, that they were able to give a quite unrivalled service. Secondly, the fact that there were no rival broadcasting organisations meant that the one Company could consult freely with the existing authorities upon the allied subjects, such as line telephony. As an example of the benefits conferred by this latter advantage, the speaker referred to simultaneous broadcasting. Such broadcasting has only been made possible by an enormous amount of experimental work and selection of lines on the part of the Post Office, since it is found that only a small proportion of the existing long-distance telephone lines are suitable for the purpose. The present tendency in long-distance telephony, he explained, was towards the greater and greater use of underground lines, but it was found that such lines were quite unsuitable for the transmission of music. It was therefore necessary to revert to the overhead system for simultaneous broadcasting, and it was only by actual trial that it was possible to ascertain which lines were suitable.

Broadcasting, the speaker considered, was proving most beneficial in a way that might not be sufficiently widely realised, namely, as a stimulant to development. For example, the practical dull emitter valve was a direct result of the popular demand for a set which made more moderate demands upon a supply battery, while the early loud-speakers had been improved out of recognition.

Turning to the question of interference, some interesting facts were given by the speaker concerning a series of experiments carried out by the Post Office to determine the amount of interference caused to broadcast reception by spark transmitting stations. A spark transmitter was installed in London, capable of putting a current of 5 amperes into an aerial, the tuning arrangement being such as to produce a reasonably sharply tuned wave. Even so, at the North Foreland station it was possible to hear this transmitter over a range of waves from 470 metres to 850 metres, although the actual transmitting wavelength was 600 metres. A receiver was installed at Dollis Hill, and it was found that heavy interference was caused over the whole of the broadcasting wave band. Experiments were then carried out with a tonic-train transmitter, with which it was found that interference was somewhat reduced, but that the signals at a distance were not nearly so strong. To produce equal signal strength at North Foreland it was found necessary to increase the aerial current to 8½ amperes, and therefore it is considered that the use of tonic train is not a practical solution of the difficulty.

The future developments of the broadcasting system, it was said, probably consisted in the provision of numerous relay stations to cover the areas where the service was at present bad. The positions for these stations must obviously be determined by several considerations, chief among which were that of interference and the density of population. This latter consideration, however, could not be taken unreservedly, since the percentage of the population taking out licences in the various broadcasting centres varied in a rather peculiar manner. For example, in London the percentage of licence-holders among the population is 1.8 per cent., in Birmingham 1.9 per cent., in Bradford, where there is no broadcasting or relay station, the percentage is 0.2 per cent., in Cardiff 5 per cent., in Newcastle 7.8 per cent., and in Plymouth, where again the conditions for reception are very bad, the percentage is only 0.043.

The speaker who followed raised the question of the present regulations regarding the use of reaction, and asked whether any representative of the Post Office

could explain the present regulations. He further suggested that the trouble of radiation caused by oscillating valve sets using reaction might be eliminated by the addition of extra valves, so that it would not be necessary to use so much reaction. This, however, was shown to be a fallacy by the next speaker, who pointed out that if a considerable number of valves were used, the inherent reaction effects in the receiver were capable of causing it to oscillate without the addition of reaction, and to become even more dangerous as a radiator than a simple set using reaction. He emphasised the point that even one high-frequency valve can be made to oscillate under many conditions without the use of any intentional reaction. This speaker then gave a number of interesting details regarding the broadcasting by the American station at Pittsburg (KDKA) upon 100 metres. He stated that on January 17 the power of this station had been very considerably increased for the 100-metre transmission, and that it was now strongly received in this country with quite simple sets. Upon a single valve set he had obtained very good reception any evening after 9 o'clock (further details of this reception will be found in " News of the Week."). The speaker gave some useful details regarding the receiver which he had found successful, and it seemed that a loose coupled tuner was necessary. He had obtained good results with a primary coil consisting of 3 turns upon a 3-in. tube, with a series condenser, the secondary consisting of 20 turns upon a similar size tube. For high-frequency coupling he had found the tuned anode method still fairly effective even upon this short wavelength.

The next speaker stated that he had been doing a good deal of work upon the question of the stabilising of high-frequency amplifiers, and had found it of great advantage to replace the conventional gridleak with radio frequency chokes, these being connected directly between grid and filament. By their use he found that the set is made more controllable, and with less tendency to " overlap."

An experimenter followed who gave some interesting figures regarding the value of the necessary negative grid bias in power amplifier work. He stated that he had measured differences of potential of as much as 50 volts across the secondary of the last intervalve transformer, and that therefore it was necessary to use a negative bias of at least 50 volts to prevent the flow of grid current. Concerning reaction, this speaker mentioned that he considered that the most certain test for radiation from a set in which one or more of the circuits are oscillating, was to vary the capacity of the aerial tuning condenser. If such variation produces an alteration in the audible beat note from a carrier wave, it was almost certain that radiation was taking place.

The present distribution of broadcasting stations. Relay stations which may be erected in the near future are shown by circles.

The Post Office representative then replied to the discussion and explained that the relaxation recommended by the Broadcasting Committee in the reaction regulation, was made because it was felt that the users of approved broadcast receivers were at a disadvantage to the wireless hooligan who made his own set without licence and disregarded regulations. It was therefore considered best to simply stipulate that the set should be used in such a manner that it caused no interference with other stations, and to leave it to the user to ensure that this was so.

Turning to the question of relay stations, which had been mentioned by various speakers during the discussion, he stated that they would be erected as soon as the income from broadcasting would justify it. He further thought that it might be desirable to erect a 25 kilowatt station to rope in the potential crystal users in all parts of the British Isles. He next explained that the suggestion of simultaneous broadcasting upon one wavelength by a number of different stations was not a practicable one, since the lag effects on the land-line used for the connection of the stations during simultaneous broadcasting was such as to prohibit any such method.

The question having been raised during the discussion as to what constitutes broadcasting hours, he said that he thought that experimental transmitters were justified in starting up when they heard their local station close down, even though some of the more distant ones might still be working.

Referring to the financing of broadcasting, he said that a very instructive position had arisen at the present time in the United States, where it was found that the country was becoming saturated with wireless receiving apparatus and the question of the payment of the broadcasters was growing acute. It was proposed to levy a regular annual licence fee which would amount to $6 per annum, thus showing that the delay in starting a regular system of payment had resulted in necessitating a heavier charge in the end. In other words, the United States were now starting to do what their elder brothers had seen from the first would be necessary.

Those readers who may have sent in application for a copy of the Service Radio Unit Booklet and not yet received same, are informed that the Service Co. tender their apologies for the delay, owing to the tremendous demand necessitating a further reprint. Copies of the Booklet will be sent as soon as possible.

News of the Week

WE understand from the Post Office that in accordance with the Report of the Broadcasting Committee, the Postmaster-General has appointed the following gentlemen to constitute a Board to advise him on broadcasting matters: — Major-General Sir Frederick Sykes, K.C.B., C.M.G., M.P. (Chairman), The Right Hon. Lord Riddell, Sir Francis Ogilvie, C.B., Mr. F. J. Brown, C.B., C.B.E., Mr. Guy Burney, Mr. Walter Payne, O.B.E., Mr. J. C. W. Reith, Mr. A. A. Campbell Swinton, F.R.S., with a representative of Labour (to be nominated later).

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On the night 16th-17th January, Mr. E. J. Simmonds, of Gerrards Cross (2OD), succeeded in getting the following message through to Mr. Hiram P. Maxim, of the A.R.R.L., Hartford, Connecticut, via 1BQ, Canada:—

"Hiram Maxim, A.R.R.L., Hartford, Connecticut. English Radio Transmitters' Society send American Amateurs greeting. Great pleasure that a number our members have worked both ways with you on low power. Hope next year we may assist you form round world amateur chain. Happy New Year. Ian Fraser, Chairman, Radio Transmitters' Society."

On the night 20th-21st January, Mr. J. A. Partridge, of Wimbledon (2KF), working with two valves, received the following reply from Mr. Maxim (1XW):—

"Chairman Radio Transmitters' Society. Your message received and very much appreciated by all at A.R.R.L. Headquarters. Hope I may see you in London in March. Hiram Percy Maxim, President."

The Radio Association has decided to organise a National Radio Week in 1924. This will be on the lines of the National Film Week and other similar weeks. The main objects will be to demonstrate the remarkable growth of a new British industry, and to arouse interest in the possibilities of Radio broadcasting amongst all sections of the community. A National Radio Week Committee is being formed representing all interests.

It is hoped that all-star programmes will be broadcast throughout the week, and many highly interesting and novel developments of broadcasting will be made known for the first time.

The Radio Association is the organisation of "listeners-in" in Great Britain. The President of the Association is the Hon. Sir Arthur Stanley, C.B.E.

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With reference to the letter from St. Dunstan's published in our issue of December 12, we are asked to announce the fact that numerous anonymous subscriptions have been received. It is gratifying to know that the publicity given by the publication of this letter has done so much good for such a worthy institution. It is with pleasure that we are able to express the thanks of St. Dunstan's Home to the numerous anonymous donors.

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Arrangements are now being made for the establishment of broadcasting stations in Montreal and Ottawa for the benefit of travellers on the Canadian National Railway. Mr. Robb, the Vice-President of the Railway, states that Trans-continental trains will soon be equipped with receiving sets handled by skilled operators for the pleasure and benefit of travellers, whilst in the company's hotels there will soon be the most complete radio sets possible. Radio receiving on trains was successfully carried out during Mr. Lloyd George's tour in Canada when the current news was constantly received by wireless on the train journey from Montreal to Winnipeg.

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The new wireless station at Saigon was opened for public service on the 17th inst., thus making it possible to send direct wireless messages from the colony to France. So far wireless communication has only been possible one way that is to say, from France to Indo-China.

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A number of reports are being received regarding the reception, upon about 100 metres, of the Pittsburg (KDKA) broadcasting station, in this country. Numerous experimenters report that it is being received at extraordinary strength, and without any fading, upon any evening after about 9 o'clock. The actual wavelength used is 102 metres, and it is, of course, somewhat of a problem to design a receiver which will function upon this abnormally short wavelength. Quite a large power is now being used at KDKA, however, and the station is quite easy to receive, success having been reported with quite a simple single-valve reaction circuit. It is said that the station is received in London somewhat more strongly than the Newcastle broadcasting station.

