Wireless Weekly

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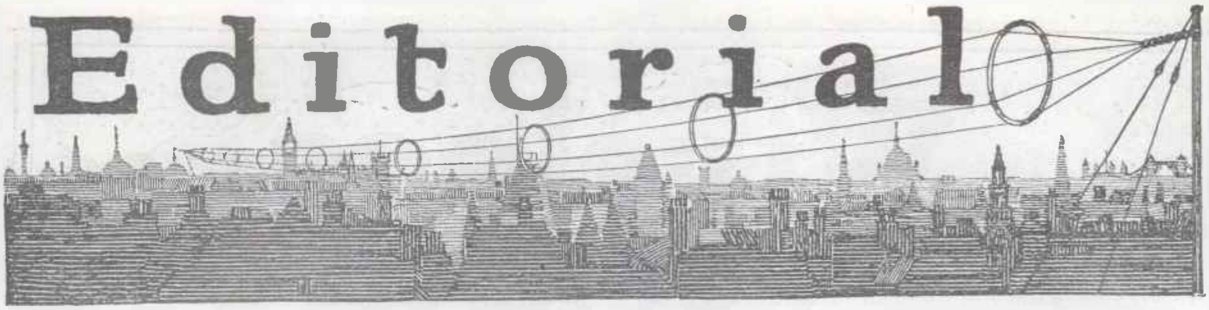


The Business Man's Time Signal

WHEN, years ago, and long before the advent of telephonic broadcasting, reception of wireless signals by amateurs was confined to a small band of enthusiasts, the famous military wireless station at the Eiffel Tower broadcast twice a day a time signal by means of its powerful spark transmitter. Here and there throughout the country watchmakers made use of these time signals to check their chronometers. Soon other stations broadcast such signals, Germany following close on the heels of France, and later the United States. Great Britain, strangely enough, remained without a wireless time signal service for many years and was without a service until the Broadcasting Company commenced activities. It seems but a few months since the only time signals we had, even from this source, consisted of strokes on a tubular bell at 2LO, accurate, perhaps, to within 5 seconds. An improved system, first introduced at 2LO by Mr. Hope-Jones during a talk on time signals, consisted in counting the seconds just prior to the hour. The present series of 6 piping dots, automatically controlled from Greenwich Observatory is, of course, of comparatively recent origin.

A Suggested 8 a.m. Time Signal

Is it not time that Great Britain, with the finest broadcasting service in the world, placed itself in the forefront of the nations providing time signals? The present arrangements are far from satisfactory, and great improvements can be effected with but little effort. From correspondence published last week, our readers will have seen that our efforts have succeeded in gaining for the public one more time signal, namely, that at 1 o'clock. The business man's time signal at 8 a.m., put forward in the correspondence referred to, has, however, yet to be conceded by the British Broadcasting Company, and we trust it will not be long delayed.

It is not always realised that only a tiny minority of listeners are at home between the hours of 10 a.m. and 5 p.m., particularly in the densely populated centres where wireless is most popular. The regulation of clocks is almost always left in the hands of the head of the house, who generally returns after 6 p.m. For such people there is but one accurate time signal available—that at 10 p.m., and efficient regulation of clocks by this time signal is precluded by the fact that the signal is sent but once. Even in the earliest days of time signal broadcasting, the Eiffel Tower sent indications three times at intervals of two minutes, so that preliminary adjustments made on the first signal could be checked on the second and third. What we really need is something of the same kind in wireless telephonic broadcasting. The first time-signal might be sent by the present method at, say, 10 p.m., this being repeated either after a two-minute interval, and again after a four-minute interval, or, if this should interfere with the general arrangement of the programme, a further time signal could be broadcast a quarter or half an hour later.

For those who do not find it convenient to listen to the 10 o'clock time signal, a service at 8 o'clock in the morning should be available. This we have called the "business man's" time signal. Accurate time keeping should be encouraged in every branch of the community, and for a large section of the public a breakfast hour time signal would be a great boon.

Finally, we must not overlook the interests of the younger members of the community. It should not be forgotten that in well-regulated families the children are all asleep before the hour of ten. The eight o'clock time signal would afford admirable training in accurate observation, and for this reason should be worth while.

Truth in Advertising

Readers will notice in our correspondence columns letters from manufacturers of condensers stating that they guarantee their capacities. We trust that before long every reputable manufacturer will be able to make a similar statement.

Some Problems in Construction

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

A few notes upon some interesting problems which confront the experimenter, and how they were overcome, in special cases.

THERE is a certain amount of fascination about those unusual constructional problems which the wireless experimenter occasionally runs up against, and there is a great deal of satisfaction to be derived from the solution of one of those problems, especially if, in solving the problem, one helps a less experienced but equally enthusiastic wireless constructor.

Within the last few days it has been my good fortune to come up against three somewhat unusual constructional problems, and the work connected with the working out of those problems has been most enjoyable.

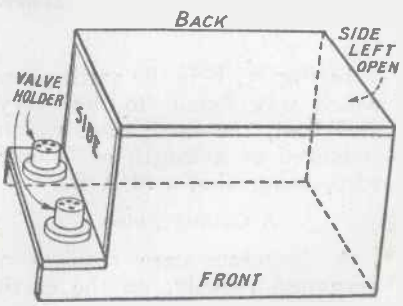


Fig. 1.—The framework.

The First Problem

The first problem was connected with the making of a two-valve set in a handsome box with a decorated lid. In the ordinary way of things, the wireless constructor chooses a box or cabinet of suitable size for the set he has in mind, and he is careful to allow plenty of room for the component parts of the set. In this case, however, the box was the first contribution towards the two-valve set. The inside measurements of the box were $10\frac{1}{4}$ by $7\frac{3}{4}$ by 6 inches, the last figure being the depth of the box.

The problem would have been a simple one if a panel could have been placed in the box in the usual way flush with the top of the box. But it was stipulated that the lid of the box should remain. Now it was obvious that if a panel had been placed in the box flush with the top of the box, and valves mounted vertically on the panel, sooner or later the valves would have been damaged by the falling lid. Hence it was necessary to make a panel of such a form as to ensure that the valves would be out of danger from the lid of the box.

The Solution

Accordingly a wooden framework was made of the shape indicated in Fig. 1, the size of this framework being such that it would slip easily yet tightly into the box. It will be noted that the two valve-holders were mounted on a low, narrow shelf, quite distinct from the major portion of the panel proper. This narrow valve shelf, when in position in the box, was less than an inch above the bottom of the box.

The whole of the framework was of wood, and the component parts of the set were selected for mounting on wood. In Fig. 2 the actual measurements of the several pieces of wood which made up the framework are given.

How the Components were Mounted

The two-valve set mounted on the framework was a slightly modified form of the two-valve set described in *Wireless Weekly*, Vol. 2, No. 18, page 618. The transformer was mounted on the underneath side of the top of the framework. The two variable condensers, the two filament rheostats and the terminals were mounted on the top part of the framework. The grid leak and condenser were placed on the vertical end of the framework as near to the detector valve-holder as possible.

In wiring up the set, the wiring of the component parts mounted on the top part of the framework was carried out before the top was screwed into position. Leads were left for the eight connections to the valve-holders. These eight leads were soldered to the legs of the valve-holders last of all. Fig. 3 is a sketch of the framework when finished.

The Second Problem

The second problem was connected with the erection of an

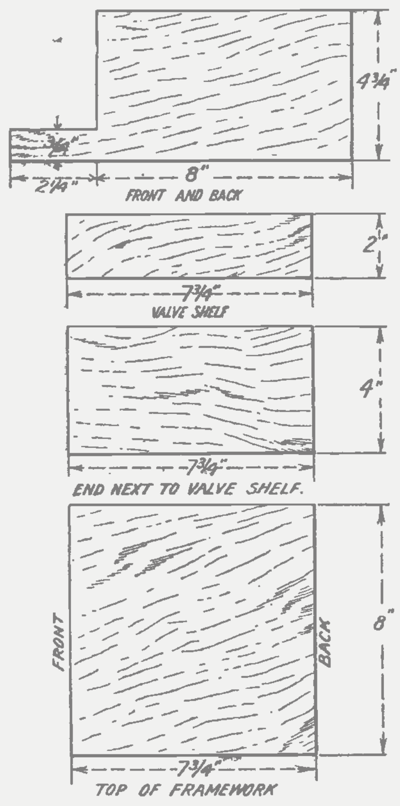


Fig. 2.—Details of the construction of the framework.

aerial at a house where an outside aerial was almost an impossibility. At the front of the house and at the two sides there was insufficient room for an outside aerial. At the back of the house the ground sloped away so quickly that an outside aerial would have called for an unusually high mast. Since the house stood on high ground, an indoor aerial immediately under the roof seemed the best proposition.

Construction of the Aerial

As the space under the roof had a boarded floor, the actual constructional work of erecting the aerial was quickly carried out. First of all, seven large cup-hooks were screwed in the rafters, four on one side of the roof and three on the other side. At eighth cup-hook was screwed

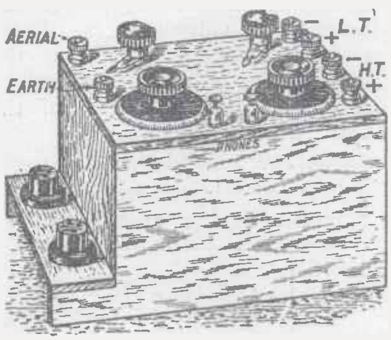


Fig. 3.—The framework, complete with panel and components mounted up.

in the position shown in Fig. 4. Next, seven small egg-shaped insulators were strung on the aerial wire which consisted of 100 feet of 7/22. An eighth insulator was then secured to the end of the aerial wire. By means of a short length of thin wire, the end insulator was then fastened to hook 1 (see Fig. 4). The aerial wire was then taken over to the other side of the roof where, by means of another short length of thin wire, the second insulator was fastened to hook 2. In similar fashion, the other insulators were dealt with. After all the insulators had been placed in position the aerial wire, which just passed through the insulators, was pulled tight all along its zig-zag path.

The Down Lead

The question then arose as to how the aerial wire should be taken down to a room on the ground floor. One alternative was to take the wire through the roof trap-door and down the staircase. This, however, would have meant a long aerial down-lead. Between the roof and the top of the walls of the house the builder had left a number of small spaces for ventilation purposes. One of these gaps came immediately over a side window in the room in which it was desired to install the receiving set. It was therefore decided to pass the aerial wire through this gap and take the down-lead on the *outside* of the house to a lead-in in the side window referred to. In order to insulate and protect the aerial wire where it passed through the gap just by the eaves, a foot of stout rubber tubing was threaded on, and placed finally over the aerial wire where it passed through the gap between the roof and the top of the wall.

This indoor aerial proved most efficient. On a two-valve set excellent loud-speaker telephony was received from 2LO fifteen miles away.

The Third Problem

The third problem was concerned with a two-valve receiving installation which had apparently developed a serious fault during a month of disuse. Signal strength with the set tuned-in on London fifteen miles away was very weak. There appeared to be nothing wrong with the wiring nor with the component parts. On testing the set on my own aerial signal strength was all that could be desired. The fault was therefore either in the aerial or in the earth connection of the installation referred to.

Some Preliminary Tests

An inspection of the aerial was carried out, but no fault was found, so that it was clear that the earth connection had become in some way unreliable. As it

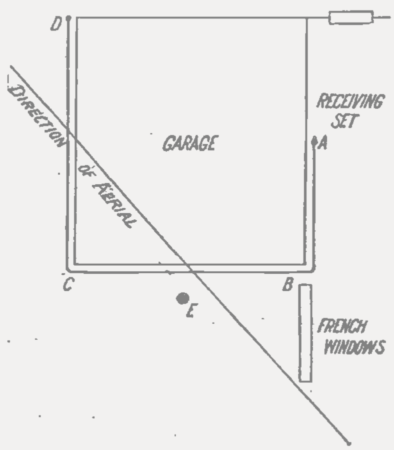


Fig. 5.—An efficient counterpoise.

was a somewhat difficult matter to get at the earth connection—a large tin buried in the ground—it was decided to put in another earth altogether. Accordingly a piece of water-pipe, two feet long and two inches in diameter, was buried in the ground and a soldered connection made to it. Using this as the earth, the set was tried again, and to the great astonishment of the owner of the set, another wireless enthusiast, and the writer, no improvement was noticeable in the reception of 2LO.

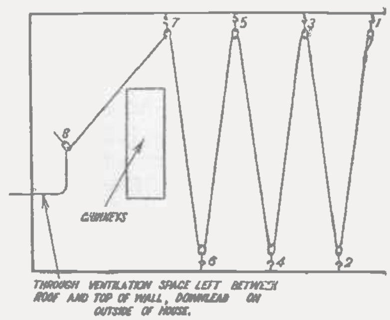


Fig. 4.—A roof aerial with a down lead on the outside of the house.

In Fig. 5, E is the earth pipe, which was found to be very inefficient, the earth lead, which consisted of a length of flexible wire, being shown at A B.

A Counterpoise

A desperate case requires a desperate remedy, so the earth wire was pulled away from the buried pipe and attached to a length of bell-wire, which was placed along the ground for a few yards under the aerial. This wire, which was No. 18 gauge, is seen at B C D in the drawing. It was placed round the sides of the garage, as shown, and supported from the ground at a height of approximately 5 feet. Using this bell-wire as a counterpoise, the set behaved as it was intended that it should behave. In fact, with the counterpoise, better results were obtained than had ever been obtained with the more conventional earth.

The owner of the set would not hear of another earth connection, but proceeded to fix up a more permanent counterpoise. Fig. 5 is a plan of the counterpoise as I last saw it.

GOOP-WAYFARER No. 761

Synopsis of Previous Chapters

(In previous instalments readers have been given an inkling of some of the wonders of the new Goop-Wayfarer circuit No. 761. The way in which various important parts are made has been described, and some of the most useful constructional hints that have ever appeared in wireless literature have been generously presented to readers. If you have not read the earlier chapters lose no time in reading them now. (There seems to be a double meaning here!) In any case, be in at the death, and

FINISH THIS GREAT NEW SERIAL NOW)

The Superest Super

True to my promise I am now about to draw aside the curtain and to disclose to your astonished and admiring gaze the whole wonder of this superest of all super circuits, hyperest of hypers, the great Goop-Wayfarer No. 761, for which during all these weeks the world has waited upon the tiptoe of expectation. Look most carefully at the diagram and trace out the circuit as well as your quivering hand will allow you to guide your pencil. The merest glance will show you that it is something quite out of the ordinary, that it is a circuit likely to make history. It is unfashionable enough to employ a high-tension battery which we have been told is merely an added source of expense, but as I shall show you presently how to acquire this battery at no expense whatever, you may set all doubts at rest on this score. Though there is only one valve, this circuit is guaranteed by both "Wayfarer" and Professor Goop with their hands upon their hearts and their fingers crossed, to bring in the programmes of any self-respecting broadcasting station at a range of at least forty miles. Further, its transmitting range, when the inductance L_2 is made to nestle tightly against its fellow L_1, is certainly quite five miles. When this is done signals in Morse code can be sent by the simple process of waggling out dots and dashes with the condenser C_2. One dash transmitted in this way is guaranteed to produce a series of far worse things from the lips of all listeners in the neighbourhood himself without the loss of temper, finger tips, or self-esteem. Whilst I think of it, though, it might be as well to say just a word about C_2. As you will no longer have your supply of cigarette tin inner lids, having consigned these some weeks ago to the dustbin, you may be in rather a quandary to find a way of making it without doing violence to the love of truth which is, of course, innate in you. Personally, I should be inclined to buy and to fit it to the set without further bother, trusting that my

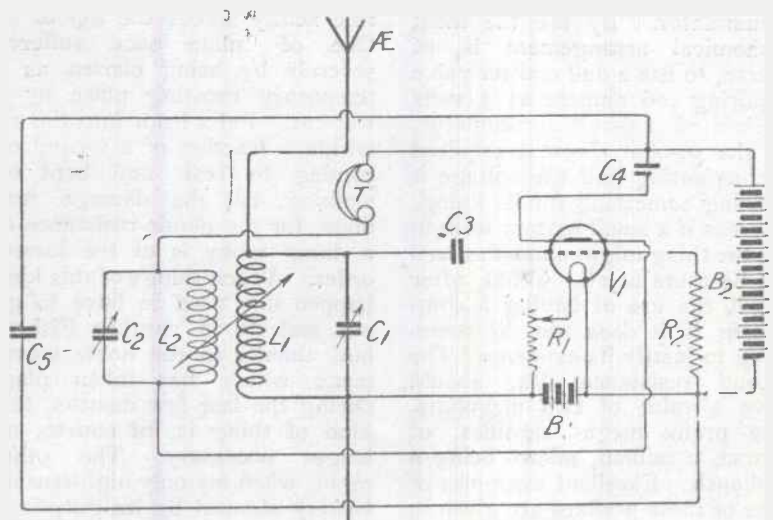


Fig. 1.—The GW761 circuit.

The Parts

You have already seen how to construct the inductance L_1 and the condenser C_1. L_2 is exactly like L_1 only more so, whilst C_1 and C_2 are the image of one another, especially C_2. I feel, therefore, that I need give no further hints upon the making of these components which even the radiotyro (a noble and expressive word) will be able to construct for friends would not ask awkward questions. To the nervous, however, I recommend the following course. Purchase a condenser, and having done so take it to pieces and put it together again. It is highly probable when you have done so it will never work again, and that its plates will gnash against each other. But what does this matter after all so long as your honour is saved?

More Parts

C_4 and C_5 can be made quite simply at home, not by the purchase or substitution methods, but with the constructor's own fair hands. As the capacity of C_5 should be about two microfarads a fairly large amount of the best ruby mica and copper foil will be required. The plates should be cut so as to have an overlap of precisely one square centimetre. In this case the number required will be exactly 40,000, the dielectrics and covers consisting of 40,002 pieces of mica measuring $\frac{3}{4}$ in. by $1\frac{1}{4}$ in. The pleasant task of putting these together will provide congenial employment for the long summer evenings. Having tackled C_5 successfully we can turn with a light heart to C_4, which requires but twenty plates and twenty-two pieces of mica.

Resistances

The resistance R_1 is a rheostat whose value both monetary and ohmic will depend upon the valve in use and upon the size of the accumulator. By far the most economical arrangement is, of course, to use a dull emitter valve requiring .06 ampere at 3 volts worked off a 6-volt accumulator. As the 50-ohm rheostat required is thus eating half the voltage it is doing something for its living, whereas if a small battery were in use the thing might almost as well not be there at all. What, after all, is the use of having a component if it does not do something to justify its existence? The second resistance, R_2, should have a value of two megohms. The prefix mega- signifies, of course, a million, micro- being a millionth. Excellent examples of uses of these prefixes are given in the words megaphone and microphone, a megaphone being a contrivance enabling you to speak to the million, whilst a microphone renders the submerged millionth audible. The best way of making R_2 is to obtain 19,140 yards of No. 40 s.w.g. enamelled Eureka wire and to wind this non-inductively upon an ebonite former. Ordinary copper wire of the same gauge may be used if you dislike Eureka. A little more will be needed, of course; it will be found that 750,000 yards is about the right amount. Be very careful to keep the wire from tangling, for it is distinctly fatiguing to have to keep on pulling 15 miles or so through loops in order to get at the end. I venture to give my personal assurance that those readers who complete the copper-wound two-megohm resistance will find that it works quite as well as the little thing that unenterprising wireless folk buy for the purpose for half a crown.

The High Tension Battery Problem

The high-tension battery used to be rather a problem when one was hard up. You bought one for about a sovereign, and when it had been in use for less than a week your better half, in a tidying fit, placed a steel foot-rule neatly across the top of it. One of mine once suffered severely by being chosen as a temporary roosting place by a wet cat. Felix leapt into the air within a fraction of a second on coming to rest, and kept on walking, but the damage was done, for the ohmic resistance of a damp tabby is of the lowest order. When things of this kind happen one used to have to go out and do in another Fisher; but, thanks to the noble movement which has taken place during the last few months, this kind of thing is, of course, no longer necessary. The other night, when my only high-tension battery showed by its gurglings that its end was near, I walked round to see my friend Gubbsworthy, who I found, of course, in his wireless den. I inspected his set with great care, and observed that he had a particularly fine specimen of high-tension battery, absolutely brand new, which I determined to make my own. It is now working most satisfactorily upon my set, and Gubbsworthy, so far from regretting its loss, is glad to have seen the last of it. Here is the way in which the perfectly painless separation of battery from owner was accomplished.

The Method

I spent a whole morning in reading up all the literature upon which I could lay hands that dealt with the high-tensionless circuits. Then after lunch I started round to see Gubbsworthy once more, taking a selection of it in my pocket. "Quite a nice set," I said, "and considering how old-fashioned it is it does not do badly." "Old-fashioned?" said Gubbsworthy. "What on earth are you talking about? This is about the last thing in wireless" "My dear fellow," I protested, "I have no doubt that you think you are up to date, but I see that you have got a high - tension battery there. Really, Gubbsworthy, I am surprised that you should be so behind the times. None of the best people think of using them now." Gubbsworthy, who is always rather touchy and dislikes to have any piece of apparatus that invites criticism, was distinctly annoyed, but eventually he calmed down, and asked me to tell him more. I did so, saying neither too much nor too little. Then I left my selection of literature with him and went for a walk. When I returned I found him about to begin the remaking of his set. "Of course," I said, "you cannot be seen with a thing like this in the house" (here I pointed to his HTB); "no self-respecting man could nowadays." Gubbsworthy agreed heartily, and I consented to remove it for him, promising to bury it at the bottom of my garden. I faithfully carried out my promise, after which I dug it up again. And there you are!

WIRELESS WAYFARER

Sediment in Batteries.

By C. R. HARDY.

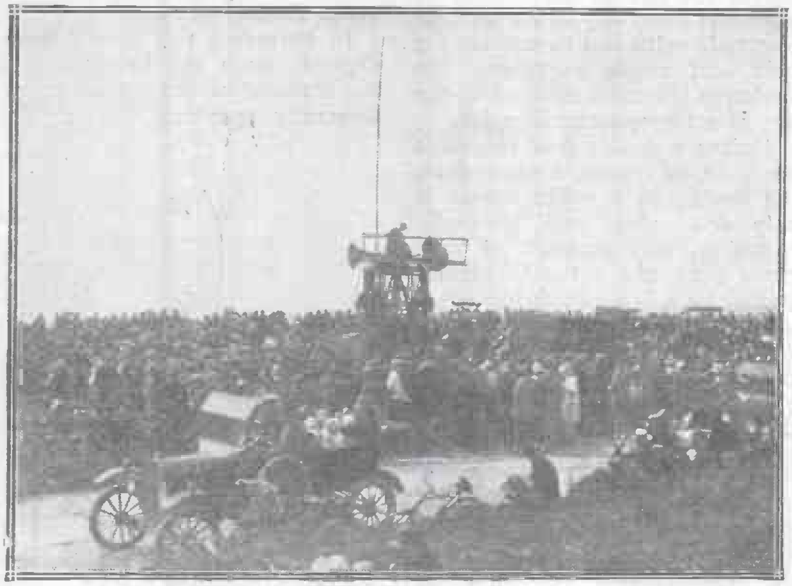
A SMALL quantity of lead oxide falls from the plates of an accumulator in the course of time and settles in the space beneath the plates, but there is no need for apprehension on this account. The nature and construction of the plates used in an accumulator precludes the possibility of avoiding sediment altogether, although under normal conditions of usage the quantity is very small and does not involve any danger to the battery. It is obvious that a certain space must be provided under the plates to allow of the sediment settling there conveniently, for if it were to touch the plates it would bridge across from positive to negative, thereby causing a short circuit.

Porous Materials

The active materials which are responsible for the electrical storage capacity of the plates of an accumulator are manufactured in such a way as to produce a highly porous mass, in the case of both the lead peroxide of the positive plates and the "spongy" lead of the negative plates. The reason for making the active materials extremely porous is in order to enable the electrolyte, which carries the current during charge and discharge, to reach all particles of the active materials, so as to bring about the necessary chemical changes which accompany charge and discharge. It will be realised that a highly porous mass cannot be expected to have the same coherence and strength as a mass tightly packed together, but it is remarkable with what success accumulator makers have combined the qualities of porosity, coherence and strength, and have thus developed plates of a very robust character.

Effects of Charging and Discharging

During discharge the active materials of positive and negative plates combine with the sulphuric acid in the electrolyte, and are gradually converted into lead sulphate. This substance occupies a larger volume than do the active materials, so that a certain amount of expansion takes place. On charge the exact opposite occurs; lead sulphate is converted into active materials and a general contraction takes place. This periodical expansion and contraction tends to loosen a few particles on the surface of the plates and cause them to fall to the bottom of the cell as sediment. Normally, the quantity of sediment falling is almost negligible, and can cause no ill-effects, but there are however certain conditions of usage of a battery which may result in the production of an undesirable amount of sediment.



[*Photo, C. A. Oldroyd.*

High-power broadcasting by the sea. A recent open-air demonstration was given on Walney Island, near Barrow-in-Furness, and attracted large crowds, as our photograph shows.

Over-discharge is likely to bring about a tendency to the production of an abnormal quantity of sediment owing to the fact that the expansion which normally takes place on discharge is allowed to proceed to an excessive degree. There is, however, more danger from over-charging than from over-discharging. If a battery is over-charged the gassing, which accompanies the end period of charge, is unduly prolonged. The bubbles of gas as they rise from the plates tend to detach particles of active materials, from the positive plates especially, thus producing sediment. It is advisable to treat batteries, when charging and discharging them, as strictly as possible in accordance with the instructions issued by the makers.

Sulphation is a fruitful cause of excessive sediment. When sulphation occurs, for whatever reason, the porosity of the active material is much diminished by the inter-spaces between the particles being filled with lead sulphate. When a sulphated battery is put on charge the current cannot penetrate into the mass and is therefore concentrated upon the surface. The intensity of the current at the surface is such that the active material at that part is charged at too high a rate and a considerable amount of local gassing takes place, resulting in the loosening of the particles.

Impurities, which may find their way into the battery if care is not taken to exclude them by the use of the purest acid and distilled water and the prevention of accidental contamination, will attack the active materials and undermine their cohesive qualities, thus causing the production of sediment. Great care should be exercised in keeping the battery free from impurities, for they

(Concluded on page 439)

Valve Notes

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

Use of Diodes in Reflex Circuits

TO some a crystal detector is a source of annoyance, and requests are continually made for reflex circuits in which the crystal is eliminated, a two-electrode valve being substituted.

I am afraid that I am not an enthusiastic supporter of the use of two-electrode valves in reflex circuits, because as two-electrode valves are not on the market as such it is necessary to use a three-electrode valve and to connect the grid and anode together. No saving is therefore effected by the use of a three-electrode valve.

Unless a double dual circuit is used, or, of course, a multi-dual, the saving in a reflex circuit is only one valve, and, generally speaking, any attempt to save more than one valve is accompanied by a loss of general efficiency in the high-frequency amplification which off-sets any advantage gained by extra reflexing. I have been trying to work out a three-valve set using two stages of high-frequency amplification, a detector valve and two stages of low-frequency amplification, but results are not sufficiently consistent to justify a description of the construction of such an apparatus.

Using a Two-electrode Valve as a Detector

The use of a two-electrode valve as a detector will certainly eliminate the crystal, but on the other hand, the same valve could be used to better effect as a detector working on the leaky grid condenser principle, or as a low-frequency amplifier.

In spite of my personal views on the use of two-electrode valves as detectors in reflex circuits, I am giving this week a simple circuit which may be tried out by those interested. It certainly works quite effectively, but, on the other hand, I consider that better use might be made of the second valve.

It will be seen that a high-frequency transformer L2 L3 is used for passing on the high-frequency currents to the valve V2, which is the two-electrode rectifier, the grid being connected to the anode. The rectified currents pass through the primary T1 of the step-up transformer T1 T2, the secondary of which is in the aerial circuit, as usual.

In operating this circuit much depends upon the brightness of the filament of the second valve. Generally speaking, the brighter the filament the louder the signals, but at the same time the brightening of the filament introduces greater damping into the circuit L3 C3. It will probably happen that there is some natural reaction effect taking place in the first valve which, when the filament of V2 is switched off may quite readily oscillate. If this is so, controlling the filament of the second valve will not only vary the rectified current obtainable, but will also control the reaction effect in the first valve.

Some Experiments

Experiments may be tried by connecting the grid of the second valve, not to the anode, but to the filament or to a point on the high-tension battery. It will probably be found that the filament connection reduces the signal strength obtainable, because the rectified current passed by the valve V2 will be decreased. If, however, the grid is connected to a point on the high-tension battery B2, just as good results will be obtained as if the grid were connected to the anode of the valve.

Interesting experiments may be carried out by modifying the point X, to which one end of the primary T1 is connected. The end of the primary may be con-

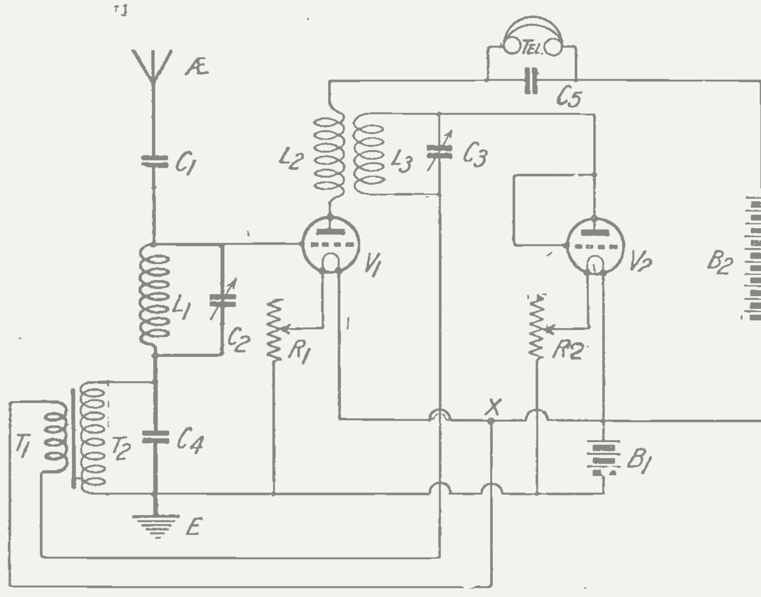


Fig. 1.—A simple reflex circuit, in which the usual crystal detector is replaced by a two-electrode valve.

nected to different points on the accumulator B1, but usually it will be found that the best results are obtained when the anode and grid are maintained at a small positive potential.

The Three Valve Dual

As occurred when the ST100 was first published, a number of readers appear to be having some trouble with their three-valve duals made in accordance with designs published in *Modern Wireless*. A few sets which have been examined by the Radio Press Service Department indicate that minor faults are to blame, although in some cases readers have completely altered the whole design of the set, cramped it into about half the space, or tried to include the circuit in a magnificent oak cabinet. I cannot reiterate often enough the sheer folly of modifying the design and then complaining that the set will not work. And yet it seems that no matter how often we urge readers to keep to our designs, some will continually depart from them and incorporate "improvements." There is nothing whatever to prevent anyone from improving our designs or modifying them, but we can accept no responsibility whatever in such cases. On the other hand, all the sets described in Radio Press publications will work exceedingly effectively; the actual instruments are on view at the offices of the Radio Press Service Department, 19, Devereux Court, Strand, W.C.2. The sets can be built with absolute confidence, and if any trouble is experienced, the Service Department is ready to report on any faulty sets and, if desired, to put them right. A nominal charge is made, but none if the fault is in any way that of the publishers. It is impossible to do more than this to ensure obtaining the full confidence of our readers.

Modifying a Given Design

For the benefit of those who desire to modify our designs it would be as well to point out that some circuits lend themselves to arrangement in almost any position, while others are very particular, and in such cases it is more than ever essential to retain the author's design. A detector and note magnifier circuit, for example, may be adapted to hundreds of ways, whereas circuits using two stages of high-frequency amplification and reflex circuits are temperamental and the correct disposition of parts, and in many cases the correct parts, form a vital part of the whole design. In some cases of change, good results will be obtained, but the matter is always problematical.

□ □ □

Sediment in Batteries

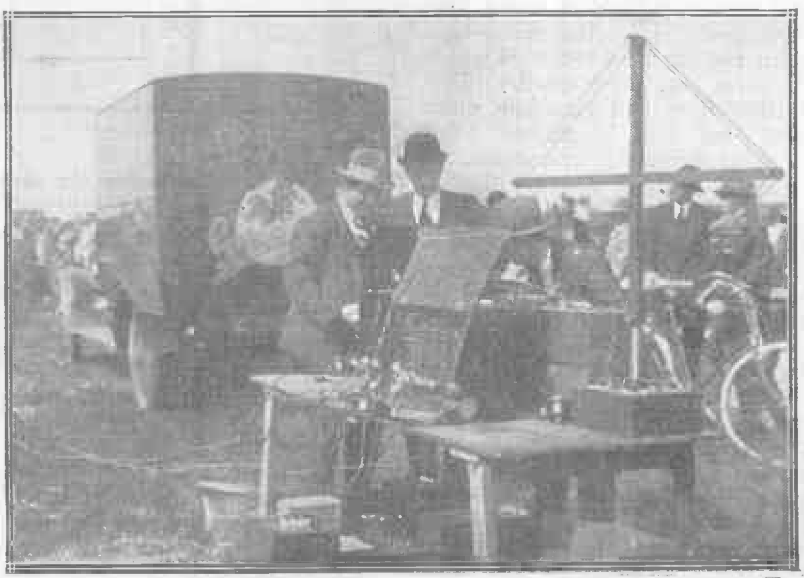
(*Continued from page* 437.)

can bring about a considerable amount of trouble.

Sediment is quite harmless if it falls clear and settles in the sediment space without touching the plates. Should, however, a particle lodge between the plates a short circuit may result. Batteries are usually fitted with separators to prevent anything of this nature occurring, but it may happen that a small piece of active material will fall at the ends of the plates and lodge between them and the side of the container. If this occurs, tapping the side of the container will usually cause the particle to fall to the bottom.

Removing the Sediment

If much sediment falls the sediment space may be insufficient for the purpose, in which case there will be a danger of short-circuiting. The procedure that should be adopted in these circumstances is, first of all, to discharge the battery and then invert it over a sink. After the electrolyte has drained away the battery is filled with distilled water and well shaken to stir up the sediment. On again inverting the battery over the sink much of the sediment will be carried away, and a repetition of the procedure should clear the battery of all but a trace. After this the battery is filled with pure dilute sulphuric acid, specific gravity .215 approximately. A little gentle shaking will cause any particles of sediment adhering to the plates, separators, and other parts to fall to the bottom. The battery is then put on charge at the normal rate until the voltage and specific gravity have ceased to rise and have remained constant for at least an hour. It may be found that the specific gravity is not in accordance with the figure given in the instructions issued with the battery, and adjustments may be necessary. The electrolyte is accordingly removed and replaced by stronger or weaker acid, as the case may be. After this the battery should be kept on charge for a time, as the gassing which takes place will cause the liquids to mix thoroughly.



[*Photo, C. A. Oldroyd.*

High-power broadcasting by the sea. A close-up view of the complete receiver used in a Walney Island demonstration. Note the batteries under the table.

High-Frequency . . . . . . Transformers

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

Continued from Vol. 4, No. 13, page 418.

The Semi-tuned Type

THE true tuned transformer requires, of course, a variable condenser across either one or both of its windings, and this imports one more tuning adjustment into the receiver. In some cases this is undesirable, and it was to meet this objection that the present-day type of semi-tuned transformer was designed. The reader will be aware that the resonance curve of any winding included in a tuned circuit can be flattened out by the use of resistance wire for the coil itself, thereby very much increasing its damping. This fact is applied to the high-frequency transformer to convert it into the semi-tuned type, quite fine resistance wire being used. No. 40 single silk-covered Eureka is commonly employed, although finer gauges are occasionally met with. A transformer of this type can be made for experimental purposes by winding the same bobbin which was recommended for the tuned type with 100 turns of the wire which I have just mentioned. This transformer will function quite well on the broadcast band without a variable condenser.

Uses of Semi-Tuned Type

The great value of the semi-tuned type, however, is that it can be made to cover a very wide range of wavelengths by means of a tapping switch only. It can thus be incorporated in the internal arrangement of the set, and relieves one of the necessity of changing over transformers for different wavelengths. The flattening of the resonance curve produced by the use of the resistance wire is easily made so great that by means of appropriate tappings a transformer will cover such a wavelength range as 300 to 3,000 metres with a 12-stud switch with fair efficiency. Of course, the results are never quite equal to those of the properly-tuned types, but in some cases this loss of efficiency seems justifiable to achieve some definite end. For example, when two stages of high-frequency amplification are used it is possible to perform all the tuning which is necessary by means of a pair of stud switches with their knobs linked together so that the motion of a single handle gives the necessary variation. This, with one variable condenser for tuning the aerial circuit, may thus constitute the whole of the controls of the set. For some commercial purposes, in particular, such an arrangement is highly desirable, where a set may be used by only semi-skilled operators, with very little time for making adjustments.

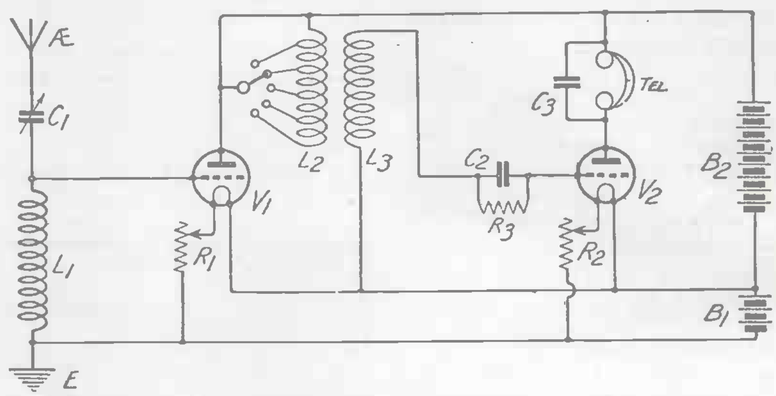


Fig. 1.—Illustrating the arrangement of the switch upon a semi-tuned transformer.

The construction of such transformers is a somewhat difficult task for the experimenter, since a good deal of laborious trial and error work is needed, and I do not propose to give any detailed instructions for making them, especially in view of the fact that they have never achieved very great popularity with the amateur, who, as a rule, does not hesitate to incorporate components requiring quite a number of tuning controls in his set. If a commercial type is used, care should be taken to see that its switching is properly carried out, that is to say, that the switch makes some provision for counteracting possible "dead end" effects. The simplest and probably the most effective palliative in a case of this sort is to use a switch whose action is to short-circuit the turns which are *out* of use.

The Aperiodic Type

This type of transformer is simply a further development of the form which we have just been considering, that is to say, the windings are still more heavily damped, by the use of still finer resistance wire, so that without tappings a transformer may cover quite a large wavelength range. For example, the barrel type with four terminals, illustrated in one of the photographs last week, will cover a wavelength range of 1,000 to 5,000 metres with very fair uniformity. For the wavelength above 5,000 metres, it can be made to give quite good results by inserting an iron core into the hole which is bored through its centre. It will then work quite well up to about 20,000 metres.

Notwithstanding their name, these transformers are not, of course, really aperiodic, and must have some sort of natural wavelength, but this is very far from pronounced, and, in the case of the specimen which we have just referred to, falls in the neighbourhood of 2,500 metres. These transformers were actually designed for working on this wavelength, particularly for the reception of the Eiffel Tower time signals. However, the increase in signal strength upon this particular wavelength is not at all marked.

The chief use of such transformers as these is in multi-valve sets where ultra-simple handling is required, such as those for commercial and service use, and in certain special cases. Probably the only common application of them in experimental use is in a long-wave amplifier for use in one of the various Armstrong super-heterodyne circuits. They serve quite well for such a long wave amplifier, although they only give a little more amplification than the resistance capacity method of coupling. These transformers are quite easy to make, and all that is required is a cylindrical piece of ebonite 2 in. in length, and 1¾ in. in diameter, in which 8 slots should be turned 1/16th in. wide and ½ in. deep. These are wound alternately primary and secondary, and joined up to form two separate continuous windings. No. 42 or 44 single silk-covered resistance wire should be used, and the total number of turns in each winding should be 1,000.

Reaction in Transformer Coupled Circuits

When the regulations regarding reaction were somewhat different to those in force at the present time, a number of ingenious arrangements were devised for applying reaction to the intervalve circuits of the high-frequency amplifier, and one of these employed a reaction coil coupled directly to the tuned winding of a high-frequency transformer. Although these arrangements were certainly a good deal better than using no reaction at all, they cannot compare for convenience and results with reaction upon either the aerial circuit or secondary circuit, when this can be used with a reasonable amount of care to prevent radiation, and they are now passing out of use. Their main drawback was that they were not capable of compensating for losses in the aerial circuit, and that in cases of a poor aerial and earth, that is to say, in just those cases where assistance was needed, they did not give one the power to obtain that assistance.

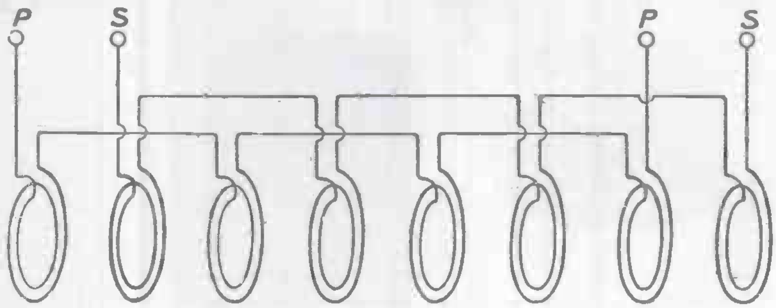


Fig. 2.—Showing how the primary and secondary slots are connected.

□ □ □

"Success" L.F. Transformers

A Further Test

In connection with the report on the "Success" L.F. intervalve transformer, published in our issue for July 2, the makers have requested us to submit their products to a further test, in view of the fact that the transformer tested by us was one of an old type, and had been manufactured some considerable time ago, before their staff became accustomed to the work. Accordingly, we have independently obtained a number of "Success" transformers from trade sources. These have been carefully tested, in comparison with one another, with a standard of known excellent performance, and with a specimen of the "Success" purchased over the counter from a local dealer by a "Radio Press" messenger unknown to the vendor. In each case, the most favourable possible combination of H.T., grid-bias, mode of connection, etc., was sought, and each observation repeated by an independent observer. Bright emitter valves of known dependability were also used.

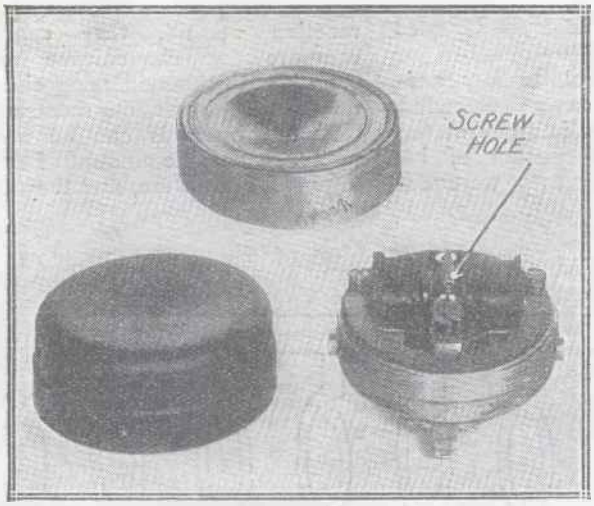
The "Success" transformer purchased from a retailer was picked out immediately by its very poor performance; the tone was thin and reedy, and the amplification poor, corresponding exactly to what had been observed with the first transformer submitted. No alteration of connections or working conditions improved this. Subsequent test with the 500-volt "Meg" tester showed that the insulation was not at fault.

The several transformers obtained from trade sources, and therefore probably of recent manufacture, whilst they varied quite appreciably amongst themselves, showed a very marked improvement in performance. One, in particular, after it had been removed from its brass case, gave results which were very good indeed for a medium-priced instrument as regard freedom from distortion, though the amplification was a little lower than the standard (which, of course, is a more expensive transformer).

Two of these latter instruments, chosen at random, showed on removal of the decorative outer case the same internal construction as already remarked upon, a piece of crumpled paper being still relied upon for isolating the leads to the terminals, though it was noted that short pieces of insulating tubing were provided for insulating the leads from the core.

With the exception of one which had been entirely removed from its case for test purposes, and in which the internal wiring may accordingly have been disturbed, the insulation resistance of each of these transformers was found to be satisfactory, on 500 volts D.C., both between windings and from windings to the case and core.

If the makers can ensure in later patterns a uniformity of performance, and as favourable results as regards distortion as were noticed in the specimen mentioned here, the instrument can certainly be recommended as a good low-priced transformer.



A Brown earpiece taken to pieces. The arrow shows the hole in the reed, referred to in the article.

A NOVEL . . HOME-BUILT LOUD- . . SPEAKER

By J. G. W. THOMPSON.

AS will be seen from the photograph, the loud-speaker to be described is of the hornless type, employing a large fluted-paper diaphragm; and is of quite pleasing appearance and modest dimensions.

The materials needed for its construction are as follows :—

A single Brown's "A" type adjustable earphone—high resistance.

One pair of concentric wooden rings, known as "embroidery frames," obtainable from most art-needlework shops. The external diameter of the inner ring should be $10\frac{1}{2}$ in. The outer ring should have an adjusting clamp at the edge, so as to contract or expand it.

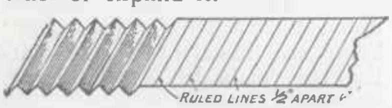


Fig. 1.—The method of folding the paper strip.

A piece of thick drawing paper, $5\frac{1}{2}$ in. wide and about 36 in. long.

One short piece of ebonite rod, $\frac{1}{4}$ in. diameter.

Three pieces round brass rod, $\frac{1}{4}$ in. diameter, each $4\frac{1}{2}$ in. long.

One piece of brass rod, $4\frac{1}{2}$ in. $\times \frac{1}{2}$ in. $\times \frac{1}{4}$ in.

Three 6 B.A. $\times \frac{5}{8}$ in. cheese-headed brass screws, with nuts.

Three 6 B.A. $\times \frac{1}{4}$ in. cheese-headed brass screws.

Three pieces strip brass 1 in. $\times \frac{1}{4}$ in. $\times$ about 3/64 in.

One piece strip brass, about 8 in. $\times \frac{1}{2}$ in. $\times$ 3/64 in.

One 4 B.A. cheese-headed brass screw, $1\frac{1}{4}$ in. long, with two nuts.

Three or four 4 B.A. washers.

Short piece No. 18 gauge tinned copper wire.

Tube of "Seccotine."

The first thing to tackle is the diaphragm. Starting $\frac{1}{2}$ in. from one end, rule lines at every $\frac{1}{2}$ in. across the width of the strip of

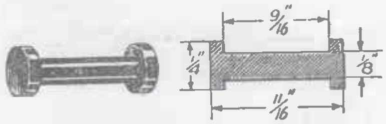


Fig. 2.—Dimensions of the ebonite "button."

drawing paper. The ruling should be done with the back of a penknife, so as to score the paper deeply and thus assist the subsequent folding process. The ruling must be very carefully and accurately done. Next start folding the paper zig-zagwise at every line, in the same way as when making a fan. (See Fig. 1.)

When the whole length has been tightly and neatly folded, bring the two ends together, and holding them thus, flatten out the resulting circular fan on a table, and see if the hole in the centre is about $\frac{1}{8}$ in. diameter. If too small, a further short length of folded paper should be seccotined to one end of the big strip; if too

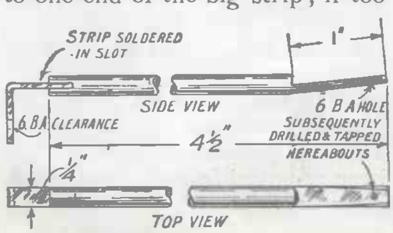


Fig. 3.—The dimensions of the brass radial arms.

large, a short length should be cut off from one end until matters are right.

Then seccotine the two edges together, and leave until quite dry. In the meantime, file or turn the $\frac{1}{4}$ in. ebonite rod to the dimensions of Fig. 2.

When the paper diaphragm is ready, arrange it on a table so as to form a cone, apex uppermost. Coat the reduced portion of the ebonite "button" *very* liberally with seccotine, and insert it into the open end of the cone, at the same time flattening the cone on the table. The button

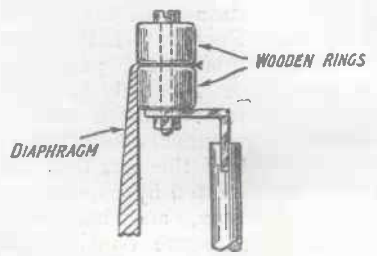


Fig. 4.—How the radial arms are fixed to the diaphragm frame.

should thus be firmly gripped at the centre of the diaphragm. It should be left for 24 hours to allow the seccotine to harden, small weights being placed on it to hold it flat, if necessary. When dry, it should be remarkably firm and stiff, and a hard "woodeny" sound should be given when the button is tapped with a pencil.

The mounting of the diaphragm in the embroidery frame needs great care, and on *no account* should this be attempted until the seccotine has set dead hard.