Basket Coils for Broadcast Wavelengths

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

Some useful notes upon one of the most efficient types of coil for short wave reception.

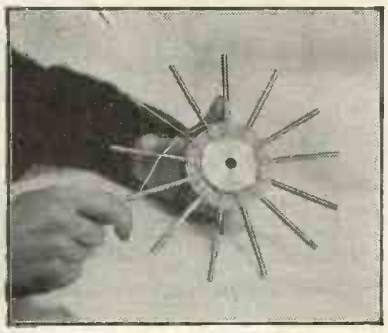

Fig. 1.—A basket coil in process of winding.

ONE of the most efficient and convenient tuning coils for short-wave reception ever invented is the simple type known as the basket coil. It is rather more compact than the single layer type, yet its turns are well separated from each other, and the electrical differences of potential between them are quite small. Hence it has a very low internal capacity, and its efficiency is a good deal higher than that of most of the true multi-layer coils, such as the honeycomb, and is, indeed, quite on a par with that of the best single-layer coils.

The only serious drawback of this coil is its somewhat fragile nature. To make it strong enough to be capable of removal from the "spider" (i.e., former) on which it was wound, the coil must be either shellac varnished

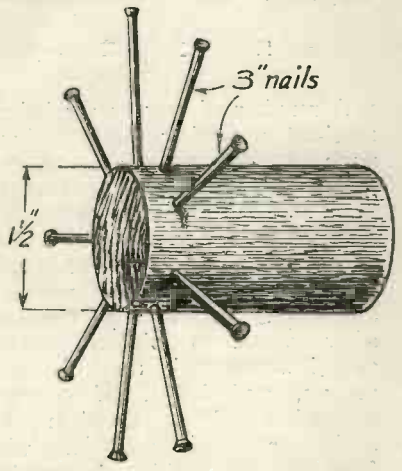

Fig. 2.—A home-made spider.

or impregnated with paraffin wax, which, of course, is regrettable, since it produces an undesirable increase in the self-capacity of the coil, and also introduces dielectric losses. Now, to keep these ill effects within reasonable limits it is important that the least possible quantity of wax or shellac remains in the cotton or silk covering of the wire when the process of impregnation is finished, and it may be useful to give an outline of the best method of performing the operation. The first essential to the successful use of shellac (recommended in preference to wax in the case of baskets) is the employment of suitable varnish of good insulating properties, and care should be taken to purchase it from a reputable electrical firm, and not from a general paint and colour merchant. The varnish should be diluted considerably with methylated spirit and applied sparingly with a brush, the coil being then left to dry for half an hour, after which it is to be thoroughly baked either in an oven or in front of a hot fire to expel the last traces of moisture. (The spirit contains a certain amount of water.)

The basket coil is so called on account of the resemblance which exists between the method of winding it and the process of weaving a basket. A "spider" is used, which generally consists of a metal or wooden hub in which are mounted an *odd* number of radial spokes arranged like the spokes of a wheel. A photograph of a basket coil being wound upon such a former is reproduced upon this page, and an examination of this illustration will show how what is known as a "single" basket coil is wound. As may be seen, the wire is passed alternately over and under the spokes until the requisite number of turns have been wound on. The wire is then cut and the finishing end is made fast by tying in two or three places to the turns beneath with thread. The coil is then varnished and baked, after which the spokes are pulled out and the coil removed from the former.

The inherent weakness of the basket coil can be somewhat reduced by judiciously tying together the turns of the coil at various points as winding proceeds. The weakest part of the coil is usually the inside, and it is especially desirable to secure the inner end of the winding. The tying is best done as winding proceeds, since the operation is much easier at this stage than it would be if one waited until the whole coil had been wound.

The question of the kind of wire to use for any given basket coil depends to some extent upon each constructor's preferences.

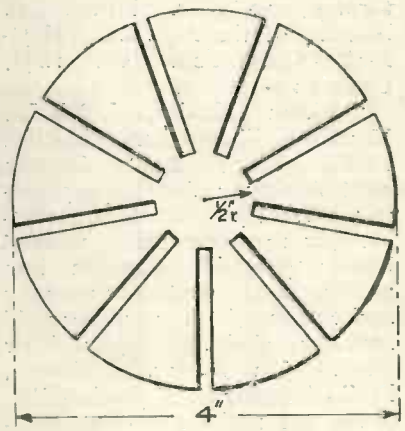

Fig. 3.—Dimensions for a disc type former.

The decision has to be made upon two questions, the first concerning the thickness (or gauge) of the wire, and the second referring to its covering or insulation. The choice of the gauge is always a matter of compromise, since efficiency demands that the

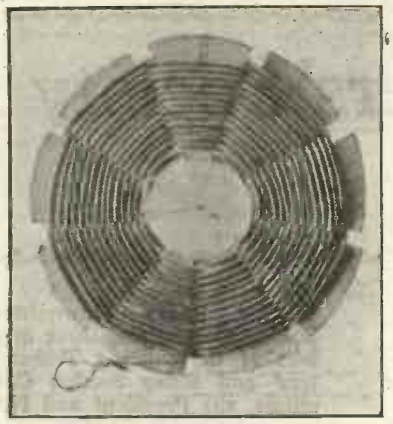

Fig. 4.—A coil wound upon a cardboard disc.

wire shall be thick, so that its resistance may be kept low, yet if thick wire is used for any except the smaller coils they become unwieldy in size. It is therefore necessary to choose such a size of wire for any given coil as shall be the thickest permissible if the size of the coil is to be kept within reasonable limits, and this consideration involves using different gauges of wire for coils of different sizes. Coils having only a few turns should be wound with quite thick wire, say, No. 20 or 22 S.W.G., while those for the longer waves having some hundreds of turns must be kept compact by the use of wire of perhaps No. 30 gauge.

The type of insulation to be selected depends partly upon the amount of space which can be allowed for the coil, some coverings being thicker than others, and to some extent upon whether the coil is to be impregnated with wax or shellac or left without any such protection against moisture. If the coil is not to be damp-proofed, cotton-covered wire should always be used, since, contrary to popular belief, cotton absorbs considerably less moisture from the air than silk. Provided that the covering is to be damp-proofed, it may sometimes be allowable to use silk in cases where great compactness is essential. Wherever possible, however, it should be made a rule that cotton should be used, since cotton is considerably thicker, and the thicker the covering the greater the spacing between turns, and hence the lower the internal capacity of the coil. Further, double silk or double cotton should always be used, rather than the single form of covering.

The simple basket coil which has been described is capable of useful modification in a variety of ways. For example, there is the very convenient method of winding known as the double basket. In this form, the wire is taken alternately over and under *two* spokes at a time instead of one, and the coil which results from this system is considerably stronger than the single basket and considerably more compact. This coil is a distinct improvement on the single form, and is to be preferred for all normal uses. The spider used for winding basket coils should preferably be purchased, since they are rather difficult to make, and reasonably cheap to buy. At a pinch, a makeshift one can be made by driving a number of 3-in. wire nails into a cylindrical piece of wood, as illustrated in the accompanying diagram. Instead of using a former (or spider) having radial spokes, basket coils can be wound upon formers made of cardboard or thin sheet fibre, ebonite or celluloid. A circle of cardboard can be cut out and slit as shown in the accompanying diagram, and upon this the coil is wound as before, the spokes of the former being replaced by the radial strips of the card disc. Here, again, the coil can be wound as a single or double basket, preferably the latter. If cardboard is used for the former, it should be damp-proofed, and it will not then be necessary to impregnate the coil itself. The self-capacity of the winding can consequently be kept a little lower than that of a coil wound upon a spider, since the latter form of coil must be waxed or varnished, but against this advantage must be set the dielectric losses in the cardboard or ebonite former.

The table given below gives data for an efficient set of coils to tune from 150 to 700 metres when used in the aerial circuit with a variable condenser of 0.0005 μF capacity and a series-parallel switch. It is assumed that they will be wound upon a spider having a central hub of between $\frac{3}{4}$ of an inch and $1\frac{1}{2}$ in.

Coil Number.	Number of Turns.	Gauge of Wire.
1	25	22 d.c.c.
2	35	
3	45	
4	60	
5	80	

To receive broadcasting with these coils, No. 2 or 3 will be required for the aerial circuit, No. 5 for the tuned anode circuit (with a variable condenser of 0.0003 μF, air dielectric type), and No. 4 for reaction.

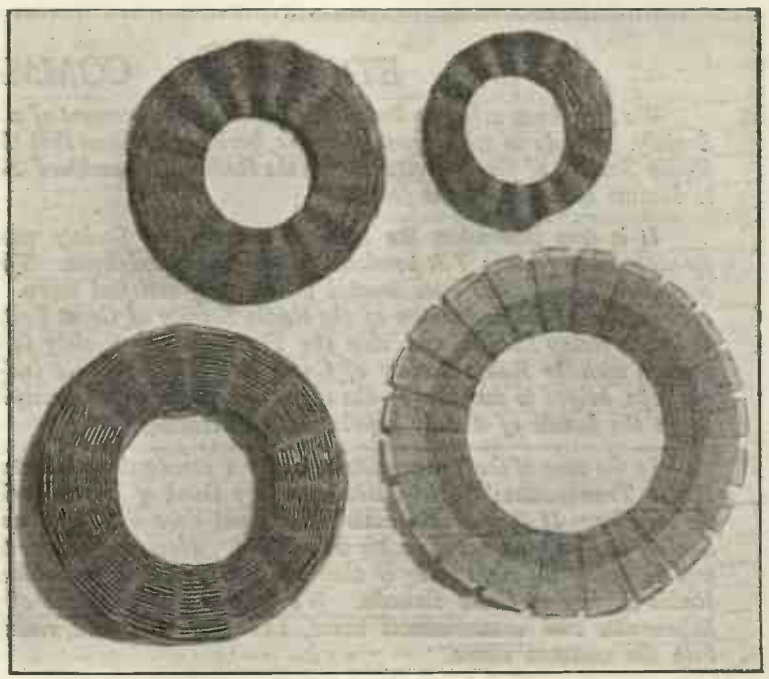

Fig. 5.—A group of typical basket coils.

The Radio Transmitters' Society

IMPORTANT NOTICE.

You are hereby requested to attend an EXTRAORDINARY GENERAL MEETING of the RADIO TRANSMITTERS' SOCIETY, to be held at the Institute of Electrical Engineers, on Friday, February 1, at 6.30 p.m., to consider the important matter about which details are given on the following Agenda :—

After business has been transacted Captain P. P. ECKERSLEY, President of the Society, has kindly undertaken to deliver a Lecture upon

"SOME RECENT EXPERIMENTS IN RELAYING WIRELESS TELEPHONY."

It is understood that Captain Eckersley will deal particularly with the Short-Wave Portable Transmitter and Receiver employed by the B.B.C. for the transmission of performances from the OLD VIC THEATRE. As a relatively low wavelength was utilised, and successful transmission and relay of the Old Vic was the first automatic wireless link carried out in this country, the Lecture will be of special interest to Members of the Society.

AGENDA.

(1). To consider and if thought fit approve the following Resolution :—

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

(a) The Radio Transmitters' Society agrees to join the Radio Society of Great Britain by amalgamating with the Transmitting and Relay Section of the Radio Society.

(b) The Radio Society of Great Britain agrees to the formation of a Joint Managing Committee for Section, consisting of seven members of the existing Radio Transmitters' Society Committee, three members of the existing Transmitters' and Relay Section Committee, the President and Hon. Sec. of the Radio Society of Great Britain being also *ex-officio* members.

(c) The Radio Society of Great Britain undertakes to co-opt on to their Council two Members of the Joint Managing Committee, when formed. The Joint Managing Committee to nominate three persons from whom the Radio Society of Great Britain Council will choose two.

(d) Dr. Eccles personally undertakes to propose the election of Captain Eckersley as a Vice-President of the Radio Society of Great Britain.

(e) The Radio Transmitters' Society and Radio Society of Great Britain both agree that mutually satisfactory arrangements will be made whereby Members only pay one subscription, and that existing subscriptions to either or both Societies will be credited to Members.

EDITORIAL COMMENT.

We have been asked to insert the above announcement of a meeting of the Radio Transmitters' Society. We do so with great pleasure, because it shows that there is a genuine desire for both the Radio Society of Great Britain and the Radio Transmitters' Society to meet together and the latter to become absorbed by the former.

It is true that when the Radio Transmitters' Society was first formed, we said that it was foredoomed to failure if it persisted in a separate existence. This remark, we believe, was treated as a challenge, and some even treated it with self-satisfied scorn. The last few months have seen the resignation of the committee of the Radio Society of Great Britain, the disappearance of the British Wireless Relay League, and now the Transmitters' Society is to consider a proposal for amalgamation with the Radio Society of Great Britain. All this indicates a new spirit which we have, perhaps, helped to encourage—the spirit of broad-minded strength, the unity of control, this control to be in the hands of a duly representative assembly.

In the case of the Transmitters, we have constantly advocated amalgamation ; we believe that the Radio Transmitters' Society, whatever they think of us, comprises most of the best transmitters in the country. If they amalgamate we are not sure that it is not ***they*** *who are absorbing the Radio Society section, and not the other way round. Nevertheless, for the general good, we believe that they will be doing the right thing if they will sacrifice their individual name and help to strengthen the Radio Society of Great Britain. We commend the scheme of amalgamation as being a generous, honourable and commonsense move, and they will gain, rather than lose, dignity in agreeing to help the common cause.*

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

A few notes of general interest to the experimenter and home constructor.

IN my notes recently I referred to the difficulty which arises, when using primary cells to supply dull emitters, by the drop in voltage upsetting such adjustments as reaction. There is a still more important point to be considered when using primary cells in multi-valve sets fitted with dull emitters. Let us assume we are dealing with large primary cells giving 1.5 volts on open circuit. When such cells are discharging through a single valve, the voltage will drop several points and will remain at this figure, as explained last week, for the duration of reasonable discharge. Let us, however, switch on a second valve — the current taken from the cells thereby being doubled. A further drop in voltage will take place and with each additional valve we shall drop a few more points. Naturally we provide sufficient cells in series (together with a filament resistance or resistances) to compensate for this drop in voltage when switching on further valves. The trouble arises when, having adjusted the filament resistances so that an adequate voltage is given to each valve, when several valves are alight, we switch out several valves leaving, say, only one. The voltage applied to this valve will now be much higher than is desirable and may quite likely burn out the valve or destroy its useful properties.

* * *

It must not be forgotten that a dull emitter can frequently be rendered useless by applying too high a voltage to its filament, although this voltage may not be sufficient to burn it out. Thus we may have two valves side by side both looking the same, both with their filaments alight at the same brilliance (or dullness) yet one may be efficient and the other useless. The reason is that the excessive voltage may have caused the thorium coating of the filament to be driven off.

* * *

Experimenters who like to listen for distant broadcasting may be reminded that the German broadcasting station at Koenigswusterhausen can generally be heard on Sunday mornings between 10 a.m. and 12 a.m. Apparently it works between 10 a.m. and 11 a.m. on 4,000 metres and between 11 a.m. and 12 a.m. on 2,700 metres (just above the Eiffel Tower adjustment). The modulation is poor and a good portion of the programme consists of gramophone records, of which the needle scratch can be heard quite plainly. The other Sunday morning I listened to this transmission and heard it quite clearly all over the house on a loud-speaker, using two stages of high-frequency, detector and two note magnifiers. It was comfortably audible in the room with only one note magnifier. Just prior to this I had heard at least two transmissions taking place simultaneously on a wavelength of 2,400 metres. I was not able to identify these transmissions as there was a lot of interference, and even without this I doubt whether they would have been clear enough to understand what was being said. The Eiffel Tower transmissions are particularly good in quality lately. It is not generally known that all the telephony at the Eiffel Tower is done with a single valve of a pattern practically unknown in this country. It is known as the Holweck and possesses the advantage that one can change the filament, should it burn out, in a moment.

Those readers who have built the ST100 circuit from my design in the July issue of *Modern Wireless* are recommended to try connecting the earth wire, not to the ordinary earth terminal, but to the negative low-tension terminal. The set when thus connected becomes more stable when used with telephone headpieces, and it will generally be found that there is not much, if any, reduction in strength. When connected in this way, it is possible to take very long leads from the telephone terminals, so that a loud-speaker can be operated in another part of the house, a very useful arrangement when some member of the family is ill and still wants to hear the broadcast programme. If you are fortunate enough to possess two loud-speakers, try connecting them in series in this way, one being in the room where you are using the instrument and the other in the distant part of the house.

* * *

A loud-speaker can be quickly improvised from one of the popular electric fires in which a heating element is placed within a copper bowl. Practically all of these are made so that the wire protector can be lifted off and the heating element pulled out of the socket, thus leaving the bowl clear. If this is done a single telephone earpiece can be suspended in the bowl at a point found by trial whereupon the sounds will be very considerably amplified, often quite enough for a small room.

ERRATUM.

Referring to the advertisement of Messrs. S. G. Brown, Ltd., appearing on page vii, of Vol. 3, No. 6, we are informed that the paragraph commencing "If you could only look inside the . . . .", contains a printer's error and should read "If you could only look inside the business end of a Brown loud-speaker you would find a "*CONICAL* aluminium diaphragm of the thinness of paper," and not . . . "you will find a *comical* aluminium diaphragm . . .", as stated therein.

The "C.R.

By E. H. Chapman, M

In the following article Dr. Ch adaptation of his im

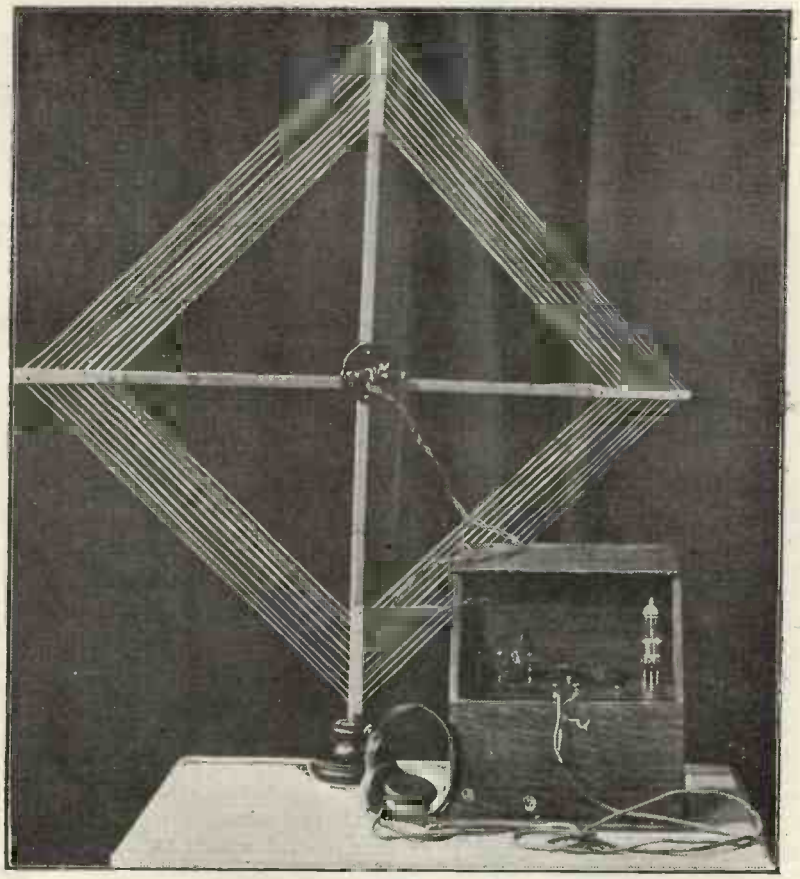

Fig. 1.—The receiver connected to the frame aerial.

THE novel feature of the one-valve receiver to be described in the present article is that, when the specially-designed frame aerial is used, no other coils are necessary. All the inductance required is provided by the windings on the frame aerial and tuning is accomplished by means of two variable condensers on the panel. The work of the receiver is not confined, however, to frame aerial reception. A simple three-plug coil may be used in lieu of the frame aerial and connection made to an outside aerial, tuning again being accomplished by means of the two condensers.