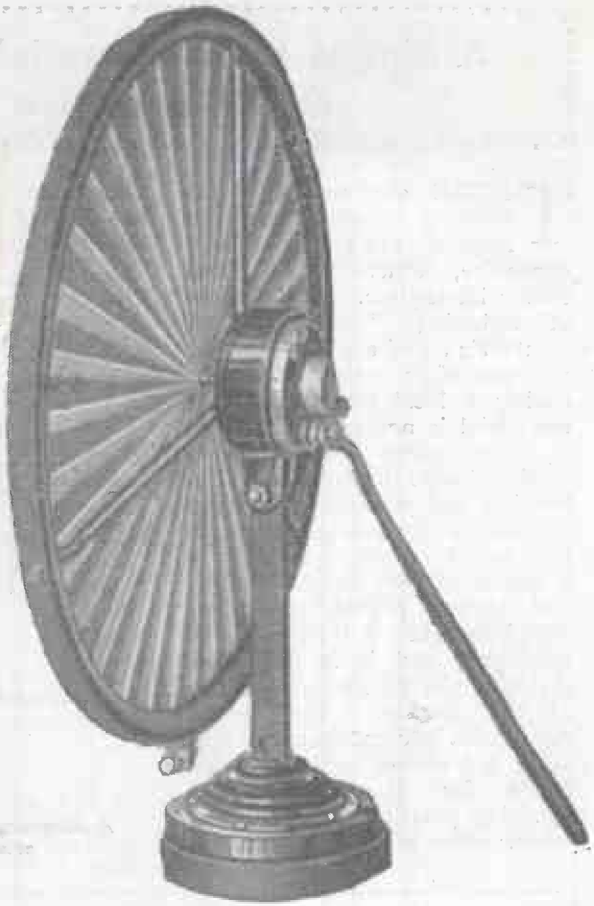
Lay the smaller ring on the

Full constructional details of an interesting hornless instrument giving great purity of reproduction.

table, and exactly centre the diaphragm over it. Open out the adjusting clamp (if present) on the outer ring, and press this latter over the inner ring, thus squeezing the outer edge of the diaphragm between the two rings. When about half-way down, tighten up the clamping screw, and press the remainder of the way. Trim off any surplus paper at the back edges, and this part is now complete.

Next prepare the three brass arms holding the diaphragm frame to the 'phone earcap.

Make a $\frac{1}{4}$ in. deep hacksaw cut in one end of each of the arms, and solder the 1 in. × $\frac{1}{4}$ in. × 3/64 in. brass strips into these cuts. Bend the strips at right angles and drill a 6 B.A. clearance hole in the ends. (See Fig. 3.)



A photograph of the completed loud speaker. The paper diaphragm is clearly seen, together with the Brown earpiece clamped upon the standard.

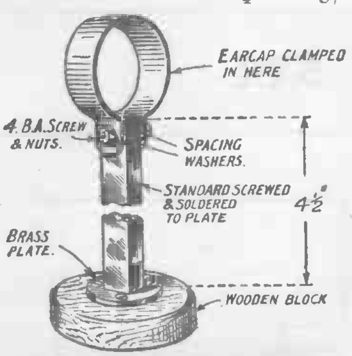


Fig. 5.—Details of the standard and earpiece clamp.

The other ends of the rods should then be filed to the shape shown. This is to accommodate the conical depression in the face of the earcap.

Next drill three equidistant 6 B.A. clearance holes through the rim of the diaphragm frame, and secure the three arms by nuts and bolts, as shown in Fig. 4. The arms should almost meet exactly over the button in the centre of the diaphragm.

Unscrew the earcap of the 'phone, and lay it face downward over the three arms. Centre the middle hole in the earcap over the button and turn the cap round so that the arms lie exactly below three of the six outer holes. Mark the arms at these points with a scriber, remove from the frame, and drill and tap 6 B.A. at the marked points. Replace, and secure the earcap by three $\frac{1}{4}$ in. 6 B.A. screws, inserted from the inside of the cap. One arm is shown in position in Fig. 6.

Thus the earcap is firmly fixed at the centre of the diaphragm, and should be about $\frac{1}{2}$ in. to $\frac{3}{4}$ in. from the surface of the diaphragm. The whole arrangement should be firm and rigid—a most important point.

Next remove the aluminium diaphragm from the Brown 'phone, leaving only the casing, magnets, and reed. Screw a short piece of 18-gauge copper wire into the hole in the centre of the reed. This wire must be made absolutely straight and stiff (by stretching). Screw the earpiece into the earcap, and clip off the end of the projecting wire, so that when the earpiece is almost screwed home, the wire presses firmly against the diaphragm button. The reason for not screwing the earpiece completely home is that the diaphragm will stretch slightly in time, and to maintain the pressure, the earpiece may be screwed in a little more to take up the slack.

The only thing remaining is to mount in some suitable stand. A simple method is given in Fig. 5, which should explain itself. The spacing washers between the brass standard and the earcap clamp are to allow movement of the latter, so that the diaphragm can be tilted to any desired angle. The wooden base may be of the kind used for mounting electric-light switches.

(*Continued in col. 3, page 449.*)

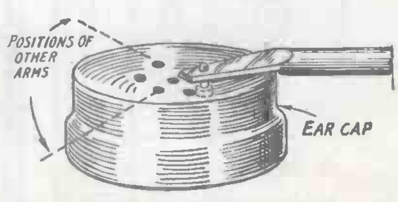
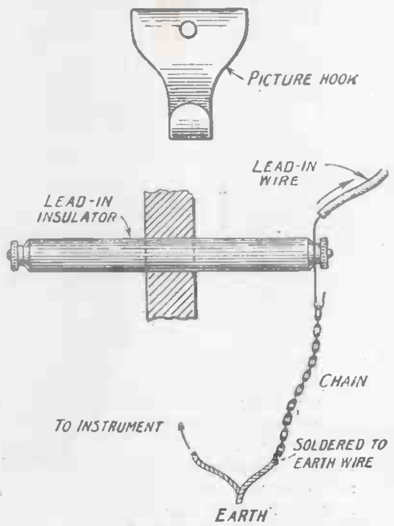


Fig. 6.—How to fix the radial arms to the ebonite earcap.

A Simple but Substantial Aerial Earthing Device

THERE are several aerial earthing devices on the market, some sound and expensive, others cheap and totally inadequate. The chances of lightning "striking" an amateur's aerial are very remote, yet none of us is entirely at ease during a local thunderstorm if the aerial is not earthed, or, as is more often the instance, earthed inside the building. The housing and making waterproof of a sufficiently substantial single pole switch outside a building is a matter of very careful design, and always proves expensive, especially when a transmitter is employed, and it is important that there be no surface leakage at the lead-in. The writer remembers a commercial station being put almost entirely out of action for transmitting, yet receiving practically unhampered when, after a severe gale and heavy rain, damp penetrated the housing of the earthing switch and "shorted" aerial and earth.



A diagrammatic view of the arrangement.

The earthing device described can be erected for a few shillings, and is quite substantial for the purpose, even taking into account the proverbial vagaries of lightning.

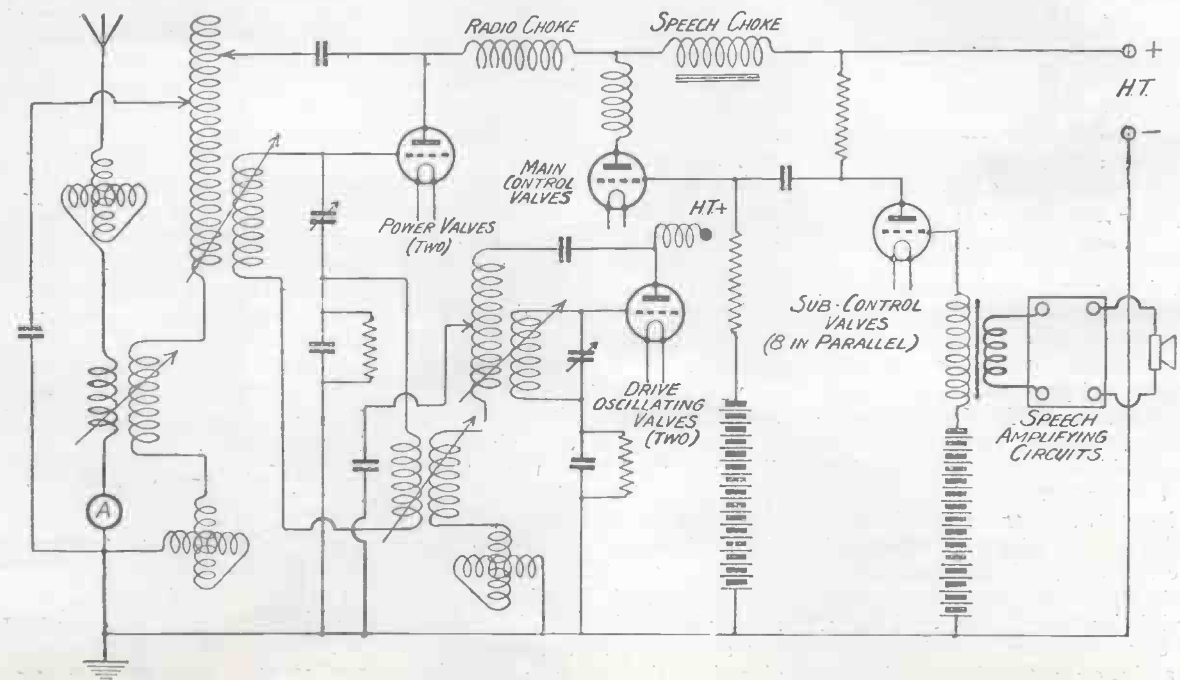
Construction

An ordinary picture hook of the suspension from picture rail variety is flattened out at the bend where it engages on the picture rail, and a hole bored of a size to allow it to slip over the screwed rod of the lead-in insulator. The aerial lead is secured as usual. A length of chain—it may be of any conducting material (the writer employs brass picture chain doubled)—is securely soldered to the earth wire at a convenient point. Normally it will lie on the ground, but when required is simply hooked on to the picture-hanger.

If you want to feel really secure, the leads to instruments inside the building may be disconnected at the lead-in insulator and from the earth connection.

W. A. H.

The Transmitting Circuit at 5XX

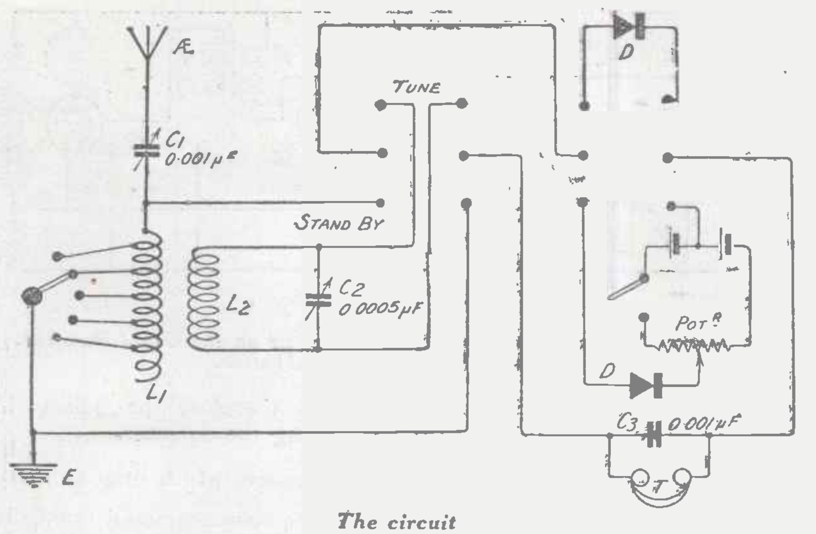


A diagram of the 5XX transmitter circuit. For simplicity, the rectifying valves, smoothing circuits, and the filament connections have been omitted. Choke control is used.

Practical . . . . Back-of-Panel Wiring Charts

A Selective Crystal Receiver

By OSWALD J. RANKIN

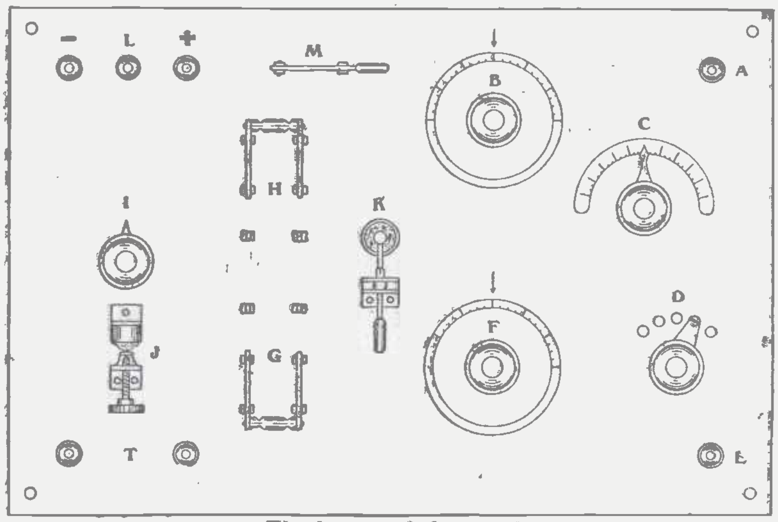


The circuit

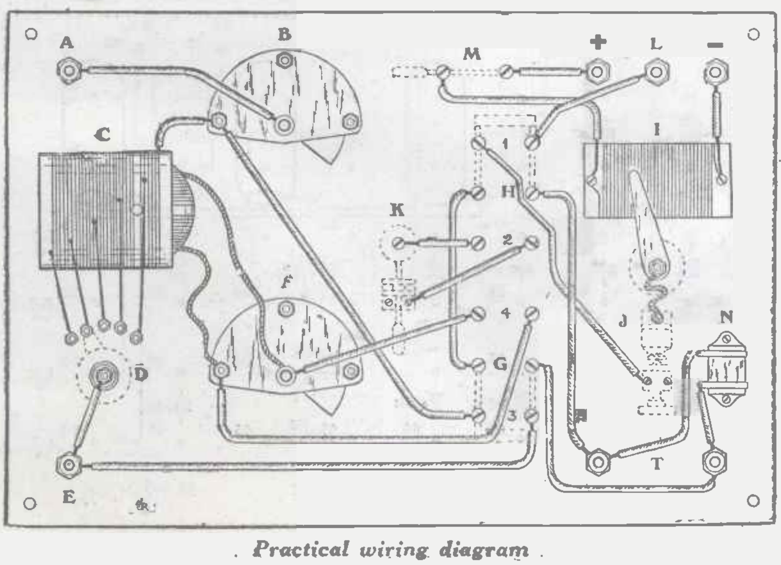
THIS circuit includes two double-pole double-throw switches G and H. The former is known as a tune and stand-by switch, the position shown indicating that the switch is in the "stand-by" position. This is for use when searching for stations, and tuning is carried out by variation of the selector switch D, which varies the number of turns of wire used on the stator of the vario-coupler C, and by adjustment of the series condenser B whose capacity is 0.001 μF. With the switch in position 4, final tuning is carried out by adjustment of the rotor knob of the vario-coupler, and the variable condenser F which has a capacity of 0.0005 μF. Re-adjustment of the condenser B may be advantageous. The latter position of the switch G does not have a noticeable effect on the signal strength previously obtained, but with a little practice, very selective reception will result.

The switch H brings into use either the ordinary galena detector K, or the carborundum detector J with the necessary potentiometer I, having a resistance of about 400 ohms. To use the carborundum detector, two dry cells are connected in series, i.e., the positive terminal of one cell connected to the negative terminal of the other, and a tapping is taken from the junction and joined to the terminal L. The free minus terminal is connected to – on the set, and the free plus to + terminal on the set. The small switch M, included to cut off the current when not required, is placed in the position indicated. Every time an adjustment of the detector is made, the potentiometer knob should be varied to give best results. Failure to switch off the current by means of the switch M, or by disconnecting the batteries from the set when not using the carborundum detector, will result in a steady drop in voltage of the battery until it becomes useless.

The position 2 of the switch H brings into use the detector K, which is adjusted in the usual manner. The condenser N is placed across the telephone terminals, a suitable value being 0.001 μF.



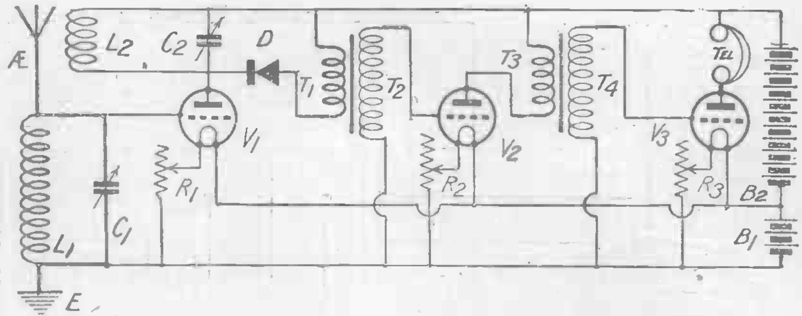
The layout of the panel



Practical wiring diagram

A Further Circuit on the Omni Receiver

This week we give details of a three valve and crystal circuit which may be tried on this popular receiver.



An interesting circuit which may be wired up on the Omni Receiver. A wiring key will be found below.

THE circuit shown in Fig. 1 consists of a stage of high-frequency amplification, followed by a crystal detector and two stages of low-frequency amplification. Good loud-speaker results are obtained over moderate ranges, whilst distant stations give excellent signals in the telephones.

L1 is the aerial coil tuned by the variable condenser C1 of 0.0005 μF. The anode coil L2 is tuned by C2, also 0.0005 μF. D is the crystal detector which rectifies the magnified oscillations in the plate circuit L2 C2, the rectified currents then being stepped up by the intervalve transformer T1 T2 and applied to the grid of the second valve. T3 T4 is the second transformer and the telephones are marked T. The introduction of grid bias often proves an advantage, and details concerning its application are given later.

Connections

The circuit is easily wired up on the Omni receiver, the following connections being necessary :—

51—17	21—23
25—52	2—21
17—18	30—14
18—12	29—48
26—25	6—15
4— 9	7—24
9—10	56—16
1— 2	55—29
4—20	8—31
28—22	32—40
23—24	26—48

Coils

The aerial coil is plugged into the centre socket of the three-coil holder. Since constant aerial tuning is not employed, the size of the coil will depend on the size of the aerial upon which the set is used, and Nos. 25, 35 and 50 should be tried. The anode coil L2 will be a No. 50 or No. 75 coil, and is placed in the rear moving socket.

Operating the Set

The anode coil is first kept well away from the aerial coil, and tuning carried out by adjustment of the anode condenser on the left ot the panel, and the aerial condenser in the centre. The crystal detector generally needs careful adjustment for best results. The anode coil may now be brought up slowly towards the aerial coil, continuously retuning on the two variable condensers, and an increase in signal strength may result. If not, the leads to the anode coil must be reversed by altering the connections on the terminal board. Disconnect 4—9 and 2—21; join 9—21 and 4—2.

With some crystals of the artificial galena type, a very light adjustment of the cat-whisker may cause continuous self oscillation to occur, despite the damping caused by the resistance of the crystal. Care should therefore be taken in adjusting the detector.

Experiments which may be Tried

When constant aerial tuning is used it is possible to state definitely the size of coil to use in the aerial socket, and since many readers prefer this straight-forward procedure to the usual method of finding the correct size of coil by trial, the necessary alterations on the terminal board are given. Disconnect 51—17, join 51—11 and 3 to 17. For broadcast wavelengths below 420 metres a No. 50 coil should now be used in the aerial socket, while for those above, a No. 75 coil should be used.

Series tuning may be tried by making the following alterations to the original key :—

Disconnect 26—25, 26—48 and 51—17; join 51—26 and 52—48. A larger coil will probably be necessary for the aerial socket.

A fixed condenser connected across the primary winding of the first transformer may improve the quality of the received signals,

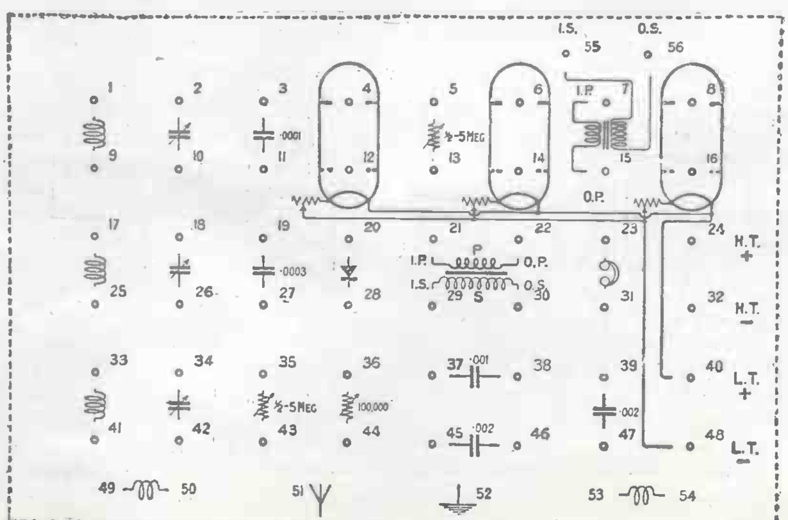


Fig. 2.—The terminal board.

and is included by connecting 21—37 and 22—38.

If signals are distorted on the low-frequency side of the circuit, considerable improvement may be effected by applying negative grid bias to the last two valves. Disconnect the lead 48—29, join 29 to the negative terminal of the grid battery, and connect the positive terminal to 48. A higher anode voltage can be used without distortion when the grids are negatively biased. Reversing IP and OP connections to the transformer should also be tried.

Should it be desired at any time to cut out the last valve, this may be accomplished by disconnecting 8—31 and 6—15, and joining 6—31. The rheostat of the valve not in use should, of course, be turned to the off position. Using only the two valves, quite good 'phone strength is obtainable from some of the distant stations, but the three valves are generally necessary for loud-speaker work.

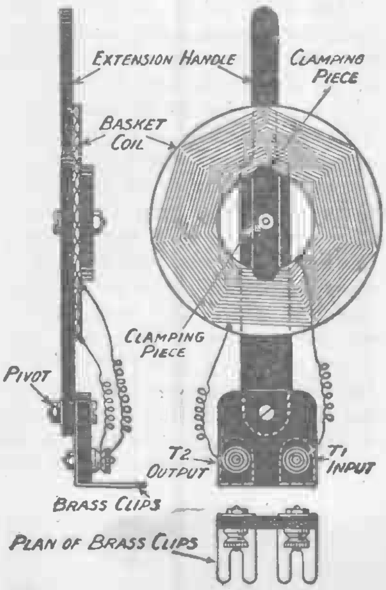
COIL HOLDERS ADAPTABLE TO TERMINALS

A useful and novel method of mounting basket coils.

ALL are acquainted with the several designs of coil holders of the plug-in type now on the market. It is, however, at times desirable to use coils which may be brought into operation by inserting between panel terminals of the plain type. The writer has found from experiment that hardly any type of coil surpasses the basket coil which is so deservedly popular amongst experimenters. This may not, of course, be the opinion of all, as it is largely a matter of individual taste, but all will agree that they are very convenient and compact. The best type to use are those which have well spaced windings and which are not shellaced.

Constructional Details

The construction of the coil holder is clearly shown in the diagram given. The dimensions should conform to the diameter of the longest coil used. Tuning is effected by the movable arm. This is made of a piece of ebonite about $\frac{1}{2}$ in. wide by $\frac{1}{8}$ in. to 3/16 in. thick. It is shaped as shown, one end acting as an extension handle. The centre hole is drilled to clear a 4 B.A. screw, and likewise the hole which bears the pivot screw. Next, make the clamping piece from a piece of ebonite $\frac{1}{4}$ in. wide by $\frac{1}{8}$ in. to 3/16 in. thick. The length of this piece depends upon the diameter of the centre hole of the basket coils. If this diameter be 1 in., then the clamping piece should be $1\frac{1}{4}$ in. in order to give an overlap to grip the coil. A centre hole is drilled to clear a 4 B.A. screw. The method of inserting the coils is to be seen plainly in the drawing. The base piece holding the brass clips is made of a piece of ebonite 1 in. square by $\frac{1}{8}$ in. to 3/16 in. thick. A hole is drilled to clear the 4 B.A. pivot screw. Two further holes are drilled to clear 4 B.A. terminal screws. The moving arm may now be assembled to the base piece, as



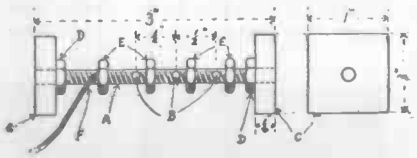
Two views of the holder, showing the construction.

shown. Two brass clips are made and bent to shape and secured to the base piece by means of the terminals which should be as small as possible. The holder is now complete. The output winding of the basket coil is secured to the terminal T2 and the input winding is secured to T1. The ends of the basket coil should be formed into a flexible spring, as shown, to allow for the movement of the arm. This is easily done by winding the ends round a pencil. It will be seen that the coils are easily and quickly changed in the holder. The brass clips should, of course, be so spaced as to fit into the panel terminals between which it is desired to place them. If the centres of the clips are spaced $\frac{5}{8}$ in. apart, the panel terminals should also be spaced accordingly.

H. B.

A Useful Multiple Terminal

WIRELESS experimenters often desire to add or remove a piece of apparatus, or make alterations to a circuit quickly. By using multiple terminals as described below, any wire can be readily changed without interfering with other connections. An easily made four-way terminal is shown in the drawing. A is a piece of 2 B.A. screwed brass rod 3 in. long, the holes B being half an inch apart and made with a No. 39 drill. A small flat is filed on the rod at each of these points to allow the drill to start



This drawing shows how a multiple terminal may be easily made.

easily. The two end pieces C afford protection to the terminal, and are an inch square, cut from a piece of ebonite $\frac{1}{4}$ in. thick. A hole is drilled and tapped in the centre of each, and they are firmly held on the screwed rod by the two lock nuts D. The connecting wires are secured to the terminal by pushing through the holes B and screwing down the nuts E on to the wire, as shown at F. If available, milled-edged round nuts should be used, as these have a neater appearance.

A. W. BANWELL.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

Some notes of interest to both the home-constructor and the experimenter.

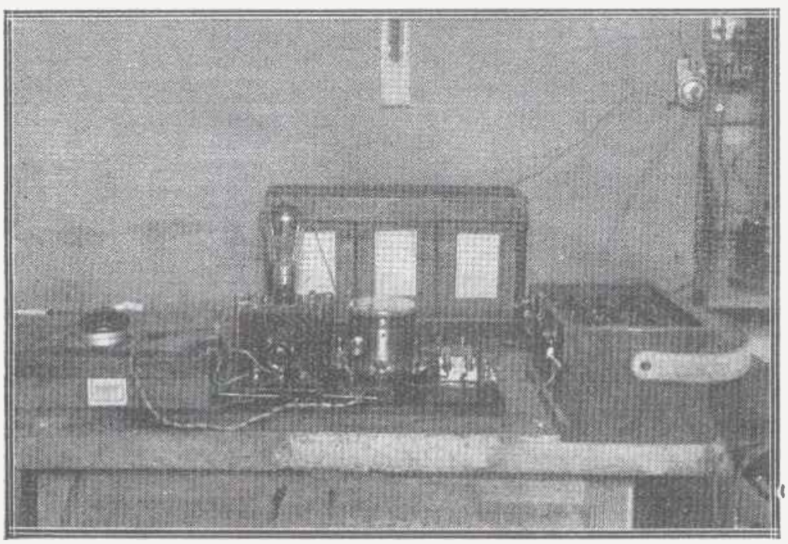
IT is one of the disadvantages of moving house that you cannot very well take your old aerial with you. When I moved recently from one side of London to the other, I decided it would be most convenient to sell the steel mast and aerial equipment as it stood, for the arrangements on that particular house would not suit the new home. Since moving I have been considering what would be the best arrangements in the new circumstances, and have only just come to a decision.

My problem may possibly be that of others, and therefore the way the solution was arrived at may prove of some interest. First, then, as to the site. The room into which the lead-in will be brought is situated on the first floor at the back of the house, and the available garden space is some fifty feet by forty feet. This means, of course, that one cannot get a very long run for the aerial, and whatever aerial is erected its height will really be only that of the distance above the upper window, as aerial height must be measured from the instruments themselves and not from the actual ground level.

A Problem of Space

The garden is situated on the hill side with open country to the south, but with some amount of screening from high trees on the west and north-west. There are two fairly high aerials in other ground at the end of the garden, although, at present, there are none which will be parallel with the new aerial on either side for some distance. As before, the aerial will run entirely over grass.

The new aerial must be used both for transmission and reception, for which reason it must be of good height, and it is advisable that it should be horizontal, with the lead-in brought down some feet from the back of the house. A number of considerations limits the height to about fifty feet, and if a mast stayed in the usual way were used, it would have to stand away some distance from the end of the garden in order that the stay wires might be brought down to the correct position. This would considerably shorten the aerial in a space already short, and for this reason I am erecting a fifty feet wooden mast which will be firmly attached, at its base, to heavy oak posts driven in the ground, with special back staying to enable it to be placed as close as possible to the bottom of the garden. The other end of the aerial will be supported by a roof mast, the height of which, above ground, will be about fifty feet, and the aerial itself will be made up of several wires separated by copper hoops to which each wire will be soldered.



The apparatus used at 2LO for relaying the Greenwich time signals.

An Earthing System

Some experiments I did about a year or more ago showed me quite conclusively that the average buried water pipe is not so efficient as it might be, and in the new system I shall bury a number of lengths of copper strips (sold for strip aerials) in the ground beneath the aerial. There will be six or eight strips running the full length of the garden and brought together at the house end to a sound soldered connection joined up to an insulated earth lead.

A Loud-speaker Mistake

It seems very difficult to dispel some of the illusions held by beginners in wireless. I am constantly meeting people who are under the impression that in buying a loud-speaker for home use, the small or baby type is the best, as, in their own words "the big size will be too powerful." Equally, I have known a number of people who were getting fair results with the baby type of loud-speaker and have purchased a larger type, expecting to get several times the volume. It should be strongly emphasised that neither small nor large loud-speakers can do more than distribute, in the form of sound waves, the energy supplied to them, and the main difference between the smaller and the larger type is that, although a little greater volume is attained with the larger sizes, the latter can distribute large quantities of energy without distortion, whereas the small ones overload very rapidly. If you really wish for the best quality in reproduction you must buy the larger type. There is a fuller and rounder tone about them which cannot be equalled by the small models of loud-speaker, which, however, are excellent value and very efficient.

NOVEL SPREADERS

Some new ideas in aerial construction.

MANY people spoil what is really a fine aerial mast by badly - constructed spreaders, whilst others add to a hideous mast spreaders which are equally ugly, making the whole installation look as though a blind man was the erector.

Good spreaders undoubtedly enhance the appearance of your work, and it is proposed in this article to deal with two simple types, which it is hoped will help to replace some of the present eyesores.

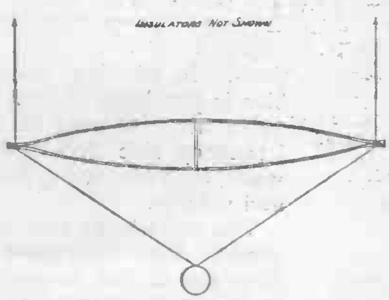


Fig.1.—A novel type of spreader combining lightness with strength.

In passing, it will be well to mention that the author does not intend here to argue the relative merits of twin and single-wire aerials.

Bamboo Poles

Since the wireless boom bamboo poles have been a very popular material for spreaders, mainly due to their lightness. Wireless factors have stocked these in abundance, variegated colour and otherwise. Even when it is possible to get one which is straight and parallel after a few months in our climate they begin to look very unhappy. The sun opens them, and the rain closes them, until finally they split. Then there is another type which, judging by its size, is strong enough to support the mast.

Fig. 2.—The strut used to stretch open the rods forming the spreader.

What is required is a spreader which combines the light-weight advantage of the bamboo with the strength of the deal pole, and looks well when swung. Consider Fig. 1—this shows a good type of spreader. It consists of two 7-ft. long hardwood rods about ½ in. diameter, bound each end with stout tinned copper wire, and stretched open in the centre afterwards by a small strut. The strut in this case is about 8 in. long, and a view of it is shown in Fig. 2.

When erecting this type it will be found that the maximum strength of the spar is only obtained when the pull along the aerial is parallel with the axis of the strut, that is as shown in Fig. 1, which is a bird's-eye view.

The second type involves replacing the strut of the first type by the wooden disc shown in Fig. 3. This disc has four holes drilled at equal intervals circumferentially, through which are threaded four rods similar to those described above. These are made fast by binding the ends as before. Two small brass ferrules or short lengths of tube may be used for holding these ends if they are preferred to wire. They must, however, fit very tight.

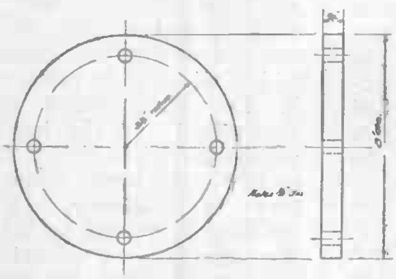


Fig. 3.—Another unusual type of spreader which is light, strong, and neat in appearance.

A coat of paint will put a workmanlike finish on these spreaders, and even if it does not keep its colour long in the smoke-laden atmosphere of the town it will preserve the wood.

A. G. H.

Uses for Gramophone Records

MANY experimenters have built panels, the appearance of which has been spoilt by filling unwanted holes with heel-ball or wax. Heel-ball will shine when rubbed, and this looks bad on a matt panel. A piece of gramophone record laid over the hole and melted in with a hot iron or screwdriver, afterwards smoothed down with emery cloth, looks better. If the job is done carefully it is hard to distinguish where the hole has been.

Another use for records is the making of formers for coils, variometers, etc. This is done by cutting the record into strips the required width, dip the strip into hot water, and bend it round a bottle or any other mould, just under the required diameter. The ends can be joined by running a hot iron along the seam. Care should be taken that the records are good, as the cheap ones generally have a layer of paper running through them.

R. M. S. (Leeds).

A Novel Home-Built Loud Speaker

(*Concluded from page 443.*)

(The base of the writer's instrument is a very large ebonite knob, surmounted by part of the casing of a microphone, as may be seen in the photograph.

The loud-speaker is now complete, but before using, the adjusting screw of the 'phone should be turned until a "ponk" emitted by the diaphragm indicates that the reed is clear of the magnets.

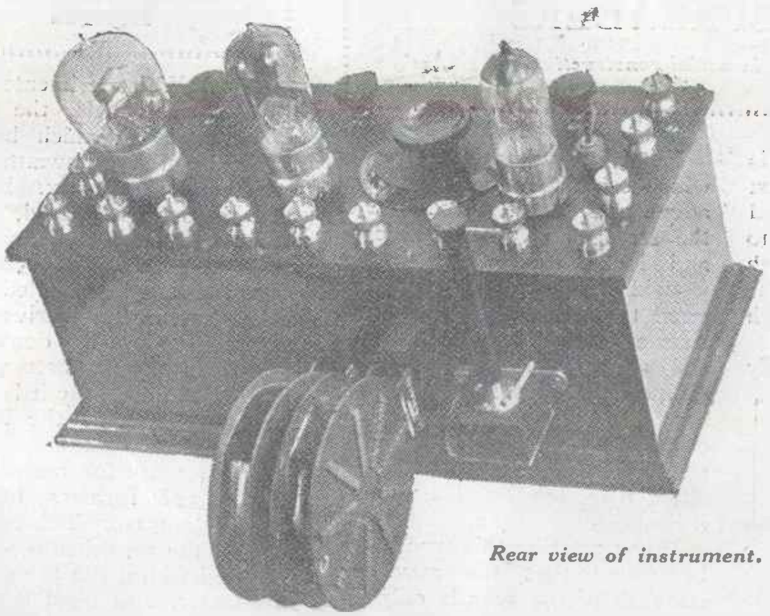
The results are very pleasing indeed, the rendering of violin music being particularly true. The tone is very sweet, and the volume is equal to most of the ordinary types of loud-speaker, being ample for even a large room. It must not be expected, however, to be capable of filling a large hall, as the small earpiece employed would be grossly overloaded.

Editor's Note: The principle involved in this design closely resembles that adopted in a patented commercial instrument.

A Compact R
the Neutrody
Using Plug-

by J. UNL R

This circuit first appeared in "Wirele
in an article by A. D.



Rear view of instrument.

IT has long been felt by the writer that a really efficient method of stabilising a coupled circuit with a tuned anode H.F. valve would appeal to those aiming at maximum selectivity in their sets. With this object in view the three-valve amplifier about to be described has been designed. To those who do not wish to wind special coils, the fact that the Hazeltine Neutrodyne principle may be applied with ordinary standard plug-in coils of low self-capacity will be much appreciated.

High Selectivity

Maximum selectivity, without the use of wave-traps, which, to a certain extent, rob one of signal strength on distant stations, was the ideal aimed at. The set was to be capable of working a loud-speaker on several of the B.B.C. and Continental Stations, and to get them all on 'phones with as little interference as possible.

As a particularly selective commercial double-circuit tuner was available, it only remained to design a suitable amplifier. It was decided that this should be of the usual very popular and most useful all-round combination, namely, 1 H.F., detector and 1 L.F. valve, and that any combination of valves should be possible without complicated switching, which in the H.F. side of any set usually gives rise to unwanted complications and is often the cause of much trouble difficult to eliminate.

Previous experience had shown that, though quite good, potentiometer control of the H.F valve was not all that was to be desired, and it was decided to use the neutrodyne principle by which all grid to plate capacity in the H.F. valve may be neutralised and the bugbear of self-oscillation in this valve completely combated without any loss in efficiency, as when stability is gained by increasing the damping or allowing grid current to flow by use of a potentiometer across the low-tension supply to make the grid a certain amount positive with respect to the negative end of the filament.

The Circuit

Fig. 2 shows the theoretical circuit finally decided upon, connections to the tuner and amplifier units being shown in dotted lines.

From this it will be seen that provision is made for using different values of high-tension voltage on each valve, so that the valve most suitable for its particular function may be used and worked under the best conditions. In addition, suitable grid bias is provided, so that a power valve may be used in the low-frequency side for loud-speaker work, thus improving both purity and volume.

The right-hand side of Fig. 2 shows the theoretical wiring diagram of the amplifier which it is the purpose of this article to describe, and from this the simple expedient adopted to get any combination of valves can easily be seen.

To use H.F. and detector 'phones are inserted between the terminals T5 and T6, and the last valve is switched off on its rheostat R3, the connection from the grid condenser being plugged into the point X2 (Fig. 2).

Detector Alone

The detector alone is obtained with the 'phones in the same position, but the grid connection plugged into X1 and V1, switched off on its rheostat R1. In this case it is necessary to reverse the reaction leads. This is easily

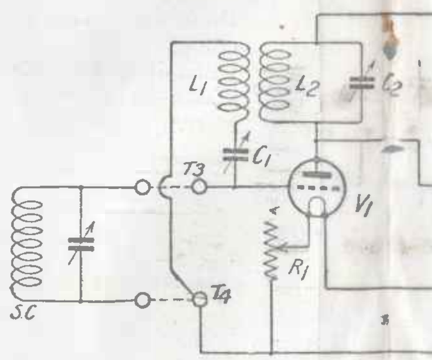


Fig. 1.—Showing the Neutrodyne portio
for adjustment of

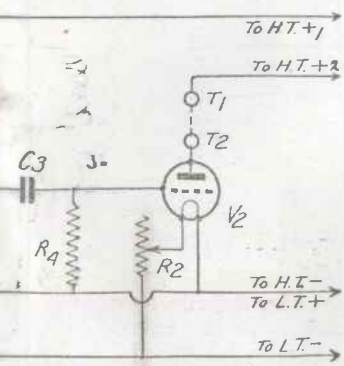
Receiver on he Principle -in Coils

DOWN.

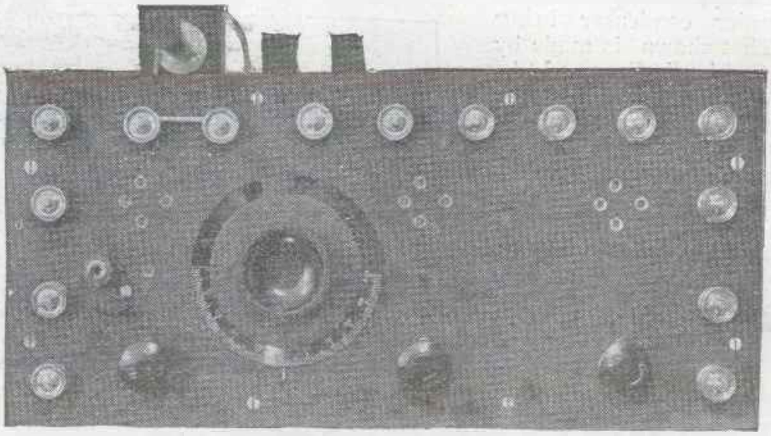
's Weekly" of Sept. 5th. 1923, Cowper, M.Sc.

accomplished by connecting the terminals T1 and T2 on the amplifier to terminals T2 and T1 on the tuner, respectively.

When it is desired to use the L.F. valve, T5 and T6 are shorted and the 'phones or loud-speaker connected in the plate circuit of the valve V3 between the terminals T14 and T15. Thus it can be seen that any combination of valves may be obtained with ease. It will be noticed that the condenser C4 (Fig. 2) is connected to the side of the transformer going to H.T. + and to terminal T5. This puts the fixed condenser C4, which should be about .002 mfd., across the 'phones when using the detector alone or with the high-frequency valve, and acts as a by-pass condenser for the radio-frequency currents, so that reaction may be smooth and easily obtained. The fact of the primary of the low-frequency transformer being in series with the 'phones has not been found to noticeably affect the signal strength.



n of the circuit, and connections Neutrodyne.



Plan view of panel.

Reaction

Reaction is obtained from the plate circuit of the detector valve V2, the connections to the tuner being taken to terminals T1 and T2 on the left-hand side of the panel, the reaction coil being coupled to the secondary circuit, as shown in the theoretical circuit of Fig. 2.

The terminals T3 and T4 are the input terminals of the amplifier, the former being connected to the grid of the high frequency valve V1 and also to X1, which consists of a valve socket, and the latter to the negative side of the low-tension battery, so that the grid of this valve is given full negative potential through the secondary coil of the loose-coupled tuner.

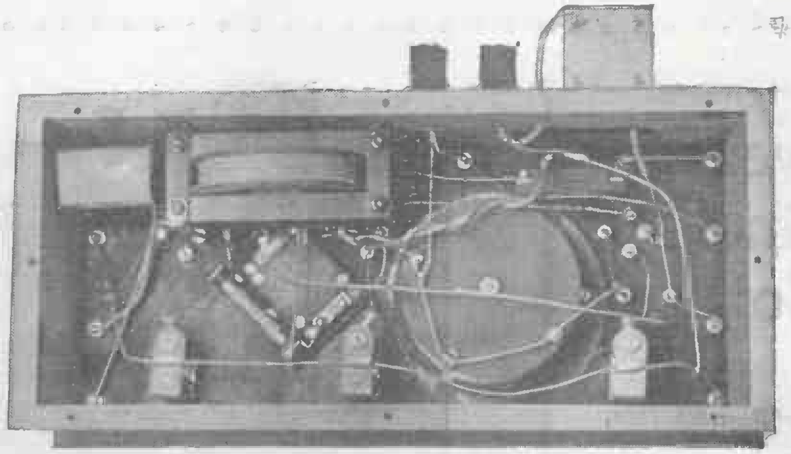
Referring again to Fig. 2, it will be seen that the plate of V1 is connected to another valve socket X2, located as shown in the photograph, and to one side of the tuned anode circuit L2 C2, the other side of this circuit being taken to a suitable H.T. tapping via terminal T7.

Reason for Neutrodyne

In practice, even with no reaction, when the oscillatory circuit L2 C2 is tuned to the same wavelength as the grid circuit oscillations will be generated with the lower end of the secondary coil connected to the negative low tension, and the virtue of this valve as an amplifier of telephony will be lost. This is due to the back-coupling effect of the grid to plate, internal capacity of the valve and magnetic coupling of the wiring handing back the magnified energy from the plate to the grid circuits. If these coupling effects can be neutralised and V1 be worked with its grid fully negative, the valve will then be working on the most suitable part of its curve for pure and efficient amplification. It is here that the neutrodyne method of stabilising V1 scores over potentiometer control.

The Coil

L1 is the neutrodyning coil which is tightly coupled to the tuned anode coil L2, and one end of which is connected through an exceedingly small condenser C1 to the grid of V1 and the other to the negative side of the low-tension battery, which corresponds to H.F. earth potential. The function of L1 is to obtain a back-coupling effect, through the neutrodyning condenser, in opposite phase to that of the grid to plate capacity, which will neutralise the latter, thus giving complete stability, but not at the expense of loss of amplification. This really is a form of reaction, but negative in effect. The coils L1 and L2 are of the same inductance value and are coupled as closely as possible, as will be seen from the photograph, whilst the stabilising condenser C1 has a maximum capacity of only about twice that of the grid to plate capacity of the valve. An especially small and finely variable condenser is here necessary, the ordinary so-called vernier condenser being useless. That shown is made by Messrs. Gambrell Bros., Ltd., and was specially designed for this purpose, a long anti-capacity handle being fitted, obviating hand-capacity effects.



Interior view of cabinet and wiring.

List of Parts

One mahogany cabinet, 11¾ in. × 5¼ in. × 3¾ in., with detachable base.

One ebonite panel, 12 in. × 5⅝ in. × ¼ in.

One variable condenser with ebonite end plates .00025 mfds (Gambrell Bros., Ltd).

One stabiliser condenser (Gambrell Bros., Ltd.).

One grid condenser .0002 mfds fixed.

One grid leak, 1.5 megohms.

One by-pass condenser, .002 mfds.

One Mansbridge condenser, 1 mfd.

One intervalve transformer (4—1 ratio), (Western Electric Co., Ltd.).

Three T.C.B. filament resistances.

Fifteen 4 B.A. W.D.-type terminals with nuts and washers.

Twelve valve sockets.

Two Clix with nuts or two more valve sockets.

One complete Clix.

One 4 B.A. ½-in. countersunk screw with nut.

Eight ¾-in. No. 4 wood screws.

Two coil blocks.

Sixteen gauge tinned copper or square section wire.

Twenty gauge tinned copper wire.

One length insulating sleeving.

General Design and Lay-out

The amplifier is contained in a cabinet of the dimensions given above, the valves, condensers and filament resistances being conveniently mounted on a horizontal ebonite panel. This allows a suitable overlap all round the cabinet, giving a neater appearance than would be obtained if this were flush with the sides. The particular size was chosen to conform with that of the tuner unit. The bottom of the cabinet is fixed by means of suitable wood-screws and is detachable, as the wiring has to be completed from the underside with the panel in place. The intervalve transformer is mounted on the side of the case, as are the two coils and the stabilising condenser. This arrangement makes the instrument very compact and the leads short; no detrimental interaction effects are obtained, due to the closeness of the components. As can be seen from the photograph, all terminals are situated at the back and sides, leaving the front of the panel clear for easy adjustment of the three filament resistances and the tuned anode condenser. This particular arrangement places the coils and neutrodyning condenser as far remote from hand capacity effect as possible.

The functions of these terminals are as below:—

T5 T6—'Phone terminals—shorted when all valves are in use.

T7—H.F. H.T. tapping to high-tension battery.

T8—Detector, H.T. tapping.

T9 and T10— + and – grid volts—may be shorted if low H.T. supply and no power valve is used.

T11—H.T. tapping to low-frequency valve.

T12—Is a common terminal to –H.T. and + L.T.

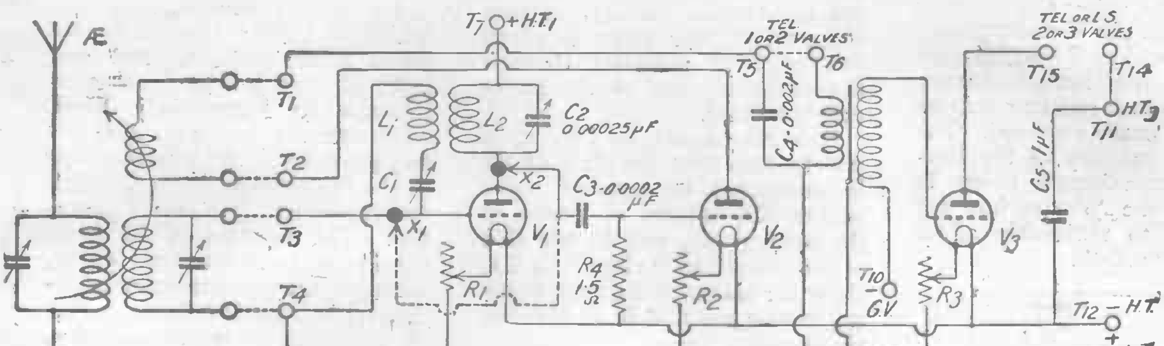


Fig. 2.—Complete circuit diagram, including tuner (a separate unit).

T13—On right-hand side of panel is L.T.—.

T14 and T15—Telephone terminals.

The function of the four left-hand terminals has already been given, being merely input and reaction terminals, linking up with the tuner.

The position of the three valves and the tuned anode condenser C1 may readily be seen from the photographs. The tapping from the grid condenser C3 is brought through the panel in front of the high-frequency valve by means of a flex lead through the panel, connected below to a stiff lead soldered for rigidity to a 4 B.A. countersunk screw held by a nut below the panel. X1 and X2 may be either valve sockets or Clix connectors, into which the Clix plug on the flexible lead is plugged. The left-hand one allows the detector or detector and low-frequency valves to be used, whilst using the right-hand socket brings the high-frequency valve into circuit. The three filament resistances at the front of the panel are T.C.B. type, suitable for bright emitters, but the dull-emitter type may be substituted if desired. These were chosen on account of the small space they require below the panel. The transformer coupling the detector and low-frequency valves is made by the Western Electric Co., and on account of its size is mounted on the side of the cabinet, wood screws being used to hold it. The two coil blocks are also mounted on the same side of the cabinet, and should be so spaced as to allow the anode and neutrodyning coils to be almost touching. Distance between these two blocks should only be fixed when it is decided what coils will be used; close coupling has been found to give the best results, and no advantage is gained by making this variable. The blocks used on the instrument are of the type to take double-plug coils, but so that any type of coil may be used, plug and socket type may be substituted. These are fixed by 4 B.A. screws through the side of the box.

The grid condenser and clips taking the leak may be fixed with screws through the panel. The by-pass condenser and that across the high-tension battery are held in position by the wiring, which is sufficiently rigid to obviate any other method of fixing. On referring to the photograph of the wiring it will be seen that certain leads are twisted together, one being covered with insulating sleeving. This tends to prevent a certain amount of interaction, but may only be carried out in the case of reaction coil and telephone leads.