Fig. 3 shows the circuit diagram as used for frame aerial reception. It will be noticed that an earth connection is indicated. Although the earth connection may be omitted in some cases, stronger signals are in general obtained and the set is much more easily managed when an earth connection is employed.

The Frame Aerial

The wooden framework of the frame aerial was made from two lengths of wood each 3 ft. long and ½ in. square in section. In order to clamp the two wooden struts securely together at right angles, a cut ¼ in. deep and ½ in. wide was made right across each strut in the centre (see Fig. 4). To take the wire on the frame, ten saw cuts were made at each of the four ends of the struts. These saw cuts were cut straight across the wood by means of an ordinary hand saw and they were spaced ½ in. apart. Four pieces of three-ply wood, each 6 in. long and ½ in. wide, were cut ready to screw over the saw cuts after the wire had been wound on the frame.

A simple and effective base for the frame aerial was found in one of the small circular stands which form the base of a familiar type of shop window fixture. The bottom end of what was to be the vertical strut of the frame aerial was made circular for 1½ in., so as to fit fairly tightly into the circular hole in the base stand. There was no necessity to secure the vertical strut by a screw underneath, since the frame aerial stood firmly and rigidly when placed with the circular end of the vertical strut in the hole in the stand. There was also the advantage that the frame could be rotated without rotating the stand. Fig. 4 shows how the vertical strut of the frame was prepared. The horizontal strut only differed in having no circular end.

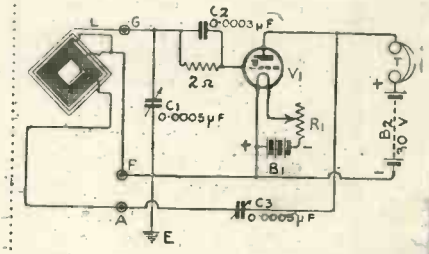

Fig. 3. The Circuit.

Fig. 4.—Details of the vertical strut of the frame aerial.

After the two cross struts had been screwed together, a circular piece of ebonite of about 3¼ in. diameter was screwed on to the frame at the centre. Four screws were driven through the ebonite, one into each "spoke" of the frame, thus making the frame very rigid. This ebonite disc carried three valve sockets, as shown in Fig. 5.

There were in reality two coils of No. 22 D.C.C. wire on the frame. For the first 5 turns commencing from the inside, the

' Receiver

A., D.Sc., Staff Editor.

man describes an interesting ed Reinartz tuner.

" aerial " coil and the " grid " coil were wound on simultaneously into the same saw cuts. The " grid " coil was then continued alone for the remaining 5 turns. When the two coils had been wound on to the frame, the four pieces of three-ply wood were screwed in position over the saw cuts, thus eliminating the possibility of the wires coming out of the saw cuts. Fig. 5 indicates how the ends of the two coils were connected to the valve sockets on the ebonite disc. It should be noted that the letters A, F and G, used in Figs.

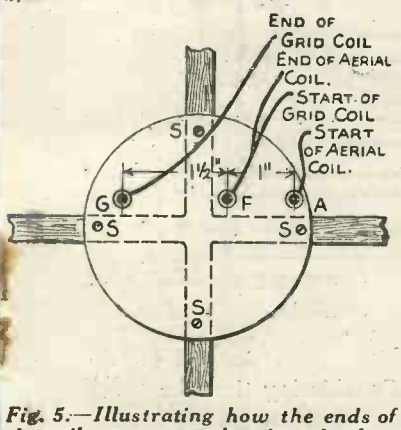

Fig. 5.—Illustrating how the ends of the coil are connected to the valve legs

3, 5, 6 and 7, all correspond and indicate connections.

The Connecting Lead

Quick connection between the frame aerial and the panel was provided for by a connecting lead made of three lengths of flex each a yard long. At either end of the lead, the three lengths of flex were soldered to valve pins mounted on thin strips of ebonite $3\frac{1}{2}$ in. long and $\frac{1}{2}$ in. wide, as shown in Fig. 6. To connect the frame aerial to the

Fig. 2.—The set arranged for use with an outdoor aerial.

panel all that was necessary was to plug one end of the lead into the valve sockets on the ebonite disc of the frame aerial, and the other end of the lead into the three corresponding valve sockets on the panel. By reason of the spacing between the valve pins at the ends of the leads and between the valve sockets mistakes in connections were impossible. The complete aerial and the connecting lead are shown clearly in Fig. 1, which is a reproduction from a photograph.

The Cabinet

The outside measurements of the cabinet into which the receiving set was built were :—Length, 11 in. ; width, 8 in. ; height, 11 in. The sloping front and the narrow top of the cabinet were hinged in two places in such a way that, when the cabinet was opened, the front and top formed a wide, flat shelf. This was found very convenient to use as a platform on which to place the frame aerial within easy reach.

The ebonite panel of the cabinet was 10 in. long and $6\frac{3}{4}$ in. wide. It was fitted horizontally at a height of 6 in. above the base of the cabinet. In such a position, a valve could be left in the valve holder and the cabinet closed without the valve being touched by the sloping front. The design of the cabinet is shown in Fig. 1, which is reproduced from a photograph of the set as used with the frame aerial.

The Panel

Fig. 7 shows in plan the top of the panel. An outside aerial terminal, earth and battery terminals were provided for at the back of the cabinet by five terminals mounted on a strip of ebonite 10 in. long and $1\frac{1}{2}$ in. wide. The shafts of the terminals protruded through holes in the back of the cabinet to the inside, where connections were easily made to them. These connections are indicated in Fig. 8.

The component parts mounted on the panel were—

Two variable condensers each with 14 rotating vanes,
Valve holder made of 4 valve sockets,
Grid condenser 0.0003 μF,
Grid leak, 2 megohms,
Filament resistance,
Two 'phone terminals, and
Three valve sockets for connection to frame aerial.

Fig. 8 shows all panel connections. The sketch is made from the actual panel placed in an

upright position, the battery terminal strip being in position on the back of the cabinet underneath. All the component parts, together with the cabinet were

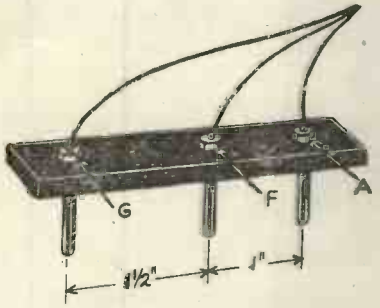

Fig. 6.—Details of the connecting lead for frame aerial use.

specially supplied by Messrs. Peto Scott, Ltd., and they were so selected that connections were all possible without the use of a soldering iron.

Use with Outside Aerial

For use with an outside aerial, coils may be made on the lines of those described in *Modern Wireless*, Vol. 1., No. 8, page 586. Fig. 2 is a reproduction of a photograph of the set arranged for use with an outside aerial. The coil shown in the photograph was of the basket-type, wound

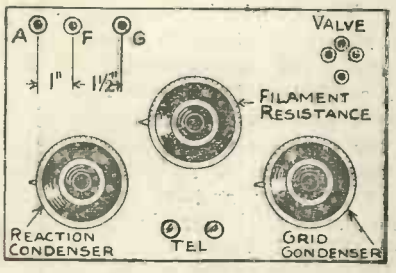

Fig. 7.—Plan view of the panel.

on a circular cardboard former of 2 in. radius. The winding, however, was somewhat different from that of any previously-described coil. The "aerial" coil consisted of 20 turns of No. 24 enamelled wire, the "grid" coil consisted of 40 turns of 24 D.C.C. wire. First of all, 4 complete turns of the "grid" coil were wound on the former, then 2 complete turns of "aerial" coil, then 4 more complete turns of "grid" coil, then 2 of "aerial," and so on. The completed coil was mounted on a piece of ebonite the same size as those used for the connecting lead, and having three valve pins mounted and spaced in the same way. The connections of the two coils to the valve pins were exactly similar to those indicated in Fig. 5 to the valve sockets in the central ebonite disc of the frame aerial. Such a coil as that shown in Fig. 2 will cover wavelengths from about 350 to 450 metres.

When an outside aerial is to be used with the receiver, the three-plug coil described above is placed with its valve pins in the three valve sockets on the panel, as shown in Fig. 8, and the outside aerial is connected to the "outside aerial" terminal, shown in the wiring diagram and in Fig. 7. The earth connection is, of course, retained.

Results

With the frame aerial in use, as shown in Fig. 1, the London broadcasting station at a distance of 14 miles comes in with excellent telephony strength. There is a marked purity of tone about the telephony so received. By careful tuning and adjustment of the filament current, Bournemouth and Newcastle have been heard distinctly and the "carrier waves" of some of the other broadcasting stations have been

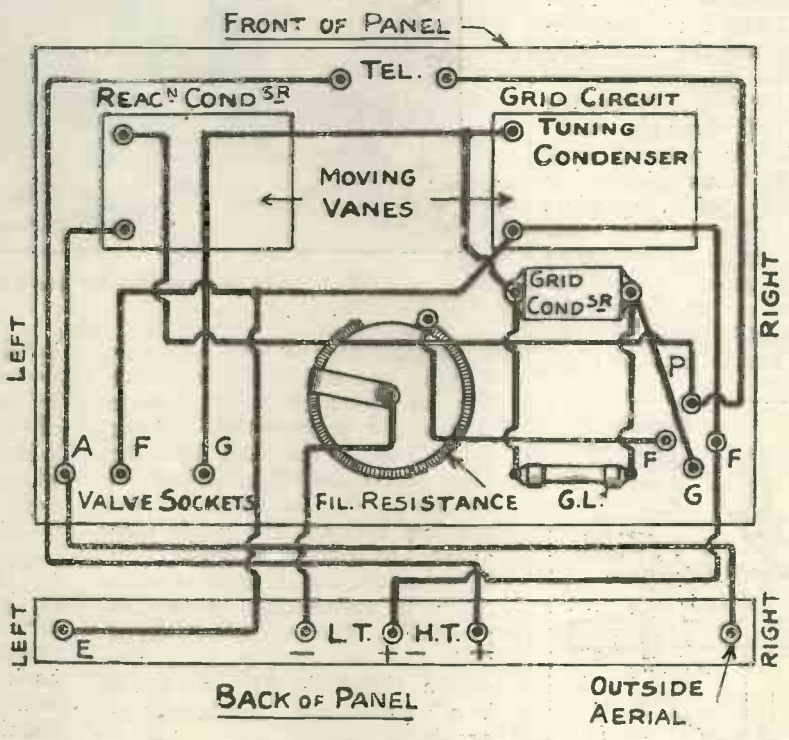

Fig. 8.—The wiring diagram.

picked up. Considering that the set is neither super-regenerative nor super-sensitive, these results are encouraging, especially when the simplicity of construction and of tuning is considered.