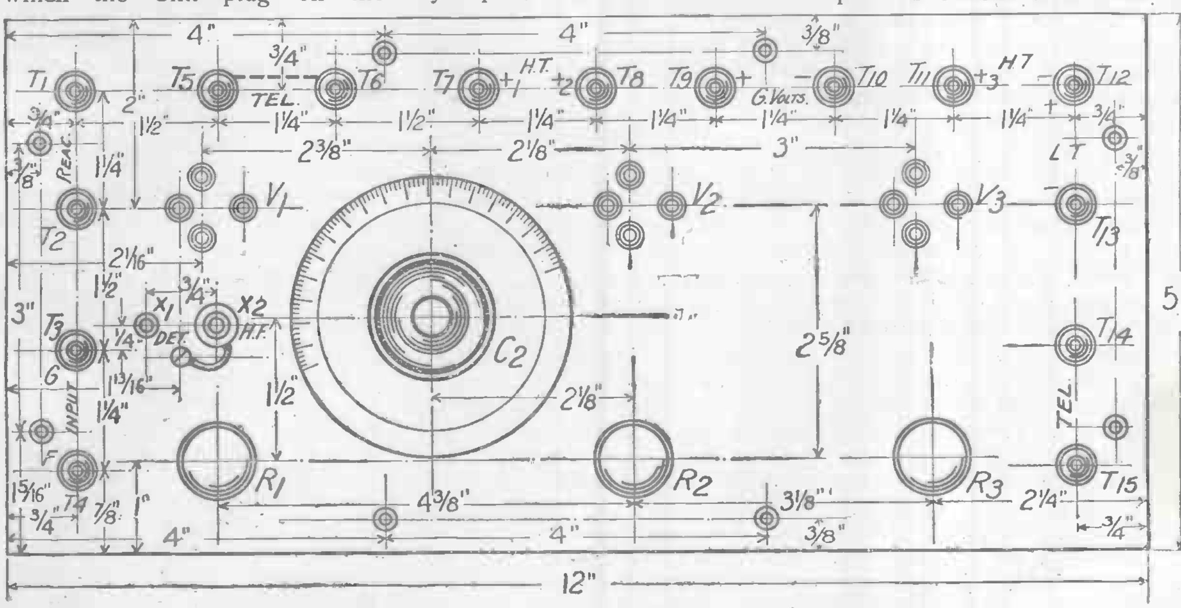


Fig. 3.—Drilling lay-out and terminal markings.

Wiring

Wiring is mostly carried out in 16 gauge bare tinned copper wire of circular section, since this is easier to bend to the desired shape than square section wire, and is sufficiently rigid where only short leads are used. Very short leads have been carried out in 20 gauge wire.

The best procedure to follow is first to make all possible connections to the components mounted on the panel, a length of wire being joined to any terminals which are not already joined to any of the components. These wires should be left for the moment free. Next solder short lengths of 20 gauge wire to the four terminals of the transformer. These are to facilitate connecting this in circuit when the panel is screwed into position in the cabinet. Connections should be similarly made to the coil blocks. Having wired the panel and the components on the side of the case place the panel in position and screw to the case, the bottom of the latter being removed. After this the final connections can be made to the coils and transformer with ease. A refinement which I have not before mentioned is that of fitting a screening disc between the ebonite end-plate of the condenser and the panel. This is connected to the point of lowest potential (i.e., H.T.+). Whether this is done or not care should be taken to see that the moving vanes are connected to H.T.+ to lessen hand capacity effect.

(Further constructional details and test report will appear in our next issue.)

How Every Crystal User may become a Valve Expert

By E. REDPATH, Assistant Editor.

Practical details of a Receiving Set comprising a high frequency amplifying valve and a crystal detector.

Continued from last week's issue.

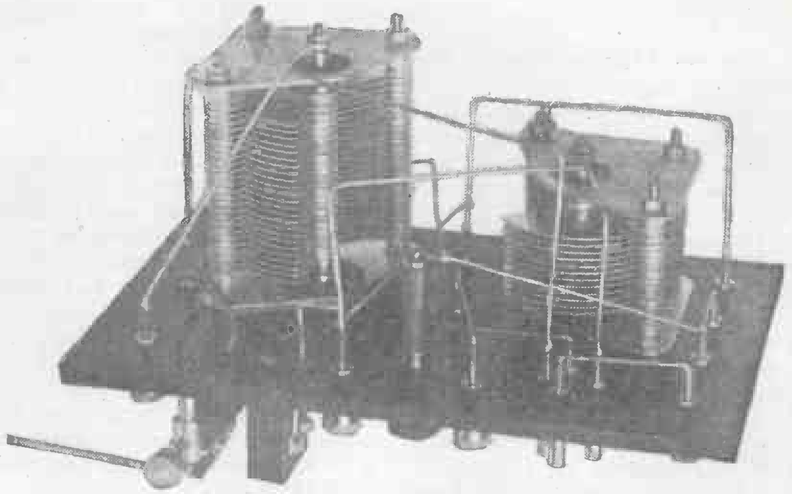


Fig. 7.—A view of the underside of the panel.

Constructional Details

The containing box measures 9 in. by $5\frac{3}{4}$ in. by 5 in. deep, and as it is of a type illustrated in this journal on several occasions, a dimensioned drawing is considered unnecessary.

The ebonite panel measures 9 in. by $5\frac{3}{4}$ in. by $\frac{1}{4}$ in. thick, and, after the original and frequently conductive polished surface has been removed by the use of the finest emery or carborundum cloth applied to both front and back of the panel, it is to be drilled to take the various components as indicated in Fig. 6.

The photograph, Fig. 7, shows the arrangement of those components which are fitted underneath the ebonite.

Full details of the wiring will be gathered from Fig. 8, which is a complete back of panel wiring diagram. For convenience in wiring, HT– is connected to LT–. If desired to add an amplifier having HT– connected to LT+, these connections in the present set should be made to correspond.

Operating the Set

The conditions which will give the best results are as follows:—

(1) The aerial circuit must be exactly tuned to the desired wavelength.

(2) The closed oscillatory circuit (or tuned anode circuit) must be exactly in tune with the aerial circuit.

(3) The coupling between the anode coil and the aerial coil should be such that the set is just a little short of oscillating.

With a very sensitive catwhisker type of detector, it will sometimes be found that self-oscillation commences as soon as the second condition has been attained. If this is experienced and a reduction of high-tension voltage does not effect a cure, try reversing the filament lighting battery connections. If self-oscillation still persists, it will be necessary either to obtain a less sensitive setting of the detector or to reverse the anode coil L2 and apply reverse reaction to check the self-oscillation. In the last-named contingency, the filament battery connections should be restored to their original positions.

To enable different stations to be tuned in readily, the ideal method is to calibrate the closed circuit by means of a wavemeter, bearing in mind that any subsequent variation of coupling between the anode coil and the aerial coil will alter the adjustment appreciably. In other words, the calibration will only be accurate with the coupling adjusted as when the wavemeter was used.

Searching for Signals

In the absence of a wavemeter, search for signals by setting the two coils at an angle of from 30 degs. to 45 degs., and the aerial tuning condenser to about one-half its capacity, Then vary the capacity of the anode condenser C2 and note at what point a slight breathing sound in the telephones indicates that the two circuits are in resonance.

If no such point is observable, tighten the coupling between the coils slightly and repeat the operation. Next, vary the aerial and secondary condensers simul-

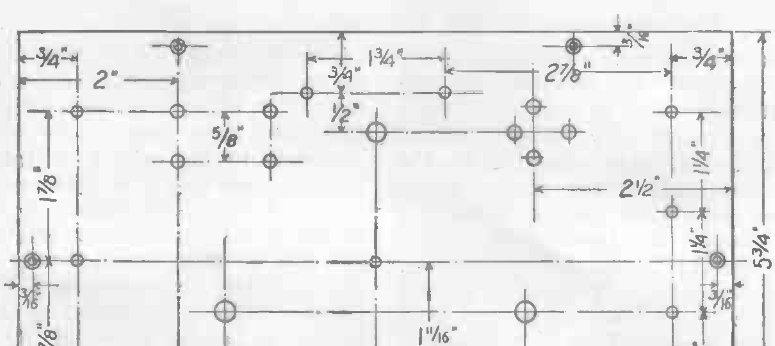


Fig. 6.—A drilling diagram of the ebonite panel.

taneously, always endeavouring to keep the two circuits in tune with one another. When faint signals are heard, increase the reaction coupling slightly and carefully re-adjust both condensers, and, if necessary, the crystal detector, until satisfactory results are obtained.

It will be found that there is a certain and comparatively loose coupling between the coils L1 and L2, which gives the best results, both as regards signal strength and selectivity.

As already mentioned, this self-oscillation difficulty may be encountered when a particularly light and sensitive setting of the crystal detector is obtained, owing to the reduced damping effect. It thus becomes a matter for experiment to determine the adjustment of the crystal detector which gives good rectification (evidenced by the purity of the speech, etc.) and which "damps" the anode circuit sufficiently to prevent self-oscillation.

It is probably more satisfactory in practice to have appreciable, and even unnecessary, damping due to the crystal detector, and to compensate for it by the judicious use of the reaction coil, than to employ some artificial means of counteracting a strong natural tendency to self-oscillation.

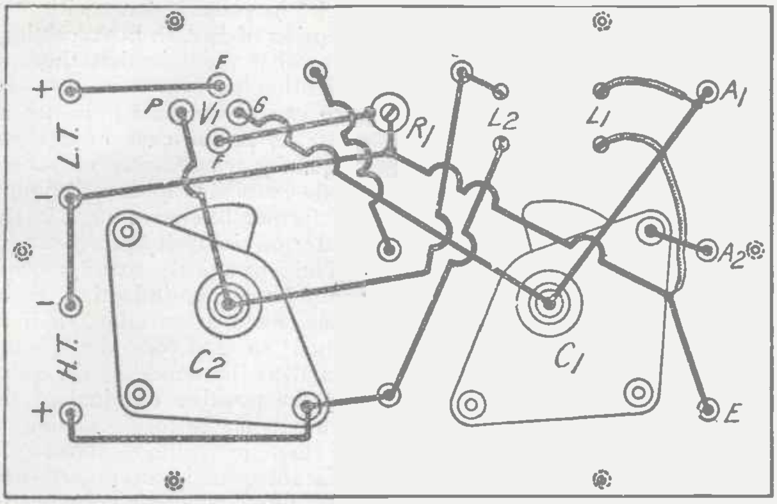


Fig. 8.—Wiring diagram of the valve and crystal receiver.

Alternative Arrangements

In the set just described, the amplified oscillations in the tuned anode circuit of the valve are applied direct to the crystal detector and telephones. The coupling between the detector circuit and the tuned anode circuit, therefore, is *conductive.*

In such an arrangement the comparatively rapid rate at which energy is absorbed from the anode circuit by the crystal detector and telephones; in other words, the "damping effect" of the detector circuit, tends to maintain the stability of the complete circuit arrangement. But for this damping effect, self-oscillation would be almost certain to occur immediately the anode circuit was brought exactly into resonance with the grid or aerial circuit, owing to the capacity coupling between the elements in the valve.

In this connection, the grid and anode of the valve may be regarded as opposite plates of a very small-capacity condenser connected between the tuned grid and tuned anode circuits.

Inductive Coupling

Instead of the detector circuit being directly connected to the tuned anode circuit, it may be inductively coupled to it, as indicated in the theoretical circuit diagram, Fig. 9.

In this arrangement the coils L2 L3 may be ordinary plug-in coils mounted in a two-coil holder, but, as there is little advantage to be gained by varying the coupling between the coils, they may more conveniently consist of the primary and secondary winding of an air-core high-frequency transformer.

This transformer may be of the almost standard type, consisting of an ebonite former having a circular groove, or grooves, carrying the windings, primary and secondary being sometimes wound in separate grooves, and sometimes in the same one, the complete component being provided with four brass pins arranged to fit a standard valve holder and thereby affording a ready means of connecting the transformer in circuit, or of changing it when desired to receive over a different range of wavelengths.

Alternatively, the transformer may consist of basket coils wound simultaneously upon the same former; of two basket coils lightly bound together with tape, or even of an ordinary cylindrical former of ebonite or cardboard carrying two coils, one wound closely on top of the other.

The primary winding (L2) of the high-frequency transformer,

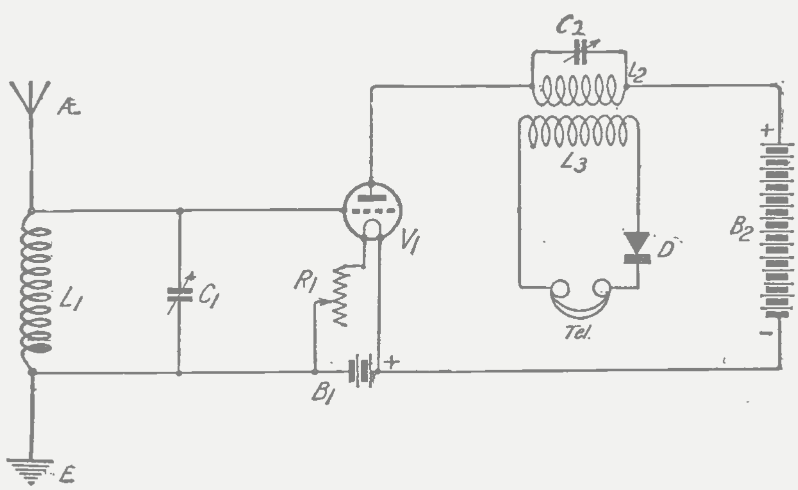


Fig. 9.—A diagram showing a detector circuit inductively coupled to the tuned anode circuit of the H.F. valve.

is included in the anode circuit of the valve and tuned to resonance with the aerial circuit by means of the variable condenser C2. The crystal detector D and telephone receivers T are connected to opposite ends of the transformer secondary winding L3.

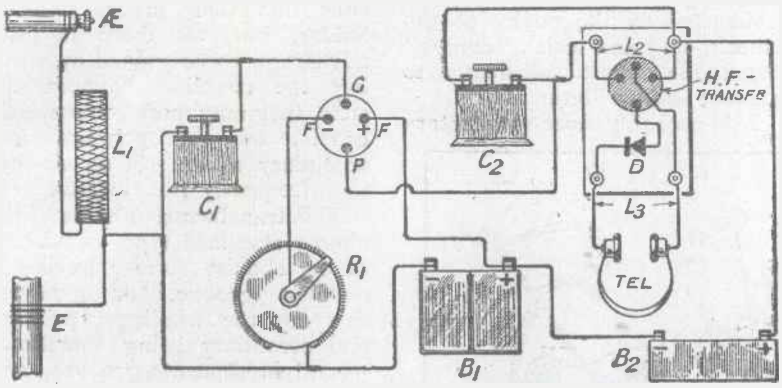


Fig. 10.—A pictorial representation of the circuit given in Fig. 9.

Fig. 10 is a pictorial representation of the circuit shown in Fig. 9, and includes a valve panel with valve holder and rheostat, condensers, a fixed coil holder to take the aerial tuning inductance coil L1, whilst a high-frequency transformer of the plug-in type is shown fitted to four valve sockets mounted upon a small ebonite base provided with the necessary terminals and carrying the crystal detector D.

The Action Involved

Referring to Fig. 9, it will be seen that the aerial circuit is tuned to the desired wavelength by means of the variable condenser C1, the plug-in inductance coil L1 being of a suitable value for the range of wavelengths to be covered. The oscillatory potentials across the variable condenser C1, due to the incoming signals, are applied to the grid and filament of the valve, giving rise to high-frequency pulses of current in the anode circuit, which, provided the tuned anode circuit L2 C2 is adjusted to resonance with the aerial circuit, and that the resistance of the coil L2 is not unduly high, will cause oscillations of considerable magnitude to be built up in that circuit. The energy of these oscillations, or, at all events, the greater part of it, is then transferred by electromagnetic induction to the transformer secondary winding L3 and applied to the detector and telephones connected thereto.

A Further Alternative

Fig. 11 is a theoretical circuit diagram of an arrangement in which a similar type of high-frequency transformer is employed, but in this case the transformer secondary winding is shunted by the variable condenser C2 to form a closed oscillatory circuit, the transformer primary winding L2 being now untuned.

In actual practice there is not a great deal to choose between these two methods, as illustrated in Figs. 9 and 11; at least, not when only one stage of high-frequency amplification is employed Where two or more high-frequency valves are used, the latter arrangement is probably the more satisfactory, owing to the greater stability or freedom from self-oscillation which is usually obtained.

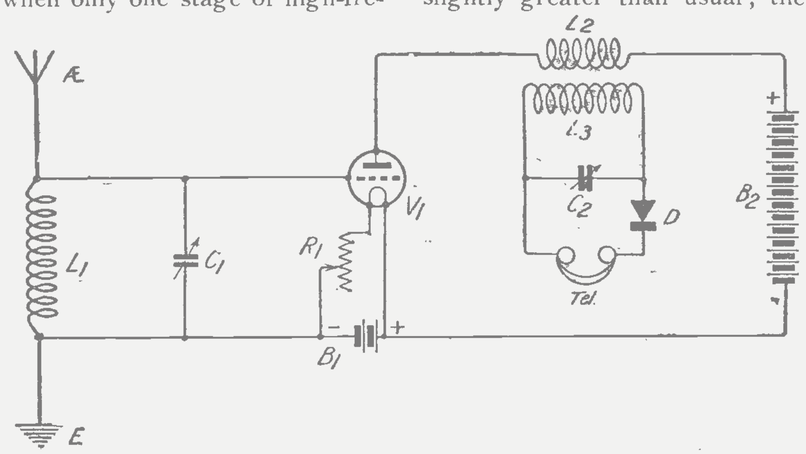


Fig. 11.—A circuit in which the coupling between the anode and detector circuits is effected by means of a high frequency transformer.

Resistance-Capacity Coupling

Referring to the previous articles of this series, it will be remembered that, in addition to the transformer method of coupling two low-frequency amplifying valves, a high resistance could be employed in the anode circuit of the first valve. Similar methods may be used in the case of high-frequency amplification.

Resistance capacity coupling proves fairly satisfactory in a multi-valve amplifier, provided that the frequency is not too high. So far, it has not been found efficient on wavelengths below 800 to 1,000 metres, and accordingly it has not been used much in connection with the reception of British broadcasting.

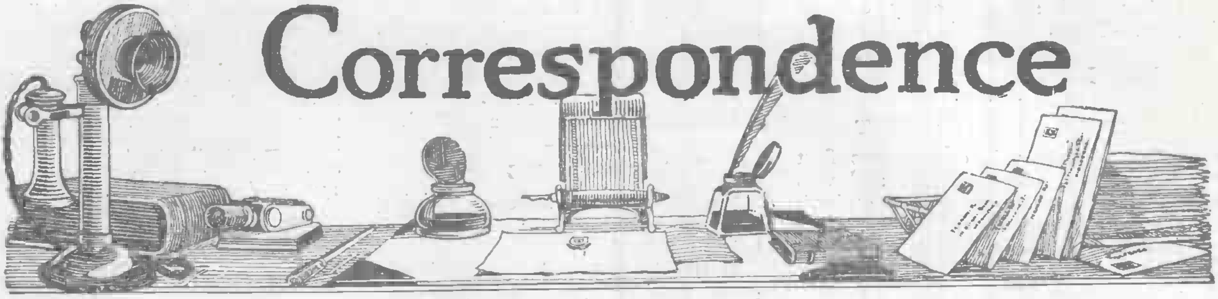
Another point is that the amplification per valve in a resistance capacity amplifier is not as great as in the case of a high-frequency transformer or tuned-anode coupled amplifier, although the former has advantage in the matter of simplicity of operation.

The practical arrangements comprise a non-inductive resistance, fixed or variable, of from 60,000 to 100,000 ohms, connected to the anode of the valve and the positive terminal of the high-tension battery. Owing to the loss in voltage across the resistance, it is necessary that the high-tension voltage be slightly greater than usual; the greater the value of resistance, the higher the voltage necessary.

Between the anode end of the 60,000 resistance and the grid of the succeeding valve is connected a fixed condenser having a capacity of .0003 μF, and the variations in anode potential of the first valve are passed on to the grid of the second, via the condenser.

NEXT WEEK:—
The Valve as a Detector.

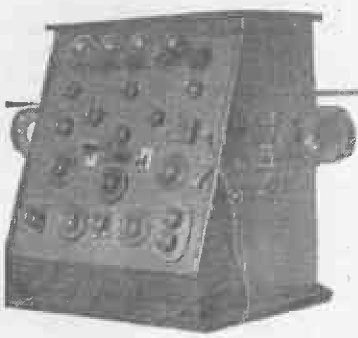
Correspondence



AN OMNI RECEIVER

SIR, You may be interested in the enclosed prints of an Omni receiver which I have constructed.

The panel I had previously in use as a five-valve (2-D-2) set with switches to cut out each valve and also switches for either tuned anode or H.F. transformer coupling. The positions of the valve switches have been taken by one Bretwood and one Lissen variable leak, and two Lissen variable anode resistances, while all other parts have been left as they were except, of course, that their connections have been taken to the terminal board. The various knobs are:—Five filament resistances, two tapped H.F. transformers, one variable condenser .001, 1 – .0003, 2 – .0002, and one vernier, stand-by tune and series parallel switches, two switches to control reaction (the three positions give one direction, off and reverse, so that reaction may be used in either direction with the coils on the left, on the right, both or neither), while the two at the bottom right hand give H.T. control, the upper circle of studs being connected every 9 volts from the negative end of the battery and the lower circle every 3 volts from the positive end. The studs are well spaced and the ebonite plate made flush with their tops, so that the switch arm does not fall between and cause a short. A plug-in crystal detector is also located on the front.



A four-valve Omni Receiver referred to by Mr. Guyler.

As shown, it is wired for three-valves, bare wire being used, and the lid is deep enough so that if required (as in this case), an extra condenser can be put in across the terminals if a size other than those available in the set is required, or in order to reduce the length of the wire connections.

The H.T. connections are taken through the bottom, as both the H.T. battery and accumulator are kept in a cupboard on which the set stands when in use.

Your ST75 circuit on this set, with loose components, and as an enclosed set gives good results here, all the B.B.C. stations being heard well, Birmingham and 5XX being loud-speaker strength. The Continental stations are also good telephone strength.—Yours faithfully,

A. F. GUYLER.

Beeston, Notts.

RECEIVING 5XX

SIR,—I have listened to every evening transmission from 5XX with the following very unsatisfactory results:—

On my crystal set (which brings in several amateurs, Croydon, and, of course, 2LO), Chelmsford is only just readable on one pair of 'phones (Brown's 4,000 ohms).

On my valve set (on which I get all the B.B.C. main stations and Paris), Chelmsford is little better than Birmingham or Bournemouth.

When I say I am very disappointed with these results I think I am only expressing the sentiment of the vast majority of London listeners.—Yours faithfully,

C. P. BROWN.

Clapham Common, S.W.11.

SIMPLE WIRELESS RECORDING

SIR,—With reference to your article in this week's *Wireless Weekly*, *re* "Simple Wireless Recording," I should like to point out that rectification can be obtained as well by another method, without taking recourse to a crystal detector.

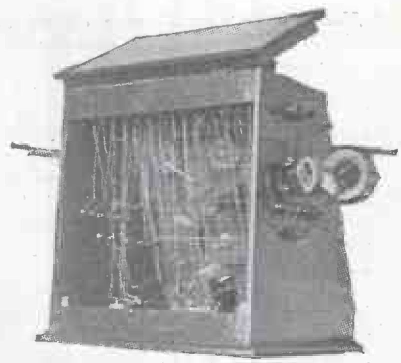
Curiously enough, nobody in England seems to have hit so far at the idea, although it is quite simple. Add a grid condenser (with leak) between outside transformer secondary and grid of each of your amplifying valves. This will give the necessary rectification. Both grid condenser and leak can have the usual value; leaks varying from 1 to 5 megohms.

The credit for this arrangement comes to Mr. J. Corver, the able editor of *Radio Expres*, our principal Dutch wireless weekly. May I suggest that you give this arrangement a trial?—I am, Sir, yours faithfully,

"DUTCH EXPERIMENTER."

Baarn (Holland).

NOTE.—This method, of course, does not get rid of the steady anode current on which the rectified pulses are superimposed. If a telephone transformer is connected in circuit the current becomes alternating once more. The method described in *Wireless Weekly* has the advantage of getting rid entirely of the anode current.—P. W. H.



This photograph shows the wiring of Mr. Guyler's receiver.

THAT PERSONAL TOUCH

SIR,—On the night of the 13th ult., whilst simultaneously devouring huge chunks of *Wireless Weekly* and charging accumulators, I was drawn from your valued paper by the remarks of Mr. Harris and several correspondents on the subject of frothing, to one of my own accumulators, which suffers from this disease, and decided to give the suggestion a trial. Very carefully I cut one small piece of nice, juicy "Sunlight" and popped it in t'ole at top.

I know it was the 13th, but all the same if "Levers'" of "shaving stick" fame want a better advert. than they have so far produced, let them communicate *avec moi*.

There is plenty to spare even after bottling a three weeks' supply of lather, and shaving every day at that.—Yours faithfully,

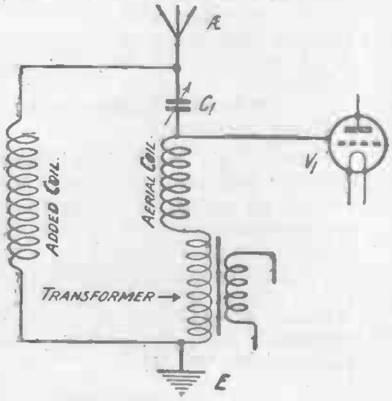
E. L. Payne.

East Ham, E.

ST100 STAR CIRCUIT

Sir,—When this circuit was first brought out I made it up, and was able to get excellent results on both the loud-speaker and 'phones. For reception of the local station it was certainly good, and I was very pleased with it.

On reading the experiences of others and the distant transmissions that they received, I began to feel



How the extra coil was added to the set referred to by Mr. Shylon.

disappointed, because try as I might, I could not get anything except the local station. I tried various kinds of crystals, and re-wired the set several times, but without result; I might add here that this was the experience of many of my friends, with the same circuit, and with the ST100.

Quite by accident I placed a coil between the earth and aerial terminals as sketch herewith, and with that addition I am able to get all the B.B.C. and Continental stations at very good strength.

The size of this coil varies with the wavelength it is desired to be received, and for the B.B.C. stations a No. 35 or 50 appears the most suitable.

With the coil in position loud-speaker results are much improved, the coil appearing to add volume of tone without distortion.—Yours faithfully,

John Shylon.

Cardiff.

AN INTERESTING SET

Sir,—I enclose a photograph of my own receiver, on which all the B.B.C. and several well-known Continental stations have been received; a few American stations have also been heard. The circuit is a perfectly straight one, consisting of 1 H.F., detector and 2 L.F. power valves. Certain minor alterations have been made since the photograph was taken, the borough lighting mains now being used as a source of H.T.—Yours faithfully,

A. J. Thornton,

Battersea. 2 A.N.B.

FROTHING

Sir,—*Re* correspondence relating to frothing of accumulators when being charged.

It has been stated that Hudson's soap powder may be harmful; whether this is so I do not know.

In many biochemical examinations, in which it is necessary to bubble air rapidly through fluids, and at the same time prevent frothing, a drop or two of caprylic alcohol is added. This liquid is entirely inert in the numerous instances in which it is employed. I do not know whether it would be without action on the celluloid cases of accumulators. It does not mix with any watery fluid to which it is added but floats on top. Perhaps some of your readers would care to try it.—Yours faithfully,

Eric Wordley, M.D.

Plymouth.

THE ST151 CIRCUIT

Sir,—Last week I built up the ST151 circuit, and was astonished at the results obtained, viz.: All B.B.C. stations at good strength, several at loud-speaker strength, London, of course, overpowering; Radiola could be heard 20 ft. away from loud-speaker; was just enjoying same when my detector valve went

A handsome receiver made by Mr. Thornton.

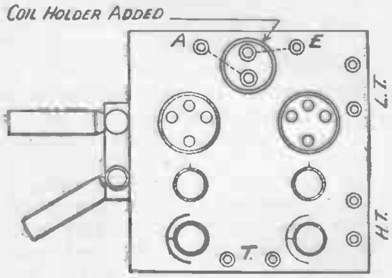
west. Decided to build ST100; results terrific; London so strong that I must detune to avoid overloading; Bournemouth, Birmingham, Cardiff and Glasgow received in one evening to be comfortably heard on speaker; Radiola as loud as ST151. My aerial is about 20 ft. high, 30 ft. long, single wire, very much screened. My first valve is an Ediswan A.R., and the second a Moorhead. L.T. 6 volts, H.T. 130, grid bias 2 volts.

Hoping this interests you and congratulating you upon evolving such circuits,—Yours faithfully,

West Ham. H. Hevey.

A SINGLE VALVE CABINET RECEIVER.

Sir,—*Re* Mr. Azer's letter in *Wireless Weekly* for July 23, dealing with results obtained with your



The position of the extra coil-holder on Mr. Shylon's receiver.

one-valve reaction set designed by Mr. Rattee.

I have had a one-valver in operation for some time now that was somewhat similar to this particular set, and, upon publication on June 18 of your set, I made the one or two necessary alterations to bring my set in line with your circuit. Results as follows: All the B.B.C. main stations (with Birmingham the easiest to get after London), 5XX, Radio-Paris, Ecole Sup., Petit Parisien, Radio Belgique, Madrid, Hamburg, and several other foreigners that I have been unable to locate. I use an ordinary set of basket coils, Raymond V. condenser, E. Bell grid condenser, Lissen V. leak, microstat Resis., and Osram 4-volt valve. The placing of the various parts is somewhat different to that of Mr. Rattee's set, and I do not use a phone condenser; but, for all that, I must say the results obtained are excellent, and certainly more than one would expect from a simple one-valver. Of course, some stations are rather difficult to hold without distortion—Madrid and Hamburg especially, but the majority mentioned come in at more than comfortable phone strength.

My set is made up sloping desk cabinet style with the movable coil-holder mounted horizontally on the top, which position I consider much more useful than on the panel, and furthermore I think it improves the appearance of the set. If you would care for a photograph of my set I will send one with pleasure.

I would very much like to see you put into operation in your journal the suggestion I made some weeks ago by letter *re* the corrections of errors in previous issues.

Here is a tip that might be of use to your readers who are beginners. When the panel is drilled, and all terminals mounted and screwed up in position, I usually write upon the panel back the name of the terminal in *white ink* just at the side of it—such as H.T. +; A.T.I.; Reaction, etc., etc. This certainly minimises the danger of wiring on to a wrong terminal.

With best wishes for your continued success, I am, sir, yours faithfully, W. G. L.

Wandsworth.

AERIAL HINTS

SIR, — With reference to an article on "Two Aerial Hints" in your July 23, 1924, issue, the following small practical hint may be of interest to those who employ ordinary rope for spreader and down lead guys.

A great difficulty with using ordinary household rope for guy purposes is the contraction which takes place during wet weather, and to those who desire a "ship-shape" aerial system with tight guy ropes, it generally happens that during a heavy shower one has to slacken these ropes or else one is confronted with broken ropes; usually with wireless luck they break during the night. However, the insertion of a small spring at the earth end of each guy rope usually well repays itself. Suitable springs about six inches long and one-inch diameter may generally be obtained at most ironmongers for about threepence each, so this need not worry the installer. During dry weather the guy is tightened so that the spring is just under tension, and it is found that any contraction due to the rope is compensated for by the spring.

The application is by no means original, but does not seem to have been brought forward, and in my case I have not experienced a broken guy since they were put in eighteen months ago. I once took the trouble to measure the expansion of the spring after 24 hours' practically continuous rain, and the six inches had become eleven! The same spring and rope are still there, but had it not been for the former the latter certainly would not have been.—Yours faithfully,

DAVID G. BIRD.

South Shields. 5QR.

"TRUTH IN ADVERTISING"

SIR,—We have read with much interest your editorial in *Wireless Weekly*, July 23 issue, and note your remarks *re* incorrectly rated condensers.

Realising the importance of absolute reliability in radio apparatus, the Sterling Telephone & Electric Co., Ltd., installed in their works at Dagenham testing rooms equipped with the most accurate measuring instruments possible to obtain. Here every variable air condenser (as well as other radio components) manufactured by the company and bearing the well-known Sterling trade mark, is subjected to rigorous tests and is not passed into stock unless it is of full-rated capacity. Moreover, the fact that Sterling square-law condensers are themselves being largely used in radio laboratory measuring instruments is sufficient proof of their reliability.

The Sterling Telephone & Electric Co., Ltd., guarantees all its condensers to be of full-rated capacity, and would welcome your careful and impartial examination of any condenser taken from our stock.—Yours faithfully,

for Sterling Telephone & Electric Co., Ltd.,

GUY BURNEY,
Managing Director.

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

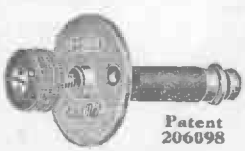
An Effective Small L.F. Transformer

A rather better performance than is customary with the small type of low-frequency intervalve transformers is shown by that sent us for trial by Messrs. L. McMichael, Ltd.

This measures only $2\frac{3}{4}$ in. by 2 in. by $2\frac{1}{8}$ in., and is of the ordinary pattern with a core of stampings with narrow air-gaps; brass angle-pieces which act as fixing-brackets and really large terminals on ebonite strips are provided. We note that the bolts which hold the parts together pass through the laminations, effectively short-circuiting them for eddy-currents in the usual manner. The iron core is of medium size; and the D.C. resistance indicated that there was plenty of wire in the core.

On test, the insulation-resistance to 500 volts D.C. from the "Meg" tester was satisfactory for primary-to-secondary and secondary-to-frame, and sufficient for ordinary purposes for primary-to-frame. In actual reception, while the amplification attained under the most favourable conditions could not approach that of a standard large transformer, being about $4\frac{1}{2}$ as compared with 7 when using power amplification, and a suitable valve and grid-bias, the tone was good, with but little distortion, even the notes in the lower register being reproduced well. The thin tinny or muffled sound of the average small L.F. transformer was absent.

The finish and workmanship of this transformer are of a high order. We can recommend this instrument to those who do not wish to invest in a large instrument, but who desire to get a satisfactory performance from their sets, together with a moderate amount of L.F. amplification.



"Fitton One" B.B.C. Single-Valve Receiver

Messrs. Shermays, Ltd., have sent for practical trial a single-valve B.B.C. receiver, the "Fitton One."

This is a small variometer-tuned set, arranged on a horizontal panel 8 in. by 6 in., the box being only 3 in. deep. The controls are an aerial-tuning variometer and a reaction-handle. The latter should be used with considerable care by the novice, as the set is capable of producing considerable re-radiation. The usual terminals are provided for connections to batteries, phones, earth and aerial.

The effective wavelength range, on a large double outside aerial, was 320 to 500 metres; on a single 70-foot aerial 310 to 480 metres (therefore not reaching Aberdeen's wavelength on the latter). The makers put forward some ambitious claims as to signal-strength and range, a special point being made that all broadcasting stations were within reach on a standard P.M.G. aerial and reasonably efficient earth—which, of course, experienced experimenters will recognise as within the powers of any properly handled single-valve receiver under favourable conditions, though not always attained on conventional B.B.C. sets.

With the circuit used, and with the type of variometer implied by the small dimensions of this receiver, much selectivity could not be expected; at 13 miles from 2LO, on a standard P.M.G. aerial of considerable efficiency, London came in at very modest loud-speaker strength (R.M.S. value of signal-voltage across the phones, time-average for ordinary music, .24 volts); whilst he was audible in the L.S. from 330 to 380 metres wavelength, on head-phones over the entire tuning-range. Thus every station, even Birmingham at 100 miles on 475 metres, was jammed effectively by the local station. Bournemouth was badly jammed by London; Birmingham, even on the low 70-foot aerial, suffered interference from 2LO, though on the large aerial he was just audible in the loud-speaker. On the 70-foot 2LO covered a belt of 8 metres. Manchester was just picked up in the intervals; Cardiff came in well in London, though, of course, at low intensity and with careful searching with a wave-meter.

The quality on these distant transmissions was noticeably poor, being mushy and with a noisy background. It was noticed that better results were obtained on the local station by arranging the L.T. connections in the more usual manner, with the L.T. plus connected to earth.

We do not think that any useful purpose is served by inviting comparisons between the performance of this small single-valve reaction receiver and that of a four-valve set of conventional design. Those who draw such invidious comparisons can never have heard the merry shout of an efficient four-valver. The precarious signals of small intensity obtainable with the single-valve on the distant stations are of a very different order. Nevertheless, we can commend the style and performance of this little set, which is decidedly a step in the right direction towards making an easily-controlled and simple one-valve B.B.C. set with a wide tuning-range on a single control. In the hands of a novice it will probably give very much better results than a more ambitious outfit, and it certainly brings more than one B.B.C. station within easy reach.

"Radiobrix" Vario-Transformer

From Messrs. Metropolitan-Vickers Electrical Co., Ltd., comes a Vario-Transformer, Type R.B.4, one of the Cosmos Radiobrix series of units.

The unit is about 5-in. tube, has a wavelength control, reaction-control and six terminals for connecting up between two valve panels carrying H.F. amplifying and detector valves, and for reaction-connection to the plate of the rectifying valve; two or more can be used in cascade also, if desired.

The effective range was found to be from 350 to 700 metres, covering thus the main B.B.C. stations.

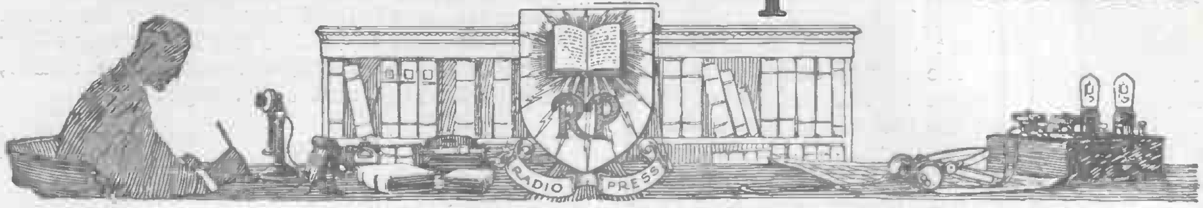
The principle of the instrument combines the ordinary tuneable close-coupled H.F. transformer with the variometer method of tuning; in this pattern the primary winding is semi-aperiodic and fixed, whilst the secondary winding is partly wound in close coupling with the former, partly wound in grooves in a rotor which turns inside the ring-shaped stator that carries the first windings. A small fixed condenser across the whole secondary winding, together with the not inconsiderable distributed capacity of the fine-wire windings, enables this variometer arrangement to give the requisite tuning-range. The effect of the fixed and almost aperiodic primary is somewhat reminiscent of the properties of the Grebe circuit. On trial an unusually high degree of stability was found, even with quite a small series condenser in the aerial and critical tuning, and without damping bias on the grids of the valves. Reaction is applied on the windings by a swinging reaction-coil to be included in the plate-circuit of the next valve, as usual.

On practical trial, the unit was found convenient in use, and uncommonly stable, as indicated. Actually, a series condenser of less than 0.0002 μF could be used in the aerial, without oscillation troubles. The degree of amplification obtained, when actually measured with good R valves, was about of the order usually found with conventional H.F. couplings. Selectivity was not very high; Bournemouth and 2LO (the latter at 13 miles) came in in London at about equal strength, with a direct-coupled primary circuit of low resistance, but no great selectivity in itself. Birmingham was free from London, but was jammed by much mush. Searching was fairly easy, as the scale graduations were readily calibrated in wavelengths.

The general workmanship and finish of this unit were, of course, of the order one would expect from a maker of the reputation of Messrs. Metropolitan-Vickers.

We are informed that on and after August 4th all correspondence to Messrs. Cunningham & Morrison should be addressed to Windsor House, Victoria St., S.W.1.

Information Department



SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

A. V. T. (MONMOUTH) enquires whether it matters in which direction he winds a reaction coil, stating that he has seen it said that if the tuning coil is wound clockwise the reaction coil should be wound anti-clockwise.

The direction of revolution of the current in flowing through the windings of the reaction coil in relation to the corresponding direction of flow of the signal currents in the aerial or other tuning coil must be in a certain sense to produce reaction effects, but this direction will vary with the number of valves which precede the one from which reaction is taken. There is no hard and fast rule as to clockwise and anti-clockwise.

J. R. C. (BLACKPOOL) asks if it is necessary for the frame aerial and receiving apparatus to be in the same room?

No; the frame may be at some little distance from the set. The leads connecting the frame winding to the receiving apparatus should not be unduly long, however, or, by reason of the capacity between them if run close together and of their inductive value if well separated, they appreciably reduce the efficiency of the frame aerial. Incidentally, long connecting leads will act to some extent as an ordinary type of aerial, and will reduce the accuracy of the frame as a direction-finding device.

A. T. V. (STOCKPORT) states that he has been informed that no earth connection is required with a frame aerial, and states that he does not quite see how any aerial system can function with no balancing capacity attached to the earth terminal of the receiver.

The explanation is that a frame aerial circuit is a complete tuned circuit in itself, a variable condenser being shunted across the ends of the frame windings. Leads are then taken from the two ends of the tuned circuit thereby formed to the aerial and earth terminals of the receiving set.

T. N. M. (HARROGATE) states that he is using a set with two high-frequency valves, rectifier, and two low-frequency and that he is very much troubled by hissing noises which persist (although diminished in strength) when the aerial and earth are removed from the set. He suggests that this indicates that the trouble is somewhere in the set, but states that the fault was only intermittent. By "intermittent" he means that he only hears it on one or two occasions in a week's use of the set.

Although the trouble may certainly be in the receiving set itself, we are very much inclined to think, from our correspondent's description, that it is really atmospherics which are troubling him. With a good set, employing two high-frequency valves, on a bad night for atmospherics, quite a lot of noise will be picked up without the aid of aerial or earth, and this, of course, is somewhat misleading. Try turning off the filament supply to both the high-frequency valves, and note whether the noise continues. If it does so it is fairly clearly located in the circuits of either the rectifier or the low-frequency valves, but if it ceases it may indicate either that our suggestion is correct as to the atmospherics, or that the fault is located in the circuits of the two high-frequency valves. Probably the best test to apply in a case of this sort is to use a second receiving set upon the same aerial and earth, and note whether it still picks up similar noises upon the nights when you are experiencing trouble.

A. B. G. (CHARLTON, S.E.7)—States that he has constructed an ST100 Receiver from Envelope No. 1, and is getting exceedingly good loud speaker results from 2LO, but is quite unable to pick up any other station. He is using a single wire aerial, only 35 ft. long and 13 ft. high.

Upon so poor an aerial there is little chance of picking up one of the other stations with your set, and the inevitable preliminary to searching for them is the erection of a much higher and longer aerial. When this has been done, you will have a chance of receiving them, but you will find the interference problem a rather serious one at your distance from 2LO. You will probably need to use a wave trap, Type A being suggested. Wind 40 turns of No. 20 D.C.C. wire on a 3-in. cardboard tube, and connect in parallel with it a variable condenser of .0005 μF. Connect this trap circuit in series between the aerial and the aerial terminal of the set, cutting out the constant aerial tuning condenser and placing the main tuning condenser in parallel. You will find that you can hear the local station almost all over the dial of the wave trap condenser, but that with patience a point can be found at which the signals are very much reduced in volume, and upon either side of which they re-appear at full strength. Leave the wave-trap set at this point and search for the other stations in the ordinary manner upon the controls of the receiver. You will probably need to employ a coil one size larger than normal in the aerial circuit when using the wave trap.

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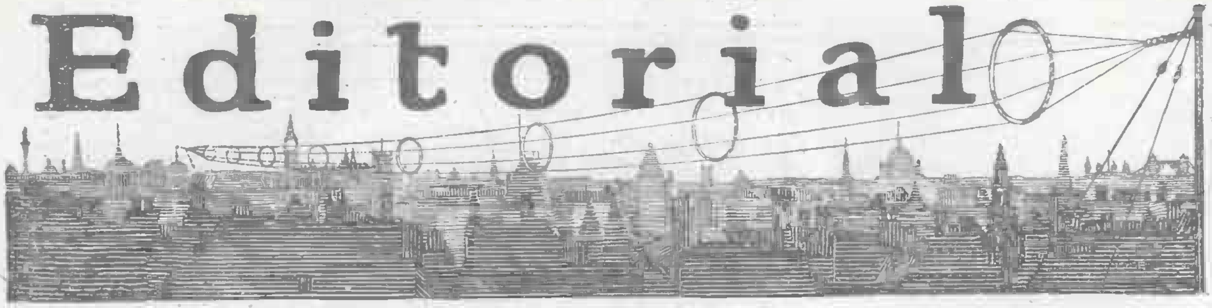


Strange Modesty

AT long last the Radio Society of Great Britain appears to be realising its responsibilities towards the Affiliated Societies, and there are welcome signs that the lethargy which has permeated the body of the Society for so long is at last to be shaken off. For this reason alone we listened with interest to the broadcast talk from 2LO on Thursday last by Mr. J. F. Stanley, B.Sc., Honorary Secretary of the General Committee of the Affiliated Societies. "Many of the delegates," said Mr. Stanley, referring to the first meeting of the General Committee, "had come to the meeting with instructions from the Societies they represented to tell the Radio Society of Great Britain that it wanted waking up, and that unless it woke up the affiliation would cease." This indeed is a healthy admission. "One of the greatest causes of dissatisfaction among Affiliated Societies," went on the speaker, "had been the lack of information concerning the activities of the R.S.G.B. in the interests of the whole amateur community. The negotiations between the Council of the Society and the various Government Departments in other bodies are often of such a nature that undue publicity would endanger the successful issue of the Society's efforts, and *for that reason the Affiliated Societies had been led to think that nothing whatever is being done.*" Still thinking that this remark might not carry conviction in some quarters, Mr. Stanley added later, "Several delegates reported that there was a deplorable lack of enthusiasm amongst provincial Societies towards the work of the R.S.G.B. This had been due," he said, "to undue modesty on the part of the parent Society in not letting the provinces know what was being done for them."

We have not hitherto seen many signs of modesty on the part of the Radio Society of Great Britain when claiming that it represented the whole of the amateur movement of this country. We have reason to believe that the delegates were by no means satisfied with the ingenuous explanations given to them at the meeting, and the opinion has already been expressed in many quarters that the meeting was a grievous disappointment to the delegates. According to Mr. Stanley the delegates left the meeting with good news for the Societies, but in many cases this was not so.

We are but a short distance from the autumn and winter experimenting season. What has the Radio Society to offer us for the autumn? Why is it that American visitors to this country need express surprise that we have no organisation comparable with the American Institute of Radio Engineers? We have frequently expressed our views on the programmes, the list of which for the past year was not an inspiring record. There is still time for the Society to retrieve its position if it will only set to work vigorously to obtain for the forthcoming winter a number of sound, original and stimulating papers on subjects which are really of general interest to the wireless experimenter, not forgetting, of course, the need for papers which will appeal to the newer recruit. In every Society there is a small band of willing workers who in an emergency will step into the breach and give a paper on a subject such as the "principles of tuning," or some historical aspect, and in the past there has been too much reliance upon such people. One of the big grievances of the provincial Societies is that the parent Society is not able to send out competent lecturers to help the younger groups who are yet not strong enough to provide their own. What hope is there of developing this side of the Society's activities if their own papers are without strong appeal?

The time has passed when airy generalities and vague assurances will satisfy the wireless public. Everywhere we find the desire that the Radio Society shall give proof that it really represents the amateur body. The number of people who hear the weekly broadcast talk runs into millions, and the need of making such admissions as those referred to above does not increase the Society's prestige.

Radio-Paris and Chelmsford Interference

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

An article of special interest to those listeners who value the transmissions of "SFR" and experience difficulty in receiving them during the transmissions of 5XX.

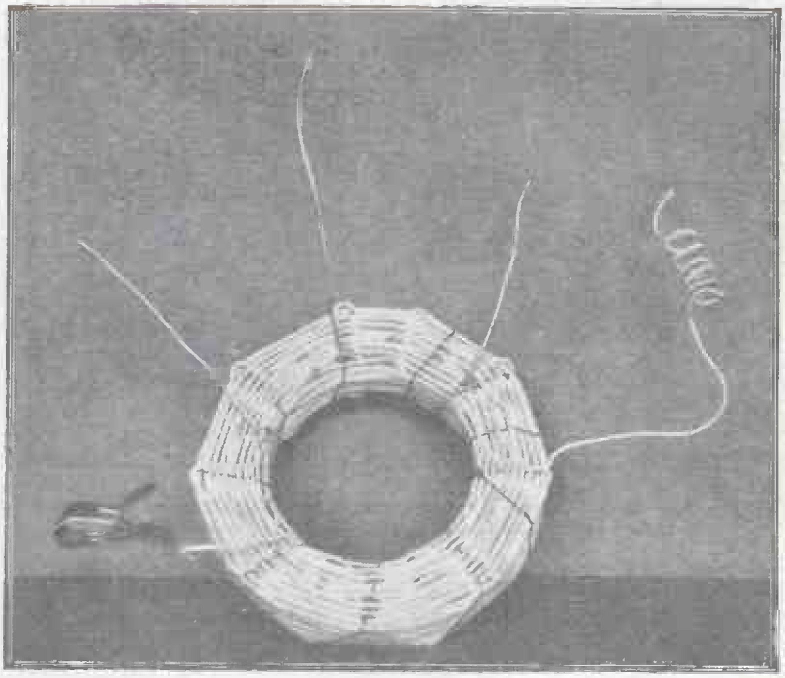


Fig. 1.—Note the position of the tappings. The "spring clip" terminal is convenient for experimental connections upon the coil.

THOSE of us who have been in the habit of listening to Radio-Paris in the past will by now have realised that the advent of the high-power station at Chelmsford is not quite such an unmixed blessing as we had hoped, for those listeners who may live within some 30 or 40 miles of 5XX. Using the ordinary single-circuit tuner and a set of only average selectivity, when 5XX is working upon 1,600 metres, it is practically impossible to receive Radio-Paris on 1,780 metres without exceedingly heavy interference, so that the best which can be obtained is that 5XX is perhaps only *equal* in strength to Radio-Paris.

I have been an interested listener to the French station for a considerable period, and viewed its disappearance from my reach with much regret, and I think that some account of the experiments which have led me to its successful recapture may be of interest to others of like views.