With an outside aerial and the three-plug coil described in this article, 2LO at 14 miles is loud enough to operate a loud-speaker so as to be heard with comfort over a fairly large room.

Broadcasting News

LONDON.—There seems to be some perturbation at the B.B.C. Headquarters as to the exact kind of Women's Hour which should be transmitted, and an influential committee of distinguished ladies has been formed to decide what best to do.

□ □ □

People in Edinburgh are greatly cheered on account of Capt. Eckersley having stated that the London programmes will be relayed to them, instead of all Glasgow programmes. It is hoped that the Edinburgh musical authorities will place all their facilities at the disposal of the B.B.C. for broadcasting local concerts, which in turn might be relayed elsewhere.

□ □ □

The broadcasting of Church services seems to have created a disturbance in religious circles. Some people say that it is the best thing that the B.B.C. has ever done, but others seem to think that it will ring the death knell of evening services in churches. As a matter of fact, the probability is that many people will listen to a broadcast service who have not been to a church for years, and attendance at the church service will revive a forgotten practice. It can be taken for granted that there will be monthly services broadcast from 2LO in future.

□ □ □

We were somewhat disappointed with the 3rd Act of Verdi's "Othello," recently relayed from Covent Garden Opera House. We have no fault to find with the production or artistes in any way, but is it not the fact that such ultra-dramatic operas as this are not ideal for broadcasting purposes, for the hisses, screams, groans, trampling and scuffling incidental to these highly pitched operas come over to us in a very exaggerated form?

□ □ □

Forthcoming Events

JANUARY.

30th (WED.). — Orchestra. Mr. Robert Naylor, tenor. Mr. Lloyd Chandos. Mr. William Robinson, humorous pianologues.

31st (THURS.).—7.30, Mr. Harry Mercer, entertainer. 8.30, Mr. Maurice Cole, pianist, and Mr. Rex Palmer will give a Pianoforte and Vocal Recital. Dance Music from Savoy Hotel.

BROADCAST TRANSMISSIONS

	Call-Sign	*Wavelength*
LONDON	2LO	365 metres
ABERDEEN	2BD	495 "
BIRMINGHAM	5IT	475 "
BOURNEMOUTH	6BM	385 "
CARDIFF	5WA	350 "
GLASGOW	5SC	420 "
MANCHESTER	2ZY	375 "
NEWCASTLE	5NO	400 "

TIMES OF WORKING.

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

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

FEBRUARY.

1st (FRI.).—Orchestral Programme by Mr. James Stewart, pianist; Miss Gladys Merridew, entertainer, and Mr. David Openshaw, baritone.

2nd (SAT.).—Dance Music. "The Two Wranglers," in a Humorous Interlude. 8.30, Acts 1, 3 and 4 of "La Boheme," relayed from Covent Garden.

3rd (SUN.).—Symphony Concert, S.B. from Bournemouth. 5, The "Children's Corner," S.B. from Newcastle. London Wireless Orchestra.

4th (MON.).—Symphony Concert, conducted by Mr. Julius Harrison, English composer. Mr. Jack Rickards and Miss Violet Stevens, "The Scandalmongers," will entertain. Orchestra.

5th (TUES.).—"The Lion's Revenge," played by Aunt Priscilla. Chansonette Concert Party. H.M. Royal Air Force Band.

□ □ □

ABERDEEN.—Induction played a strange trick on an Aberdeen reporter the other day and incidentally provided listeners with an unrehearsed "turn." An opera was being relayed from Covent Garden via Glasgow when, mingled with the music and quite distinctly, came a man's voice with a pronounced Aberdeen accent, relating a strange tale of "Arles," his entire message being broadcast. For once induction provided an entertainment as welcome as it usually is the other way.

□ □ □

Forthcoming Events.

JANUARY.

30th (WED.).—Jazz Night. Talk by Mr. George Milne on "How Postage Stamps are Printed."

31st (THURS.).—Classical Night.

FEBRUARY.

1st (FRI.).—Instrumental Night. S.B. from London.

2nd (SAT.).—Scotch Night. S.B. from London

3rd (SUN.).—S.B. from Bournemouth. Address by the Rev. MacIntosh Mowatt.

4th (MON.).—S.B. from London.

5th (TUES.). — Plantation Songs, Jokes and Melodies, by Murray's Mississippi Minstrels.

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BIRMINGHAM. — "Auntie Phyl" of 5IT did a very happy thing when she created "Snookie" of the Children's Corner. He has achieved a wonderful popularity. His adventures are to be chronicled in book form, and a local organist has

composed a "Snookie Suite"—a little work which is delightfully whimsical. The first number was played during the radio-panto-review, "Singbad the Wailer," which 5IT broadcast a week ago. Much more could be written of Singbad if space permitted. The American broadcast transmission which was suddenly switched on in the midst of the pantomine was "faked" by the studio engineers, but with the heavy mush of atmospherics and the barking of Morse, it was so realistic that many listeners must have been completely duped!

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Forthcoming Events

JANUARY.

30th (WED.).—3.30, Paul Rimmer's Orchestra. 7.30, Mr. Frank Cantell, violin recital. 8, Mr. A. R. Page, M.Inst.Met., on "Aluminium and Its Uses." Mr. Percy Edgar in a Chevalier Recital. Station Repertory Co., in Plantation Melodies and Negro Spirituals.

31st (THURS.).—3.30, Station String Quartette. 7.35, Orchestra.

FEBRUARY.

1st (FRI.).—3.30, Paul Rimmer's Orchestra. 7.30, Station Orchestra in Special Request Items. Mr. Joe Longmore and Mr. Neville Bosworth, entertainers.

2nd (SAT.).—3.30, Kiddies' Concert. 7.15, Metropolitan Wireless Band. Mr. Herbert Aldridge, Dramatic recital. Mr. John Hingeley, "Tales and Legends of the Midlands."

3rd (SUN.).—S.B. from London. Children's Concert, S.B. from Manchester. Evening Programme by the Station Repertory Choir, Orchestra, Mr. George Dillon, flute soloist, and Mr. Harvey Smallwood, Cor Anglais.

4th (MON.).—3.30, Paul Rimmer's Orchestra. 7, S.B. from London.

5th (TUES.).—7.30, Grey's Concert Party.

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BOURNEMOUTH.

Forthcoming Events

JANUARY.

30th (WED.).—Scotch Night, The "6BM" Operatic Chorus. Mr. F. M. Coppendale, Piper.

31st (THURS.).—The Aerials Concert Party. Mr. Howard Stay, D.B., E.A., Talk on Esperanto.

FEBRUARY.

1st (FRI.).—S.B. from London.

2nd (SAT.).—S.B. from London.

3rd (SUN.). — Orchestra. First, Second and Third Movements from "Trio for Two Flutes and Cor Anglais."

4th (MON.).—Welsh Night.

5th (TUES.). — Crystals Concert Party. 7.30, S.B. from London.

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CARDIFF.—Cardiff has again been entertained by the Band of the Royal Air Force, whose performances are always much appreciated in this district. Their rendering was excellent, and the "blasting," so often noticed in the transmission of brass bands, was conspicuous by its absence.

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The speech by the Right Hon. Stanley M. Bruce, Prime Minister of the Commonwealth of Australia, at the dinner given in his honour by the Australian Natives' Association, which was relayed from the Hotel Cecil, gave considerable dissatisfaction. Half an hour of that kind of thing is quite enough.

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Forthcoming Events

JANUARY.

30th (WED.).—Dance Night. Mr. Archie Gay, vocalist. Mr. Robert Godding, saxophonist. Orchestra.

31st (THURS.). — Mr. Seymour Dosser, tenor. Mr. Launcelot Dosser, baritone. Chat by Mr. John Phillips, J.P.

FEBRUARY.

1st (FRI.).—Choral Night. Chat by Councillor Arthur Jenkins.

2nd (SAT.).—Miss Olive Williams, soprano. Chat by Mr. T. Howard Coath, F.A.A.

3rd (SUN.).—Rev. Dr. Hopkin James. Selections from Wagner.

4th (MON.). — Nettlefold's Silver Band.

5th (TUES.).—King John.

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GLASGOW.

Forthcoming Events

JANUARY.

30th (WED.).—Modern British Composers' Night.

31st (THURS.).—Request Night.

FEBRUARY.

1st (FRI.).—Story Recital Night, by Mr. Percival Steeds.

2nd (SAT.).—A Triumph of Montrose.

3rd (SUN.).—Rev. Fergus Ferguson.

4th (MON.).—S.B. from London.

5th (TUES.).—Popular Orchestral Night.

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MANCHESTER.—2ZY continues to add to its musical laurels, and one could hardly listen to the orchestral and choral concerts without being uplifted by the beauty of the music. S. Coleridge Taylor's delightful little "Tale of Old Japan" was exquisitely rendered by the 2ZY augmented orchestra and chorus. In the short space of an hour one

Our photograph shows, reading from the left, Mr. Kenneth Kent, Mr. Hignett, Mr. Whitman, Miss Joyce Kennedy, Mr. Van Damm, and Mr. Nigel Playfair, broadcasting from 2LO "A Comedy of Dangers." Note the apparatus which made the noises.

had almost learned to love poor little Kimi, whose tragic death draws the tale to a close. Of Beethoven's Choral Symphony which followed, we cannot speak too highly. By the time the second movement was reached we felt in a nobler atmosphere, and this was maintained throughout the third and fourth movements. The grandeur of the music was most telling, both instrumentalists and choir working well together and producing a united and harmonious blend.

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Forthcoming Events

JANUARY.

30th (WED.).—3.30, 2ZY Trio. 6.30, Organ Recital. 8, St. John's (Weaste) Wesleyan Prize Choir, in Glees and Sacred Music. The Sirfessor. Mr. T. H. Morrison, solo violin. Mr. T. A. Coward, M.Sc., on "Birds and the First Sign of Spring." 10.10, Spanish Talk.