Loose-coupled Circuits

The obvious first step in a case of this sort is to try a loose-coupled tuner, this being probably the best known method of increasing the selectivity of any given receiver. I found that this expedient certainly achieved the desired end, in that 5XX and Radio-Paris could be separated quite easily, and I think that particular method is the one which I should prefer for my own use, since I possess a convenient tuner which is capable of being added to any valve set, and possesses the necessary switching arrangements for rapid changes from single to double circuit tuning. In the majority of cases, however, the listener will be using a complete and self-contained receiving set, which is not easy to adapt to the loose-coupled system, serious alterations being needed, and of course it also slightly complicates the operation of the set. This is especially noticeable when several high-frequency valves are used, and the set has any tendency to instability. I therefore turned my attention to the subject of wave-traps for these wavelengths, since these are devices which can be added externally to the receiver, and enable one to achieve the desired end very simply.

The Variably-coupled Trap

A very simple type of trap which seems fairly effective upon this wavelength is the coupled type, consisting of a coil and condenser entirely separate from the circuits of the valve set, but coupled to the aerial tuning inductance, and tuned to the wavelength of the station whose signals it is desired to eliminate. This arrangement is illustrated in Fig. 3, where L2 C2 represents the trap circuit. This circuit can consist of a No. 200 or 250 standard plug-in coil, shunted by a variable condenser of 0.001 μF. capacity. The coils L1 and L2 should be mounted upon a two coil-holder, and the desired station should first be tuned in with the coils well separated. A good deal of interference will, of course, be experienced, and when Radio-Paris has been tuned in to the best point, the coil L2 should be brought up to a position at an angle of about 30 degrees to L1, and C2 should be varied until a point is found at which the signals of the interfering station are suddenly very much reduced, and upon either side of which they reappear. The trap condenser should be left set to this value, and a search should then be made to pick up once more the signals from Radio-Paris, which will now come in with very much reduced interference. Further adjustments of the coupling between the coils and of the settings of the two condensers will probably lead one to a very fair degree of elimination of the unwanted signal.

The Type "A" Wavetrap

The type of wavetrap which I have found most successful as

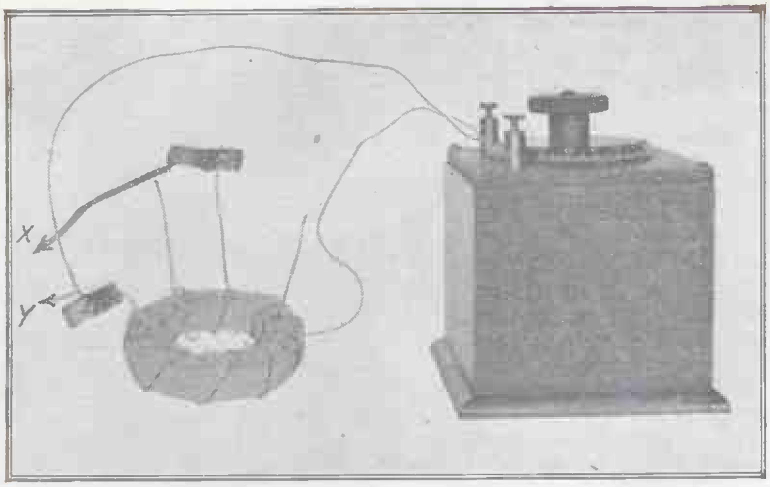


Fig. 2.—The leads X and Y are connected to the aerial and the aerial terminal of the set respectively. Compare with Fig. 6.

an eliminating device upon this wavelength and upon the majority of others is the wavetrap known as type "A," which is illustrated in a simple form in Fig. 4. This consists of a rejector circuit L2 C2 connected in series between the aerial and the aerial terminal of the receiving set, and the mode of operation is as follows. Insert a coil in the socket L1 of a size which would be correct to receive the desired station with a series condenser, although the real tuning condenser, C1, is connected in the parallel position. Set this condenser to a fairly low value, so that the interfering signal is heard fairly strongly, and proceed to vary the capacity of C2 until the absorption point is found, at which the undesired signal will suddenly die down, and upon either side of which it reappears. Leave the trap condenser set to this value, and proceed to search in the ordinary manner upon the other controls of the receiving set for the desired signals.

I have found this trap particularly effective for 5XX, but upon this longer wavelength a considerable loss of signal strength appears to occur, apparently as a result of the fact that the resistance of the coil L2 must necessarily be rather high, and therefore the resistance of the trap circuit even to frequencies other than that to which it is tuned is still high. With a coil of 160 turns of No. 22 d.c.c. wire, wound in the lattice style, and a 0.0005 μF variable condenser in parallel therewith I have obtained complete elimination of 5XX at a position in Wimbledon, and reception of Radio-Paris reduced by perhaps one-third.

The Type "D" Trap

Somewhat unexpectedly, the type of trap which seems really

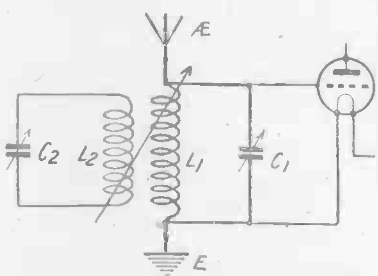


Fig. 3.—The variably-coupled type.

best for this particular purpose is that which I described recently in *Wireless Weekly* as type "D." This trap upon the ordinary broadcast wavelength appears to be somewhere about equal in effectiveness to type "B," and I advanced it as having the advantages of being slightly easier to construct. Upon this longer wavelength, however, it appears to have considerable advantages, since when a suitable arrangement of turns is adopted the elimination is practically as complete as that of type "A," and the reduction of signal strength is very much less.

A simple type of the "D" wavetrap is shown in Fig. 5, from which it will be seen that it consists of a rejector circuit L2 C2 tuned to the undesired wavelength, in the case under consideration, 1,600 metres. Instead of joining the whole trap circuit in series between aerial and aerial terminal, I connect only a certain proportion of the winding of L2, and utilise a sort of auto-transformer coupling, which enables one to obtain the desired rejection effects, without altering very greatly the tuning of the aerial circuit, and without introducing a great deal of unnecessary wire into the aerial circuit.

Just as in all wavetrap circuits, it is imperative that all the losses in the trap circuit be kept as low as ever possible, by the use of a really good quality variable condenser in the position C2, preferably of the type with air dielectric and ebonite end plates. Further, the winding must be with reasonably thick wire, say, No. 22 gauge, and I think that it is best to use double cotton covered wire, leaving it without impregnation of any sort. Experiment alone can decide the proper position for the tapping to which the aerial is connected for any given set of conditions, and therefore the coil should be constructed with tappings to enable this to be roughly adjusted to the best value.

There appears also to be a best ratio of inductance to capacity in the trap circuit, and although the figures which I am about to give will be found to produce very satisfactory elimination, I should not like to imply that

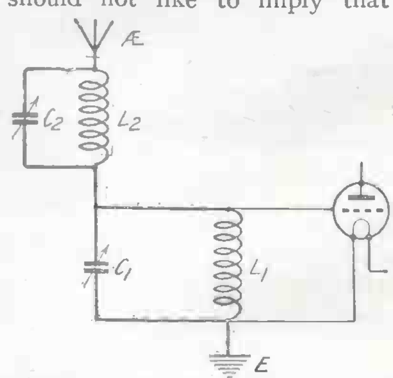


Fig. 4.—The simplest form of Type A

they are necessarily the best figures obtainable, and any experimenter can quite likely obtain still better results with the aid of a little patience and a pound or so of wire.

Winding the Coil

I used in all my experiments a coil wound upon the lattice system, since this is probably the easiest and quickest method of winding a fairly efficient multi-layer coil. The lattice coil has the further advantage that in the larger sizes such as we are now considering it is so strong as to be self-supporting without the aid of either wax or varnish impregnation, or a former of any sort.

A former is required such as the one illustrated in Fig. 7, consisting of a cylindrical piece of soft wood, 2 in. in diameter and 6 in. long, in one end of which two rows of pins, 15 in each row, are driven, the pins being "staggered" in the rows. This means that any given pin in one row is opposite to the space *between* two pins in the opposite row. The rows of pins should be $\frac{3}{4}$ in. apart, and slender wire nails 2 in. long will be found quite suitable for the purpose.

To commence the winding, first put on one turn of wire passing in a zig-zag fashion round the former, crossing over from one pin to the next. This is indicated by the zig-zag line in Fig. 7. Upon the completion of this turn, wind on one complete layer of wire, consisting of 16 turns. Upon the completion of this 16 turn layer, wind on another zig-zag turn, then another 16 turns in a single layer, and so on, alternating zig-zag turns and full layers until the required number of turns has been wound on. Ten complete full layers will be required, giving a total of 160 turns. (It is customary to neglect the zig-zag turns in a lattice, since their inductive value is small.) When the winding is complete, cut the wire, leaving about 6 in. over, and pass the end through the loops left in the zig-zag turns when one of the pins has been pulled out, thereby securing the end quite firmly. Now pull out all the pins carefully, and pull out the first zig-zag turn, which is necessary to allow the coil to slip freely off the former. Take it off with great care, so as not to start the coil unwinding from within, and immediately bind it round with thread, using a stout needle for the purpose. If the thread is passed round and round the coil, taking it through the ring formed by the coil at each turn, and pulled tight, the coil will be quite firmly held.

Tappings can be made upon lattice coils with great ease, by scraping bare and soldering upon the projecting zig-zag turns at suitable points. My own coil has tappings taken at 16 turns,

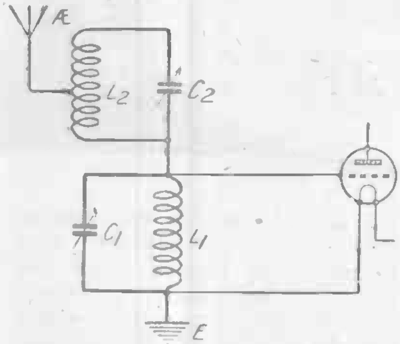


Fig. 5.—The type D wave-trap.

32 turns, 48 turns, and also an additional tapping, not visible in the photograph, at 64 turns. These turns can be easily identified

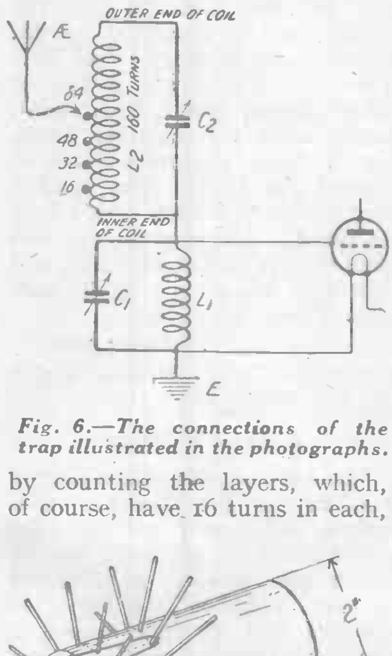


Fig. 6.—The connections of the trap illustrated in the photographs.

by counting the layers, which, of course, have 16 turns in each,

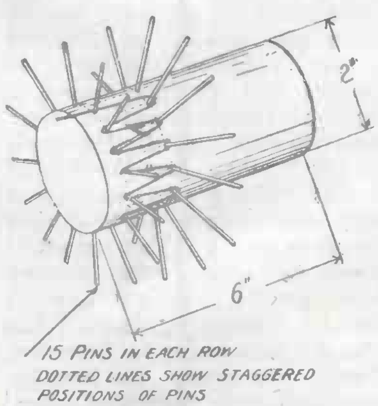


Fig. 7.—Showing how a zig-zag turn is wound in the lattice method.

Thus, the first tapping is made at the first zig-zag turn, and the second at the second zig-zag turn, and so on.

Using the Type "D" Trap

The connections of the trap are shown in Fig. 6, and it will be observed that the aerial is connected experimentally to any of the tapping points, it being necessary to determine the correct one for any given aerial by trial and error. In my own case the elimination with only 16 turns in the aerial circuit is only very poor, better with 32 and quite good with 48; 64 gives practically complete elimination of 5XX, with even a rather unselective receiving set, but reduces the signal strength of Radio-Paris slightly. Upon the other turns Radio-Paris appears to be quite unaffected. The effect upon the tuning is quite different from that of the type "A" trap, since the inclusion of the coupling turns of the wavetrap is to *increase* the wavelength to which the aerial is tuned, just as though an ordinary fixed coil had been plugged-in in series. With the aerial tapping upon, say, the 48 turn point, it would probably be found that about a quarter of the capacity of a $0.0005\mu F$ condenser must be subtracted from the reading of the condenser C1 in the receiving set to come back to the correct adjustment for Radio-Paris.

The method of operating this trap is as follows. First of all tune in Radio-Paris without the trap in circuit, then bring it into circuit, with the aerial upon the 48 turn tapping, and proceed to vary the capacity of the wave-trap condenser until the absorption point for 5XX is found, which will probably be fairly sharply defined. With the data given, it will be best to use a $0.001\mu F$ condenser for C2, but if a $0.0005\mu F$ is used the absorption point will come somewhere near the top of its scale. A fairly satisfactory elimination point having been found, attention should be turned to the adjustments of the receiving set itself, and the signals from Radio-Paris should again be tuned in. A slight further adjustment of the wavetrap condenser will then probably be necessary, and it will be found that 5XX has almost completely disappeared and that Radio-Paris is received with practically undiminished volume.

JOTTINGS BY THE WAY

Test Report on No. 761

Wishing to have our new circuit properly put through its paces, Professor Goop and I endeavoured to get the Editor to test it out. We found that we had unfortunately chosen his very busiest time; in fact, from what he said we gathered that he would have not a single spare evening for the next three months. All the rest of the staff were in some strange way similarly booked up for weeks ahead, so that the only person at Devereux Court to whom we could entrust our new wonder was the office boy, a worthy lad who promised to do his best. His first report was a little discouraging. It read :—

" Dere Sur,—I begs to state that the riter as tried your new serkit and I think it is roten. Wen I turned on the electric lamp it made a prity blue lite, and then went out, and I did not hear no broadcasting.—Yours cinserely,

" HORACE JIGGS."

We Try Again

An investigation showed that the well-meaning, rather muttonfisted Horace had got confused between the accumulator and the high-tension battery with lamentable results to the very expensive dull emitter valve with which the Professor and I had thoughtlessly provided him. Circuits have been produced that will work without high-tension batteries, without accumulators, and without all kinds of other odd bits and pieces; but so far as I know no one has yet managed to work a valve without a filament. The Professor and I therefore assembled in Horace's den beneath the stairs and saw that the wiring was correct before turning him loose again upon No. 761. Then softly closing the door we left the lad to it. On this occasion no less than two reports were received, the first a direct one from Horace, and the second what we might term an indirect one from one of his victims. Horace writes as follows :—

" Gents,—I listened on yore sett and it was grand, and I did not notice the time, and I got locked in, and I had no supper and no breakfast, and please it will be five shillings for my supper and my breakfast. I got London and Birmagen and New York and Paris, and a lott of other plaices, and it does squeal lovely when you turn the knob, and I dropt the valve cause it slipped out of my 'and, and I trod on it, and I am afraid it is no good. Hopping as you will send the five shillings immijit, and that this leaves you as it finds me.—Yours affexnut,

" HORACE JIGGS.

" P.S.—Please do not forget the five shillings."

Indirect Evidence

The other report comes from a resident in the Temple, who writes indignantly to say that never in all his existence has he heard such howling as occurred on the previous evening. It appears that he had invited a party of friends round to hear some wireless, and that he could not get anything but a medley of shrieks, yells, groans, wails, and other undesirable noises during the whole evening. Two acquaintances, he states, who possess frame aerials, obtained a cross bearing which locates the offender somewhere in Devereux Court. Of course, the howling could not come from this office, but he feels sure that we will aid him in running the offender to earth. If I know anything of Horace he is much more likely to shin up the aerial than to go to earth if a hue and cry is raised after him. However, you may be relieved to hear that for the future Horace is to be confined strictly to crystals, and not too many of them.

Those Kilowatts

Not long ago *Wireless Weekly* published photographs showing the dreadful things that can happen to you if you are so unfortunate as to have your set struck by lightning. No wise man lets this occur if he can help it, for even if things are not blown to bits the process is apt to oxidise the terminals. My friend Poddleby has just had a rather terrible adventure, which shows how serious the consequences of carelessness can be. His set has been struck, not by lightning, but by 5XX, the results being very much the same. The other evening Poddleby thought that he would like to hear Australia or something of that kind, and rigged up a stupendous circuit containing six high-frequency valves and two or three note magnifiers. In an absent-minded moment he tuned the thing to 1,600 metres, and that is the last that he remembers of the incident. If he had been using a loud-speaker at the time things would not have been so bad, but as it was he was wearing headphones, and his ears were so flattened that it took two of us quite a long time to prize them out of his neck with a screwdriver and a pair of pliers. His hair also is standing straight on end and defies all the efforts of brilliantine and bear's grease. Even the application of gear-box grease refuses to tame it. It remains standing up like a thicket surrounding the bald patch in the middle, and what is going to happen I do not know. Poddleby is quite unable to wear telephones at present, for he complains that he cannot stand the pain caused by their pushing in his up-ended locks.

A Martyr to Science

One of the latest martyrs to wireless is the man Gubbsworthy, who has made such a name for himself, not only in Little Puddleton, but certainly within a radius of quite half a mile outside the town itself. Gubbsworthy is of an inventive turn of mind, and his wireless sets are simply full of tips and dodges and gadgets and things. When you or I wish to haul up the aerial after having let it down for examination we have to do so by sheer brute force, a trying task in hot weather. Gubbsworthy does the same thing with no trouble whatever, for he has provided a dodge on the spring-blind system which makes the aerial go up by itself when you press a button. I shall never forget the look which stamped itself on his face when I thoughtlessly pressed the button whilst he was engaged in soldering on the lead in. The 7/22's caught the end of his rather large nose, which looked not unlike an over-ripe plum for a few days after. But if Gubbsworthy's aerial is ingenious his earth is very much more so, as you shall see. Little Puddleton has grown so rapidly in recent times, owing to the efforts of our local jerry-builder, that it has quite outrun the capacity of its water supply when a spell of hot weather occurs. This is a serious difficulty to all of us for the soil is clay and earths must be kept damp. Gubbsworthy, who has a conscience as well as an inventive mind, rigged up a contrivance whereby part of the water which escapes down the waste pipe of his bath is conveyed by a little wooden canal to the soil beneath which his earth plate lies buried. He can thus, in normal times, keep the place moist enough without using any water wrongfully.

Floored

The late heat-wave, however, rather floored him, for not one or even two baths a day would suffice to produce the desirable marshiness. Gubbsworthy could not bring himself to fill a bucket at the tap, as the less particular do, and he found himself compelled to take at least six baths a day. As he much dislikes cold water, and as the cook refused to have the kitchen fire going, poor Gubbsworthy is being worn to a shadow by these continual immersions. He is a true martyr to science, as I think you will agree, and the wireless club is thinking of presenting him with a special testimonial.

The Heat

The wireless club, I fear, are feeling the heat, for our discussions which used to be conducted in the most amicable way frequently show signs of developing into free fights. General Blood Thunderby, who turned up the other evening wearing a suit of white ducks (which had obviously been made for him when he was slimmer than he is now) and a solar topee, had quite a scene with Admiral Whiskerton Cuttle. Such was the noise of their altercation that it was carried far and wide over the town, through the open windows of the club house, and P.C. Bottlesworth, feeling that he might be called upon to come and restore order, hastily discovered that his presence was urgently needed at the opposite end of the town. I really do not know what we are to do about it. Both Poddleby and Gubbsworthy are getting very snappy, and even Professor Goop, who normally would not say boo! to a goose (I never do this myself by the way; in fact, I have met hundreds of geese without ever saying boo! to one of them) was really quite nasty the other day to Breadsnapp, who had lent him a burnt-out transformer by mistake. A little gentle remonstrance was certainly called for, but it was a trifle strong, I think, to go and call the man straightaway a ginger-headed, pug-nosed, flat-footed, ham-handed, freckle-faced throwback to the ancestral anthropoid ape.

WIRELESS WAYFARER

□ □ □

OPEN-AIR BROADCASTING

Our photograph shows the giant loud speakers used on the occasion of the high-power broadcasting demonstration on Walney Island, near Barrow-in-Furness. The battery of loud speakers consisted of eight individual horns.

An American Short-wave Receiver.

By GERALD R. GARRATT (5CS).

Some remarks upon an American arrangement which is immensely popular in the United States for the reception of short waves.

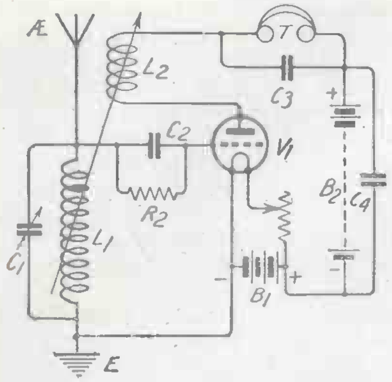


Fig. 1.—Showing an ordinary English magnetically coupled circuit.

ONE of the chief troubles of receiving short - wave signals or long-distance broadcasting is the manipulation of the reaction coil. As the position of the reaction coil is varied the wavelength changes, and this necessitates a fresh tuning of the aerial circuit. When receiving distant broadcasting stations this trouble is very noticeable, and it is far worse when receiving American amateurs on 100-200 metres.

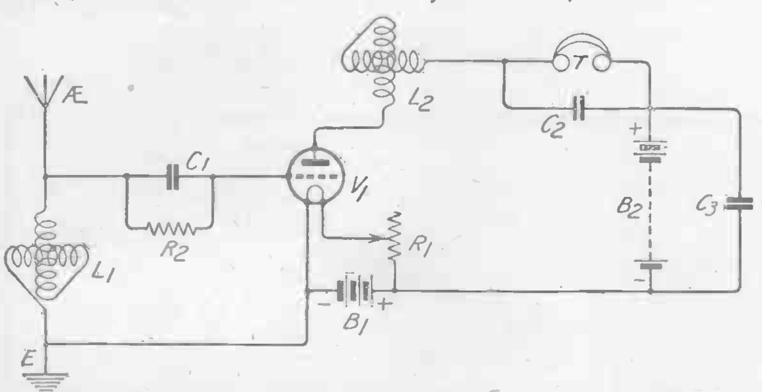


Fig. 2.—Illustrating an early American circuit using variometers. Though selective, this circuit is rather unstable.

In America the general use of magnetic reaction, as we use in England, has been given up for some time, and its place taken by the use of variometers in both the grid and plate circuits. As the variometers are fixed in relation to each other little change in wavelength occurs on adjusting the circuit. Reaction takes place when the plate circuit is in tune, or very nearly so, with the grid circuit. This arrangement has the disadvantage that the plate circuit has to be slightly de-tuned in order to bring the receiver just of the point of self-oscillation, and this results in a considerable loss of selectivity and amplification.

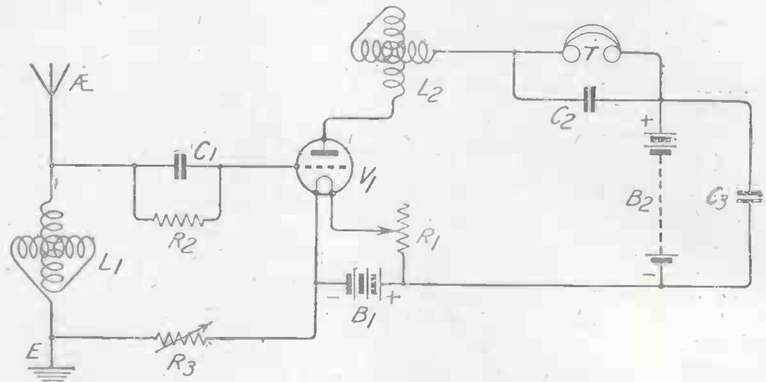


Fig. 3.—Showing a modified arrangement which, besides being selective, has high amplifying powers.

With American valves this may not occur, but when used with ordinary English valves the circuit becomes very unstable, although when it does work its amplification factor is far greater than an ordinary magnetic arrangement. The circuit is very selective, and when tested a short time ago about four miles from 2LO all the other broadcasting stations could be read easily while 2LO was transmitting, and by the addition of one low-frequency amplifying valve it was possible to get sufficient strength to operate a loud speaker satisfactorily on all the stations with the exception of Manchester.

It is, however, with some difficulty that these results were obtained owing to the instability of the circuit, but there is fortunately a very satisfactory method of curing the instability which does not seem to impair the efficiency of the circuit in the

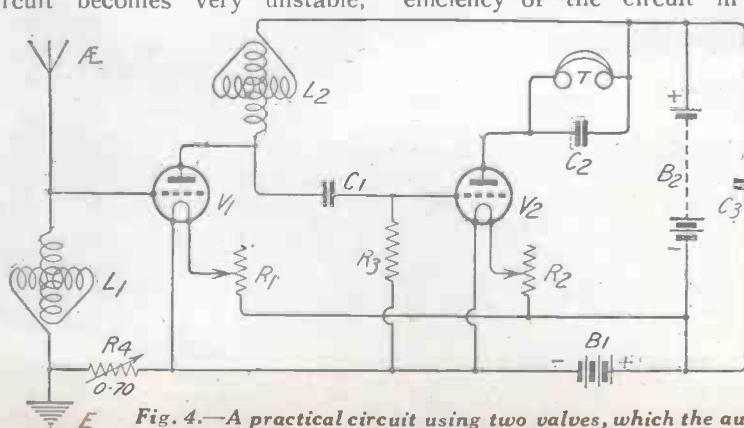


Fig. 4.—A practical circuit using two valves, which the author claims to be as sensitive as many three-valve arrangements.

least degree, although the damping introduced should theoretically reduce the amplification considerably. The reason for this is probably that by the introduction of some damping device it is possible to adjust the circuit to a more sensitive condition than is possible when no damping device is present.