31st (THURS.).—S.B. from London.

FEBRUARY.

1st (FRI.).—Popular Orchestral Programme.

2nd (SAT.).—Ivy Davies' Concert Party.

3rd (SUN.).—3, S.B. from London. 8, Talk to Young People, by Mr. S. G. Honey. 8.30, Rev. Clifford Harley, of the South Manchester Society of the New Church. 8.30, Besses o' th' Barn Band.

4th (MON.).—3.30, 2ZY Trio. 6.35, Boys' Brigade News. 6.40, French Talk. 7.30, S.B. from London.

5th (TUES.).—3.30, Concert. 7.45, 2ZY Orchestra. Miss Evelyn Belleisie, soprano. Miss Rachel Hunt, contralto. 8.45, Persiflage, by Mr. Percy Phlage. S.B. from London.

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NEWCASTLE.—We are fortunate enough to have an Assistant Station Director in the person of Mr. R. C. Pratt, who is himself a keen wireless experimenter. We were very glad the other evening to hear him giving us kiddies a chat on wireless matters during the "Hour," and we believe that the boys at least will greatly appreciate chats of this kind. Incidentally, it is interesting to learn that a large number of adults listen both to the Kiddies' Hour and to the Scholars' Half Hour.

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We have heard varied opinions regarding the amount of simultaneous broadcasting transmitted recently, but at present there is unanimity, and every listener is an "Oliver Twist," since the operatic transmissions recently have come through most excellently.

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Forthcoming Events

JANUARY.

30th (WED.).—3.45, Mr. Ernest Sharp's Trio. Mr. Tom Sherlock, baritone. 7.30, Orchestra. Miss Muriel Sotham, contralto. Miss Rosina Wall, violin. Mr. Tom Sherlock, baritone.

31st (THURS.).—3.45, Mr. Dan Jacobs, euphonium. Miss Greta Young, mezzo.

FEBRUARY.

1st (FRI.).—3.45, Mr. S. Oppenheim's Piano Quartette. 7.30, Orchestra. Mr. H. Yeman Dodds, pianist. Miss Hilda Rood, contralto. Mr. Adam Nockles, tenor. Mr. Babbs, violin.

2nd (SAT.).—3.45, Miss Florence Farrar, pianist. Mr. Dan Jacobs, saxophone. Miss Greta Fottrell, soprano. 7.30, Orchestra. Mr. Geo. Bainbridge, baritone. Mr. F. Charlton, entertainer. Miss Lilian Coburn, soprano. S.B. from London.

3rd (SUN.).—8.30, Bijou Orchestra. Newcastle Cathedral Quartette. Rev. A. E. Cornibeer, Address.

4th (MON.).—3.45, Miss Rosina Wall's Trio.

5th (TUES.).—3.45, Mr. W. A. Cresse, clarionet. Mr. Jack Cairns, baritone. 7.30, Orchestra. Miss Lilian Rowell, contralto. Miss Muriel Robins, 'cello. Mr. William Beveridge, tenor.

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SHEFFIELD.—There is a livelier interest in the relay station as a personal entity, now that things are beginning to progress with more rapidity. Mr. H. C. Head-Jenner as Director Announcer has taken up his duties and promises an "uncle" and "auntie" for the kiddies, and occasional broadcasting direct. Capt. West has conducted experiments in receiving by wireless instead of land line for relaying purposes, and the latest showed a distinct increase in power, though not in clarity.

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Simultaneous Broadcasting Events

JANUARY.

30th (WED.).—B.B.C. Dramatic Critic.

31st (THURS.). — B.B.C. Music Critic. Pianoforte and Song Recital by Mr. Maurice Cole and Rex Palmer.

FEBRUARY.

1st (FRI.).—B.B.C. Film Critic. Vocal Programme S.B. to Bournemouth.

2nd (SAT.).—Major Tosswill: Rugby International Prospects. "La Boheme," Acts 1, 3 and 4.

3rd (SUN.).—Light Symphony Concert from Bournemouth.

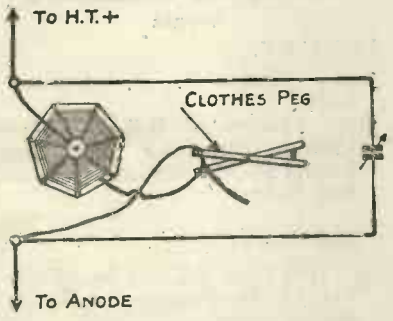
4th (MON.). — B.B.C. Literary Critic: Radio Association Talk. Symphony Concert (all stations except Cardiff and Bournemouth).

5th (TUES.).—R.A.F. Band, S.B. to Bournemouth.

MATCHING TUNED ANODE INDUCTANCES & CONDENSERS

WHEN one is working with a pair of tuned anodes, it is essential that their inductances and condensers be very closely matched; for if this is not done, searching becomes a matter of considerable difficulty. It is, of course, absolutely necessary that this should be done when both condensers are operated simultaneously by the same knob, but, even if they are not, matching effects a great saving of time and trouble and much improves the working of the set.

If one can afford to go to a firm which makes precision instruments, matched condensers can, of course, be obtained; but the majority of amateurs either make up their condensers from



parts or purchase ready-made instruments that are comparatively low priced. Here the difference between a pair may be quite big. As an example of how large it may be, I may say that I recently had two alleged 0.0003 μF condensers calibrated; one of them had a maximum capacity of 0.00027 μF, the other one of 0.00032 μF. This difference of 0.00005 μF is quite sufficient to make their settings differ considerably for a particular frequency.

Fortunately, it is not a very difficult matter to adjust condensers until their capacities are almost exactly matched. Fig. 1 shows a simple way of discovering whether there are great differences between them. By means of a double-pole change-over switch the two condensers are so wired that either can be thrown into parallel with the A.T.I. of the receiving set. A transmission is then tuned in with one of them—commercial stations on 300 or 600 metres, direction-finding stations on 450, and air stations on 900 metres are all very useful for the purpose, since there are very few moments of the day when something is not to be picked up on one of these wavelengths.

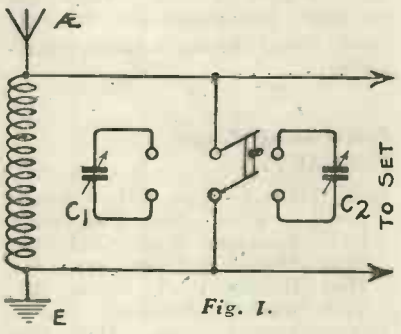
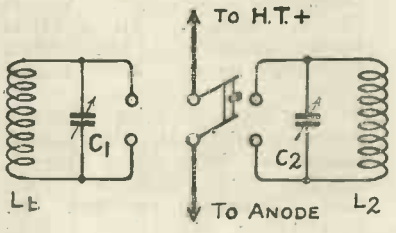


Fig. 1.

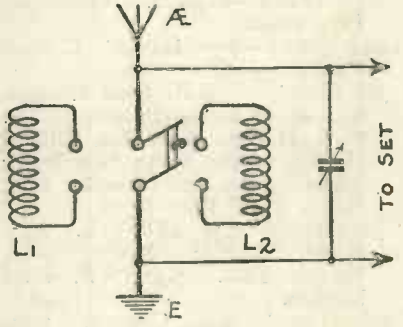
Figs. 1, 2, 3, 4.—Illustrating the various methods of matching the condensers and anode coils.



As soon as the setting of condenser No. 1 has been noted, the switch is turned over and the same transmission is tuned in exactly with No. 2. Comparisons on more wavelengths than one should be made to see whether the difference between the two is regularly maintained as the plates are more and more fully meshed. If one of them shows a very irregular rise of capacity from minimum to maximum, it should be rejected as useless, unless it can be improved by centering up its spindle, straightening its plates or some other simple process. It will usually, however, be found that one condenser has a higher capacity than the other at all settings. In this case we can proceed with the task of matching them. This can, of course, be done in either of two ways; we can reduce the capacity of the larger or increase that of the smaller. The experimenter must decide for himself which of the two is the more desirable method in view of the wavelength that he wishes to cover with the set of inductances to be used.

Should he decide to reduce the capacity of the larger, he should begin by removing the top fixed plate and testing the two condensers together again. If the reduction so made is too great, he should replace this plate, having first of all enlarged the semi-circular opening on its inner edge by cutting away some of the metal. He can then continue to reduce the size of this plate until the two condensers work perfectly together.

A small increase of capacity may be effected by raising the



value of the dielectric between two plates. The top plate should be removed, a sheet of a .002-in. thick ruby mica being fixed to its under side by means of shellac. If this is not enough, other plates may be treated in the same way, there being in most condensers a sufficient clearance between plates to allow for this. Final small adjustments may be made by so covering only a narrow segment of one plate.

Having dealt with the condensers, the next step is to tackle the coils. Basket coils have long been branded with the stigma that they are most difficult to duplicate. I have, however, found them most satisfactory for tuned anode work if they are matched in the way to be described. Not the least of their advantages is the very small degree of coupling, leading to

almost no interaction; which takes place when they are so mounted that they stand edge on. Other types of inductance can be used, but baskets are the easiest of all to match by this method.

Begin by making up or purchasing a pair of coils, both makes above the right size. I usually buy those coils which can be obtained in sets of seven for 2s. 6d. or so, and select two which are obviously too large in their present condition for the purpose required. The outer end of the winding is then undone, and the coil is mounted as the inductance of a single tuned anode, as shown in Fig. 2. The "in" end is taken to the H.T.+ terminal; the "out" end can be gripped by a spring clothes peg which also makes contact with the anode terminal. One then strips off turns until a station of suitable wavelength can be tuned in with an appropriate setting of the condenser, which should be one of those already matched. This having been done, the "out" end is passed through one of the holes left by the "spokes" and made fast. The coil is then mounted in whatever way one prefers. Fig. 3 shows the way in which the coil just finished (L1) and the one to be matched with it are next wired up. If preferred, they can, of course, be placed in the same way in the tuned anode circuit. A station is tuned in with L1 in circuit; L2 is then thrown in, turns being stripped off it in the way already described, until the clothes-peg contact brings in the station without any alteration in the setting of the A.T.C.

Before this second coil is finally mounted a further test, which enables fine adjustments to be made, should be conducted, as shown in Fig. 4. The coils with their condensers are wired with the help of a D.P.C.O. switch into a tuned anode circuit, and any final small adjustments necessary are made to ensure that the circuits are so nearly matched that any difference that there is between them is negligible. The coils with their condensers can then be placed in the position in the set in which they are intended. They will be found to work excellently together so long as valves of like capacity are used in the two units, and provided that each is wired with equal care to reduce capacity between leads and components to a minimum.

R. W. H.

Constructing Cheap Wander Plugs

THE plug described in this note has several novel features which should appeal to the reader, namely, its simple construction, its efficiency, and finally, nearly all experimenters will have by them the parts required. The cost entailed in making these plugs is approximately 1d. each, as compared to approximately 3d. each if bought.

The components required consist of a valve pin and two nuts, a piece of ebonite tubing (¼ in. bore), and some sealing wax. A piece about half-an-inch long is cut from the ebonite tubing to form the insulated portion of the plug. The inside diameter of the tubing must be ¼ in., so that a nut from a standard valve pin, which is invariably 4 B.A., can be fitted tightly into the tubing in the following manner.

Warm the end of the ebonite slightly so that the tubing is made to expand, force the nut into the end of the expanded tube and allow to cool. As the ebonite gets cold it will contract and therefore firmly grip the nut. The remaining nut on the valve pin is now screwed up as far as it will go (Fig. 1 (A)).

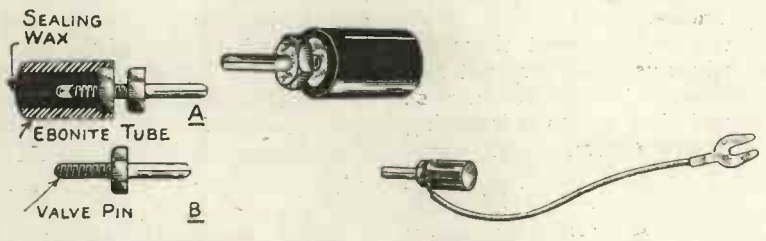
Sealing wax is used to fill up the open end of the tubing, but before doing this the valve pin should be screwed as far as it will go into the holder, so that when the cavity is filled with wax this latter will grip the thread on the valve pin as shown in Fig. 1 (B).

Red and black sealing wax is used for this purpose in order to distinguish positive and negative plugs.

The finished plug is shown in Fig. 2. It may be of interest to readers to know that the original plug described was made from the holder of an old fountain pen of the desired dimensions, and this proved equally as good as ebonite tubing.

Fig. 3 shows the complete connection with the plug at one end and a spade terminal at the other, insulated flex being used to connect the two.

G. T. K.



Figs. 1, 2, 3.—Giving details of the plug, together with the appearance of the finished article.

Pull-push Amplifying Circuits

A METHOD of amplification which dates back some seventeen years, but which has not been apparently much used in experimental reception, is that illustrated in Fig. 1. The Western Electric Company have

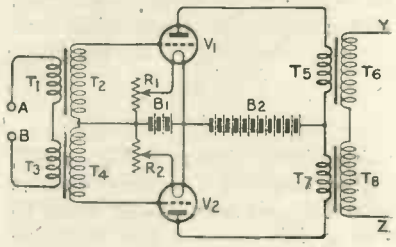


Fig. 1.—The "push-pull" amplifier circuit.

used this system of amplification very extensively, and it must not therefore be set aside merely as an interesting idea from a technical standpoint.

It will be seen that there are two valves used to carry out amplification. The valves are so arranged that when the incoming currents, at a given instant, cause the anode current of one valve to increase, the anode current of the other valve is decreasing. The apparatus, such as a telephone receiver or loud-speaker, is actuated by the output currents of both valves, these output currents being made to act in a supplementary manner on the output apparatus. Special transformers might be employed for this purpose, but in Fig. 1 four transformers are shown in use—two for the input circuit and two for the output circuit. The grids of the two valves are, at any given instant, of opposite sign, but the output currents of the two valves are made to act jointly on an output apparatus. In Fig. 1, for example, the terminals Y Z might be connected to the grid and filament of another amplifying valve.

An arrangement which I would like to suggest is the connecting of a loud-speaker in the manner shown in Fig. 2, choke coils being used in place of the transformers T5, T6, and T7, T8. If no suitable chokes are available, the secondaries of inter-valve transformers will do perfectly well. The condenser C has a capacity of about ½ microfarad, but smaller values may be tried. The choke coils recently described in connection with choke circuits may be advocated with confidence.

I have not found any particular

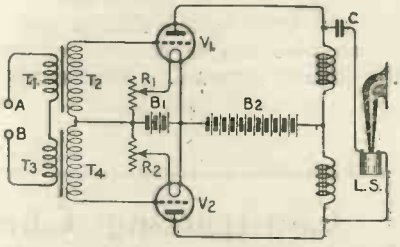


Fig. 2.—An interesting modification of Fig. 1.

merit in the pull-push type of amplifier myself, but its extensive use by the Western Electric Company in America must have a reason, and they claim that much greater purity is obtained with this circuit. We are always pleased to hear from readers as to their experiences with novel or unusual circuits, and perhaps they will communicate their results in this case.

The British Marine Wireless Service

[The following particulars will prove of interest to those who contemplate entering the wireless profession.]

IN contemplating "wireless" as a profession, would-be candidates, parents or guardians should very carefully examine the prospectuses of the various "Telegraph Training Colleges," and thoroughly investigate for themselves the possibilities of engagements when "training" is at an end.

At present the total number of British ships licensed to carry a wireless installation is approximately 3,388, while the approximate surplus of operators over actual requirements is 2,898.

Before securing a position as a marine wireless operator, each candidate must pass the P.M.G.'s examination and secure his certificate of efficiency. At the present time the number of unemployed persons holding the P.M.G.'s 1st class certificate in wireless telegraphy approximates to 1,800.

Wireless operators' pay and conditions of employment are governed by an agreement between employers and the Association of Wireless and Cable Telegraphists, particulars of which may be had from the Association of Wireless and Cable Telegraphists at the under-mentioned address.

The commencing salary for a fully-qualified marine wireless operator at present is £7 12s. 6d. per month, while the maximum salary after nine years' service is £18 17s. 6d. per month. In addition, and where applicable, there are small allowances, such as "Foreign and Extended Voyage Allowance," "Shore Allowance," "In Charge Allowance," "Tanker Allowance," etc. Complete, authentic, and up-to-date information regarding all aspects of the marine wireless profession may be had free of charge from the Association of Wireless and Cable Telegraphists, Lennox House, Norfolk Street, Strand, London, W.C.2.

Apparatus we have tested

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

A Leather-Cased Crystal Set.

An elegant little crystal receiver, the "Gledallphone," resembling a travelling clock in the external appearance of the leather-covered case with its snap-fastener, but containing an effective B.B.C. crystal receiver of the sliding inductance type, has been submitted for test by the Birmingham Wireless Co., Ltd.

On opening the case the small double ebonite panel carrying aerial and earth terminals and crystal-detector is exposed to view, and a slider knob is accessible in the centre. This slider is fitted with a ball-bearing roller contact, which on trial was found to give exceedingly smooth action and fine tuning.

The detector details met with our approval, the crystal being of good quality and easily replaceable, while the action of the cat's-whisker holder was firm and smooth. Two pairs of 'phone terminals are provided.

The instrument tuned from below 300 to nearly 900 metres. The signal strength on local broadcasting was excellent for so small an instrument, testing an unusually high percentage of the standard both by aural and microammeter observations.

The finish and workmanship are good, and the insulation resistance was excellent.

We are glad to see this type of refined and inconspicuous family receiver becoming available. We would suggest, however, that many feminine listeners would prefer to be able to close the set without disconnecting aerial and earth, and most listeners would prefer to sacrifice tuning range for the sake of a little more signal strength, as but few spend their evenings listening to Morse signals on above 495 metres.

A Versatile Two-Coil Holder.

The Radio Communication Co., Ltd., have submitted for test a two-coil holder of an interesting type, which provides an unusually large variety of movement for adjustment of the coupling of the coils. Actually, motion around three different axes at right angles to one another is possible, as well as endwise movement of the spindle carrying the moving coil. This is achieved by what is best described as an anti-aircraft gun mounting of the spindle. We understand that this holder was designed by an engineer, and it certainly is a thoroughly sound piece of engineering construction. Thus large milled-headed nuts are provided to tighten up the joints where wear may occur; the whole mechanism moves with a delightful smoothness and sureness.

On trial in actual reception, the extremely fine control over reaction provided by the variety of possible motions with the reaction coil was soon appreciated. Thus reaction could be reversed by simply revolving the spindle and the coupling reduced to zero with the greatest ease by swinging the reaction coil away at right angles to and edgewise on to the fixed coil.

The maximum possible closeness of coupling could also be obtained.

The holder will take the largest size (No. 1500) of ordinary plug-in coils, both in the lower fixed plug—which is horizontally arranged—and in the moving plug; the adjustment is still secure and steady with these heavy coils. The holder is supplied in both panel-mounting form (with drilling template) and base-mounted form. In the latter, substantial terminals, easily accessible, are provided on the ebonite base, and clearly marked in conformity with the coil-holder; a great advantage in rapid experimental work with apparatus strewn on the table.

The insulation and finish were all that one could desire.

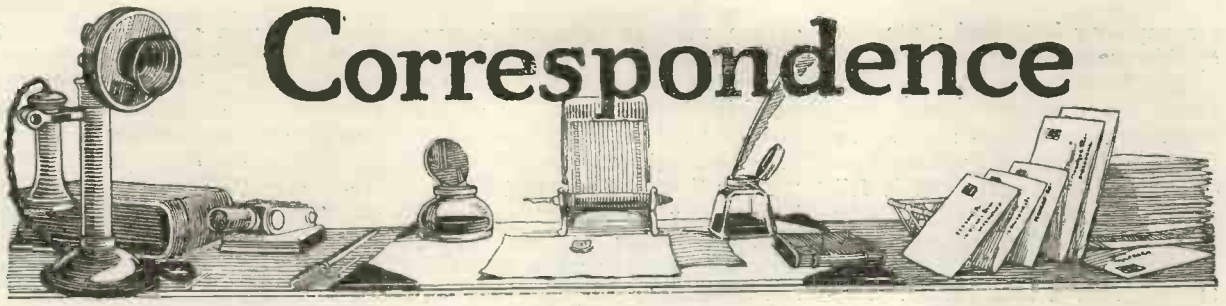
After extensive trial in varied circuits we can thoroughly recommend these ingenious and workmanlike holders to the discriminating experimenter and to the broadcast listener.

A Standard Condenser.

A fine type of standard variable condenser produced by the Economic Electric Co., Ltd., has been submitted to test. This is a large enclosed instrument of maximum capacity 0.0012 μF, with "square-law" moving plates, and an additional two-plate vernier with a control handle co-axial with the other. The minimum capacity was measured to be 0.000037 μF, and the vernier gave a range of about 0.000007 μF for fine adjustment.

The condenser is built up in the most rigid fashion on a substantial frame, with heavy metal end-pieces. Contact is made to the moving plates by braided flexible wires. A finely-graduated and exceptionally clear scale is provided with a fixed pointer that permits of close reading.

The bearings give that smooth, easy action essential in an accurate measuring instrument. The general workmanship and finish are what one should expect in a scientific standard. It is an instrument that any experimenter might be proud to possess.



Correspondence

"WIRELESS WEEKLY" 3-VALVE RECEIVER

SIR,—It may interest you, and possibly other readers of your valuable paper, to know that I have had splendid results with the *Wireless Weekly* 3-valve Receiver, described in Vol. 2, No. 12. I receive all the British stations and Paris L'Ecole Superieure with good strength.

Recently, at 1 a.m., I made my first attempt at trans-Atlantic reception, and was successful in tuning in WGY at 1.25 a.m. I could hear the church service transmitted from this station quite clearly, and I held them till they closed down at 2.23 a.m. On the following night, at 11 p.m., I again heard WGY, and listened to Stock Exchange reports and commercial news for twenty minutes. On the following morning, from 1 a.m. till 4 a.m., I made several attempts to pick them up again, but, owing to violent local oscillations I could only catch an occasional word.—Yours, etc.,

H. W. B. ADAM.

Edinburgh.

DIRECTION FINDING IN NAVIGATION

SIR,—As an aerial navigator of long experience, I cannot agree with one or two statements made by your contributor in Vol. 2, No. 13.

(1) In the first place he states that "astronomical observations are not of very great value for flying, particularly in daylight." This is incorrect, as since your contributor left the Service some years ago, the Bubble Sextant has been developed to a high pitch, and as Prof. B. M. Jones has recently shown in an Advisory Committee Report, it is the usual thing to obtain bearings and fixes to within a quarter of a degree. Using the sun for one position line, and the moon when visible in the day, and dead reckoning for the other, a sufficiently accurate fix can be made, as was conclusively proved by a long flight of 1,200 miles which was made by Air Ministry Officials in 1920 using sextants and D.R. instruments only.

(2) The wing coil method is an excellent one, but only for flying on a "home bearing." There are not sufficient beacon stations

for anything but fixed route use of this method.

(3) The rotating coil method, about which so many laudatory statements have been made, was tried in Handley Page machines during 1918 to 1921, and it fell to my lot as wireless navigator to carry out a larger number of tests for the Air Ministry, extending over a long period. The results showed conclusively the following facts :—

(a) That the average error in the " fix," using the Robinson rotating coil method, was 1½ degrees, representing about 90 miles in actual distance, or *six* times that of the sextant—D.R results.

(b) That the Handley Page machine had quadrantal errors, which varied with every fitting (metal) put on, and this necessitated constant swinging of the machine on the ground, and constant correction of the wireless directions.

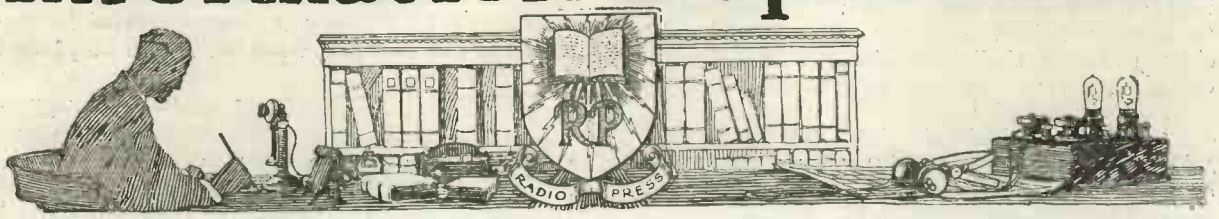
(c) That in certain localities near the Coast, and at certain hours of the day, the wireless directions found by the Robinson method went " wild," in some cases by as much as 60 degrees to 90 degrees, due to deviations of the wireless rays, as is now well known. This means that the navigator who intends to use this directional wireless method, will never know whether his signal is a normal or a " freak " one, since there is no known law to predict such deviations. This is one reason also why directional wireless is not adopted in Mesopotamia.

(d) That in the case of the Handley Page, and certain other machines, the extraneous noises, or radiations, from electrical machines such as the magnetos, is a serious detriment, the drowning of the signals being very pronounced. As recently as last year, it is stated, the wireless direction finding by the rotating coil method had to be abandoned on a night flight from Croydon to Paris on account of interference. One or two special " show " flights to Paris by day have been made by the rotating coil direction finder, but these were of spectacular interest only. The fact that since the war the rotating coil method has been constantly but unsuccessfully experimented with on aircraft, at great public expense, and that it has not been adopted either in the Air Force or on commercial craft is, I think, sufficient evidence of its unsuitability. Further, it is gathered that the Navigation authorities continue to rely upon compasses, drift readers, and in long flights (such as that of the Vickers-Vimy crossing the Atlantic), on the sextant and have turned down the rotating coil method.

As a wireless enthusiast, one does not wish to " throw cold water " on the application of wireless, but as an experienced late Service navigator, I think it only fair and sporting to point out the " snags " in this particular method. There is much more valuable work being done in connection with the use of rotating beacon ground stations, whereby the navigator merely times the signals received and gets his directions direct. The other promising method is that whereby the aircraft sends out a signal which is received by several stations, and the latter wireless the direction of the machine back. I have found this an excellent method on aircraft, but obviously not for war purposes.—I am, etc.,

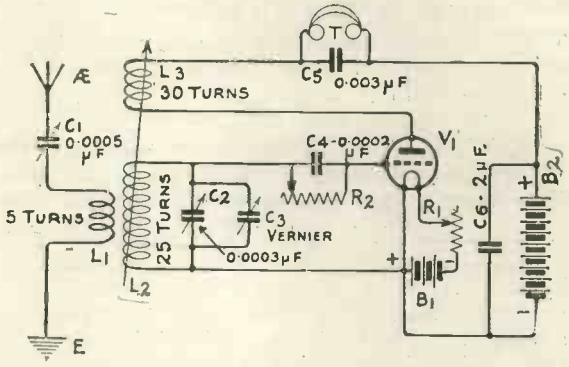
Hendon. D. M. NEWTON.

Information Department



E. D. M. (MANCHESTER) asks for a suitable circuit for reception of the very short wavelengths now being used by certain advanced experimenters for Transatlantic working.

We give herewith a circuit of a simple nature which will be found suitable. Simplicity appears to be the keynote of success upon these extremely short wavelengths, and therefore no attempt has been made to show high-frequency amplification. The receiver suggested is simply a single valve reaction circuit, to which low-frequency amplification can be added if the signals are so faint as to be difficult to read. The coil L2 may be wound with No. 22 double cotton-covered wire upon a 2¾-inch diameter tube. Immediately over the top of this the coil L1 may be wound with the same wire. The reaction coil should be wound with No. 30 double cotton covered, upon a 2-inch tube, arranged to slide inside the 2¾-inch tube. The series condenser may not be necessary, but this depends upon the size of the aerial with which it is used. It is always worth while to try the experiment of short-circuiting this con-



denser whereupon the aerial will function more or less aperiodically. Since dielectric losses are of great importance on these short wavelengths,

it is essential that they should be minimised as much as possible in the formers upon which the coils are wound. We should therefore advise that cardboard be used, and that it should be thoroughly baked, but not impregnated with either wax or shellac varnish. Similarly, the cotton covering on the coil should not be varnished or waxed, but should be kept thoroughly dry. Incidentally this circuit should prove quite suitable for the reception of the American station at Pittsburg (KDKA), which, as reported elsewhere in this issue, is now quite easy to receive in this country upon a wavelength of 102 metres.

J. W. R. (BIRMINGHAM) asks at what time the rhythmic beat time signals are now transmitted by the Paris station.

These signals are transmitted upon a wavelength of 2,600 metres upon the spark system at 1000 and 2200 G.M.T.

G. W. L. (BRIXTON) asks what is the object of shielding certain types of low-frequency transformers with a metallic case.

In some cases it is desirable to screen the windings of low-frequency transformers to reduce the interaction effect between the transformers in successive stages of a multi-valve low-frequency amplifier. The tendency to howl is somewhat reduced in this way, and it is also thought that such screening may reduce the picking up of low-frequency interference, such as that produced by the proximity of lighting mains carrying alternating current.

L. S. M. (CARDIFF) asks whether it is necessary to employ a frame aerial in the vertical position, or whether it can be placed horizontally.

To be able to make any use of the directional effect of a frame aerial it is necessary to use it vertically. If it is used in the horizontal position it receives from all directions without discrimination, and one cannot obtain the benefit conferred by the power of the vertical frame to select any given station by means of its directional properties.

F. D. (NORWICH) asks what is the best way to add a valve to a crystal set, (a) to increase the range of the receiver or (b) to increase the volume of signals from a station at a fairly short distance.

To increase the range of a receiver, add a high-frequency valve, preferably tuning the anode of this valve with the tuning arrangements already present in the crystal receiver. For example, if the crystal receiver has a variometer for tuning, this may be connected directly in the plate circuit of the high-frequency valve, with the addition of a small fixed condenser of about .0002 μF in parallel therewith. To increase the volume of signals which are already at fair strength in a crystal set, the correct procedure is to add a low-frequency valve.

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