Introduction of Damping

The damping introduced takes the form of a non-inductive resistance connected in the grid circuit of the valve, as shown in Fig. 3.

This resistance, as will be seen, is connected in the filament lead of the grid circuit. It must be variable, and has a resistance of about 0 to 70 ohms. By its aid the reaction of the circuit is under very fine control indeed, and there is no overlap. The circuit is very stable, and its amplifying powers are remarkable. The selectivity is very much greater than the ordinary auto-coupled circuit.

The Resistance

In America the damping resistances are now made by all large manufacturing firms as a standard accessory owing to the popularity of the circuit, but there does not seem to be a suitable one on the market in this country. It is, however, quite possible to make one which does all that is required, and which will not cause crackling noises as these resistances are sometimes apt to do. In the author's case the resistance was made from a converted Watmel variable grid leak. The grid leak was emptied of its original contents and filled with black stove polish, which is some preparation of graphite. A number of substances were tried, but none gave very satisfactory results until the cook came to the rescue with some graphite stove polish, which has given excellent results! I am told that it is sold as black lead. It is a black shiny paste, which has a very low resistance when compressed, but its resistance rises to about 60 or 70 ohms when the pressure is relaxed. By simply turning the knob of the resistance the oscillation of the circuit is under very smooth control.

The Principle applied to H.F. Valves

This principle can be applied to a receiver where a high-frequency valve is used if the tuned anode system is used, the plate variometer taking the place of the tuned anode coil and condenser, as shown in Fig 4. If it is desired to use the circuit down to a wavelength of 100-150, it is advisable to connect a series condenser of about .0003 mfd in the aerial. This is also shown in Fig. 4. This condenser should be variable, but with a good fixed condenser it is probable that equally good results may be obtained.

A Practical Circuit

This circuit on two valves gives results as good as any three-valve set that the author has ever heard, with the possible exception of a super-regenerative set, but the latter operates on a principle which is very tricky in operation, and requires far more care in construction and adjustment: at the best of times it is very unstable, and the quality of speech is far from perfect.

□ □ □

An Evening Illusion

CYCLING the other evening, as the light was fading, some six miles from 5IT, my attention was arrested by a twin aerial. It was slung from a high mast, which must be the envy of nearby enthusiasts.

What appeared to be a most unusual number of insulators caused me to dismount. I counted nineteen. They were evenly spaced at the ends of the aerial wires, and down the stay-wires near the top, but not in even numbers.

Puzzled, I walked nearer to get a better view, when a second surprise came. One of those on a stay-wire suddenly became detached, and transferred itself to the aerial, thus giving the explanation. They were swallows. But even with this knowledge the illusion was perfect, the motionless birds appearing as round black spots against the reddening sky, indistinguishable from the insulators, and at regular intervals.

After a brief wait, in twos and threes they slipped away, leaving but one insulator on each of the twin wires, and changing what had appeared to be super-insulation into obvious inefficiency. Cycling on, I wondered if, at times, the owner had noticed any unexplained capacity variations.

F. C. S.

□ □ □

SPECIAL NOTE

Will readers please note that the form included in our advertising pages is for use when communicating with advertisers, and not as a query coupon.

AS SEEN BY THE CYNIC

The Hunchback of Neutrodyne! A human distortion from ceaseless work. Dumb as to radio. Blind to the outside world. Hard-hearted and cynical from disappointments, but with the patience of a veteran fisherman.

The B.B.C. and Listeners' Letters

By RALPH WADE.

Mr. Wade is a member of the B.B.C. programme staff, and is therefore well qualified to write on this subject.

I THINK a few remarks on the above subject will prove of interest since there are so many persons who write to the B.B.C. on programme matters, and there may be hundreds, or even thousands more, who don't write, partly, maybe, because they wonder to themselves whether the Company really welcomes correspondence on the matter which is transmitted, and possibly they wonder, too, whether their letter or card will be read, or, if read, whether the communication will reach the right quarter.

Now any ordinary business has its correspondence system, and no one, I take it, would bother to read an article about it! It is just that the B.B.C. is *not* an ordinary business that perhaps these few lines may appeal. The personal element is ever present and is ineradicable.

Why Write?

One hears an enjoyable item on the wireless, and the first instinct is perhaps to write and applaud; then the second thought comes, "Shall I bother?" "Who will read my praise?" "What's the good?"

If I had the answering of these questions every time they arise, I should just answer the first "Yes" and not trouble about the others.

Listeners may, in short, rest content that their letters, cards, telegrams, or whatever they like to send, are *all* read and *all* notified to the officials concerned. I do not mean to say of necessity that every departmental head reads every card—he does not; but each department interested is advised every day of the letters of appreciation or criticism received in connection with every item commented on, also a list of requests and suggestions is made up daily and similarly circulated. Almost every day I am asked by someone or another, "Have you had many appreciations of so-and-so?" or "Has anyone criticised ——?"

If no one wrote, how could we know what was being enjoyed or the reverse?

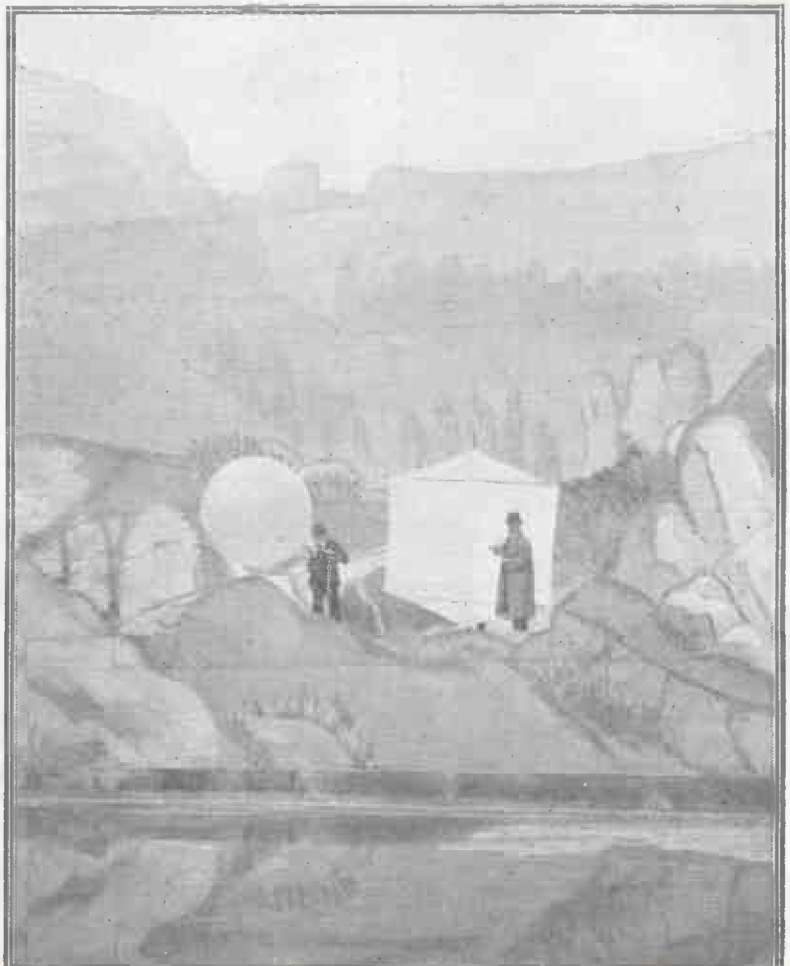
Of course, one gets cranks writing, and also there are vastly different opinions expressed or requests made.

For instance, two consecutive letters I read the other day were:—A. "Every programme should be 50 per cent. music." B. "Two musical nights a week is ample." Either of these opinions may represent extremes of thought, and it is only by balancing the opinions of many that the proper perspective may be gained. Once more—if no one wrote, how could we balance many opinions?

Frequently suggestions made are really useful. Only last week two small adjustments in our programmes were brought about directly as the result of uninvited suggestions.

Of course, amongst the vast pile of appreciations there are letters from critics, some more outspoken than others, and the most outspoken of all being almost invariably anonymous! I notice that quite a number of those who criticise do so with a note almost of apology. There is no need for diffidence in the matter, as criticism is one of the most useful ways of showing interest, and unbiased comments, however adverse they may be, are seldom other than helpful in

REPRODUCING A FAMOUS EPISODE



A scene at the British Empire Pageant at Wembley. Mr. G. S. Kemp with the kite used in the first Transatlantic experiments. *(See p. 490.)*

effecting some improvements. Correspondents need not think, therefore, that their ideas are acknowledged and then consigned to the wastepaper basket! Some proposals are, of course, impracticable or useless, for some reason or another, but all are fully considered.

Give and Take

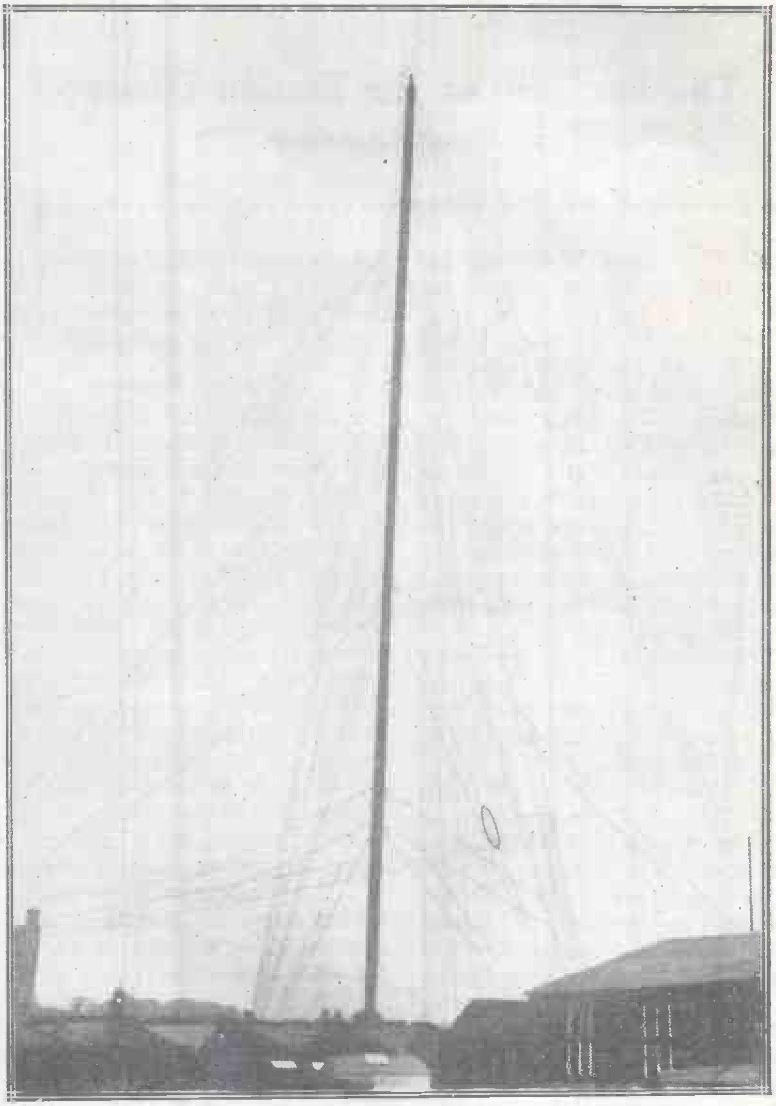
I read somewhere recently that it is no good for a broadcasting company to try and please somebody all the time with their programmes, and so long as they please all some of the time, they will not have failed. This is very sound, and there must inevitably be a certain amount of give-and-take amongst the members of the large family of listeners.

Even so, it is extraordinary how one only needs to put on an item of, say, an hour's duration, which may not be to the taste of some individual, and the next morning he will write and ask what we think he pays his licence for. I am glad to say, however, that it is more often the case that if listeners think of a programme in terms of £ s. d., they write eulogistically of some transmission and say, "It was worth the licence by itself."

A Troublesome Word

I was amused the other morning to find a postcard arising out of one of the Chief Engineer's technical talks asking that the pamphlet on "Hints About Oscillation" might be forwarded to the writer. That word is apparently rather a snag for a good many people, as I have observed several have written "O" and left a space—evidently having meant to ask someone how to spell it and then forgotten to do so; some, too, have apparently not left quite enough space, and the "scillation" is cramped into about half its proper room.

Most people, I expect, have seen the American "Applause cards." I have not come across any of these used in the British Isles yet, but the idea might appeal to some people. It is, at any rate, typical of the hustling, labour-saving methods of America. For those who do not know it, I would explain that the card is somewhat reminiscent of the old Field Service postcards, having the bulk of the communication ready printed, leaving only the individual part to be filled in by the writer. It runs something like this: "I wish to express my applause of the item............. broadcast from.........station on ...." I expect sooner or later these will come into use in England, although it is an open question whether they would really catch on over here. Quite personally I should regret it if they do, as so much of the charm of our correspondence as at present constituted lies in the individual way of expressing appreciation which each writer adopts.



One of the 450-foot masts of 5XX.

The nearest approach in England I have seen is a card printed, "I think your programme on ....was
{Good
Very Excellent
Rotten

but I sincerely trust this will not become a popular method of "Applause." The one sample I have seen thought a certain programme rotten. I turned up the evening in question and found it was a night on which a most varied programme had been broadcast—thus immediately the whole criticism became completely valueless, unless the correspondent wished to imply that he thinks every type of matter rotten; in which case, why go in for wireless at all?

Do Not Hesitate

In concluding, I should like to say to my readers who may be hesitant about writing in on any subject, "Please *do* do it"—the more the merrier, be they pro or con.

The Paradise of the Station Hunter

By GEORGE BARNARD.

IF you have been hit by the broadcast craze (or bitten by the radio bug, as we say in America), I feel a little sad for those who are forced to live in the United Kingdom. We have not yet regularly bridged the ocean ; and you are so shut in. Of course you have never known any other condition. And as we never miss what we have never experienced, you are probably enjoying yourselves fishing in your own little wireless pond.

It is almost a pity to spoil your contentment. I was happiest when I thought that a certain little pond in Sussex held all the fish in the world.

But you know how it is with radio fans, or ether prowlers, or wireless maniacs, or whatever it is you call us over there. We are a sort of brotherhood. Mutual interest in wireless is almost as strong a religion as a bond of union, and I am not sure that it wouldn't be a practical scheme to band together the wireless enthusiasts of the world in a vast fraternity as the basis of a universal understanding.

Fellow Interest

Wireless has reunited families. I have a brother who for three years had failed to reply to polite inquiries concerning his health. Recently I wrote to him that I had a radio set, and immediately he replied from London : "I am glad that at last we have a conversational topic."

Thecorrespondence showed that Great Britain and America have developed separate terminologies. You speak of valves, and we of tubes ; you of high and low frequency, we of radio and audio frequency ; you of wireless and we of radio. The cult is the same, however, despite these and other slight variations in the ritual.

But England is no place for the wireless enthusiast. After all, what is there to fish for ? A concert from London, or Birmingham, or Cardiff, or others of a handful of stations. And what then ? Hence my sympathy.

The Radio Paradise

America, on the other hand, is the radio paradise and Chicago the centre of that heaven.

Here the air is full of song. A few adjustments will bring in one or other of the six or seven Chicago stations. Another turn and Zion City comes in from sixty miles up State. And when one gets tired of religious music from that extraordinary city (which curiously enough exploits the possibilities of wireless, though the leader of the religious cult on which it is built thinks the theory of the rotundity of the earth too modern a notion)—when, as I say, one has had enough of Zion, another turn brings within range a fine station up in Minnesota, or another in one of the Canadian cities.

Choice of Stations

There are dozens of stations within a circle of five hundred miles. Five hundred miles is nothing, of course, to a moderately efficient set. Well within a radius of a thousand miles are powerful stations in New York State—at Troy and Schenectady : New York City itself. The Eastern states are dotted generously with stations which contribute their quota to my evening's entertainment in the Middle West.

Music from the Rockies

Reaching out West, Omaha, in Nebraska, sends me music through the ether. Sometimes a song comes to me from Denver, out in the Rockies. When the fates are kind the Pacific coast stations find my aerial. It is a very satisfactory evening when one is able to bridge the continent with a song from the Atlantic seaboard, and music from the Pacific coast. If in addition to these one is able to pick up an orchestral selection from Minneapolis in the North, and a Southern air from a singer down in Georgia or Texas, one goes to bed with the feeling of having compiled a fairly representative concert programme for the entertainment of one's friends.

This programme is not merely a "wireless dream." Night after night I select my evening programme from twenty different stations in as many states : the number being limited only by time.

The apparatus upon which Senatore Marconi received the first wireless signals across the Atlantic at Signal Hill.—See page 490.

An article from an American contributor reflecting to some extent the opinion held in the United States of the broadcasting conditions prevailing in this country.

Even when I have cast my line from coast to coast, and from the Canadian border to thefrontier of Mexico, there is still room for further fishing. My radio fishing pond is bigger than the United States, though it is three thousand miles or so across. Havana, down in Cuba, sends out with sufficient power to reach me when conditions are favourable. There is a station at Hawaii, in the middle of the Pacific, that is picked up regularly in the Middle West—though I admit frankly that I have never landed it.

2LO

There is always the beautiful possibility of picking up 2LO one of these days. My imagination has been dulled by the constant annihilation of distance performed by wireless. I have danced to music played by an orchestra a thousand miles away in one direction ; and have sung a duet with a man who was singing hundreds of miles away in another direction. But to get London would give me a real thrill. It would awaken vivid pictures of motor 'buses chugging past 2LO and sliding down the Hill of Fleet.

A Prophecy

When the science of wireless takes another small step ahead we shall get Australia from the West and Great Britain from the East as a regular thing. And then, of course, the British amateurs will be able to pick up the hundred or more American stations which can be relied upon for a good evening concert programme.

The irony of the situation is that you people, with about as many stations throughout the country as we muster in a decent sized city, have to pay for the privilege of listening, whilst our music comes to us as freely and generously as the four winds.

A Question of Interest

An interesting question will arise when space has been more completely mastered, and when British listeners are able to enjoy American programmes. Will they still have to pay a tax for the upkeep of the British stations, even if they ignore them and listen only to the fascinating contributions from this side ? And, if so, why ?

AN EXPENSIVE HOBBY

A neatly arranged American Broadcasting Station, privately owned and operated as a hobby by a millionaire.

A Compact Receiver on the Neutrodyne Principle Using Plug-in Coils

By J. UNDERDOWN.

Further constructional details and test report.

The wiring being completed, place the amplifier on test, using suitable valves. The writer uses either a V24 or Cossor pink top valves for the H.F. side, an R5 or Mullard Ora for detector, and a B.T.H. B4 as a low frequency amplifier, with the following H.T. voltages: H.F. 40 to 60 volts, detector 50 to 80 volts, L.F. 100 to 120 volts, and 3 to 4½ volts grid bias. Correct values can only be definitely decided by test.

The set should first be tested on a direct circuit so that its behaviour can be noted and all ordinary adjustments made. Having decided that the amplifier is working properly on direct-coupled circuit it now remains to adjust the neutrodyning circuit. This is done as follows:—Plug L1 and L2 into the two fixed blocks. These two coils should be similar in all respects, L2, of course, being chosen to cover the wave band desired in conjunction with its tuning condenser C2. Well matched coils of low self-capacity will give the best results. A coil, suitable with its condenser, to cover the same wave-length should now be plugged into the secondary circuit of the tuner, aerial and earth should be disconnected, no coils being inserted in the aerial or reaction circuits, and the latter short-circuited by joining the terminals

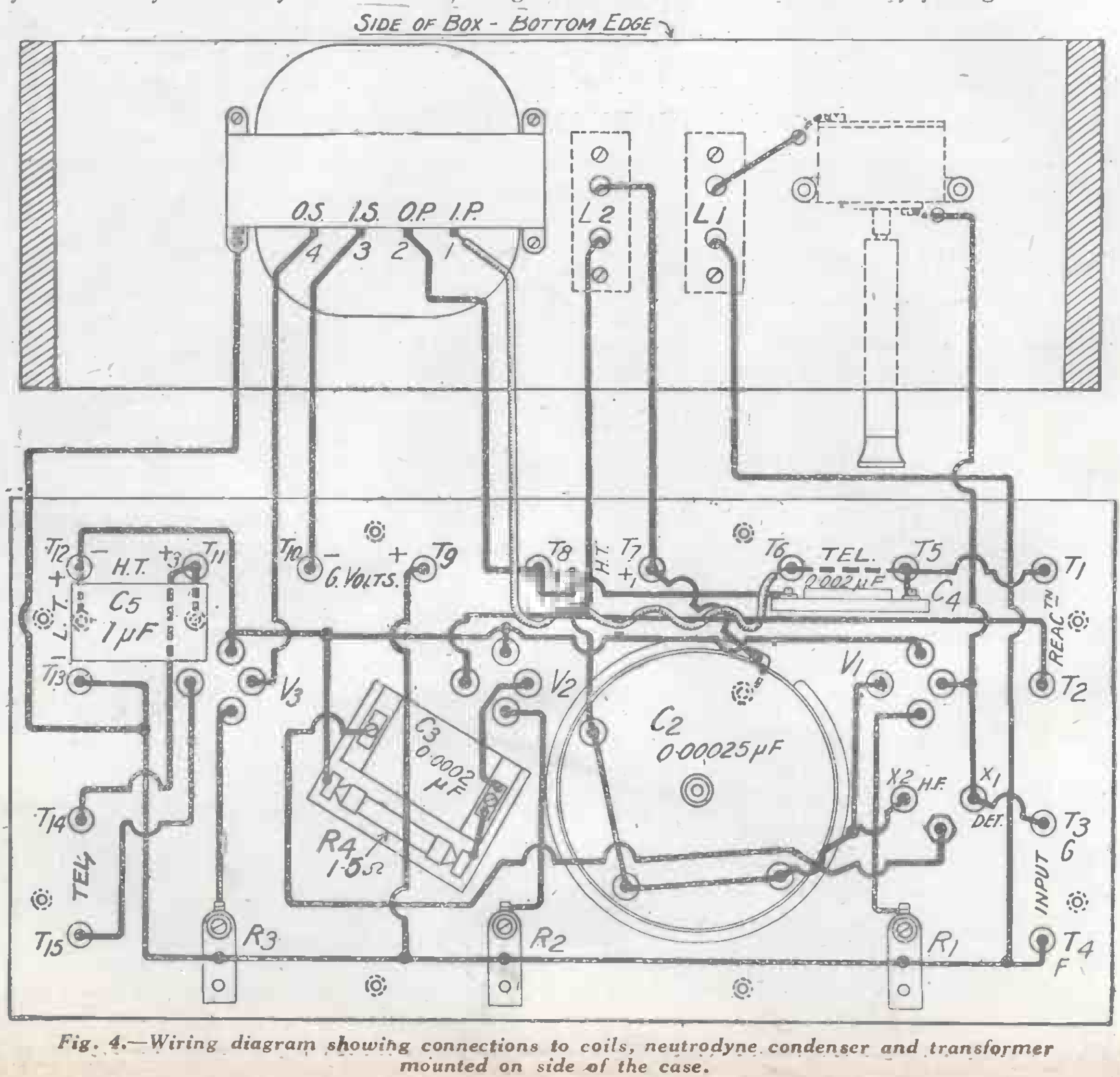


Fig. 4.—Wiring diagram showing connections to coils, neutrodyne condenser and transformer mounted on side of the case.

T1 and T2 on the amplifier. The essentials of the circuit are then as in Fig. 1. 'Phones may be inserted in between T5 T6 or the loud-speaker used with all three valves on, the high and low-tension being suitably adjusted.

First set the tuned anode condenser C2 to an intermediate position, say, 50 deg. On rotating the secondary condenser and tapping the connections to the grid of V1 (that is terminal T3), clicks due to self-oscillation will be obtained over a certain number of degrees of the secondary condenser, say, from 40 deg. to 60 deg. Gradually adjust the stabilising condenser C1 whilst varying the secondary condenser and tapping T3. If the neutrodyning coil is correctly connected the band over which oscillation takes place will gradually narrow down and finally disappear altogether when C1 is correctly adjusted. C1 must be varied very slowly, as it is easily possible to pass the correct position. If the oscillation band is not found to narrow down it will be due to the coil L1 being connected in the wrong phase, and is simply rectified by reversing the leads to this coil. All this sounds fairly difficult, but in practice will be found quite easy. On changing coils for another wavelength band only slight alteration to C1 will be necessary. On the longer waves often no readjustment has to be made on changing over, and frequently the neutrodyning coil may be dispensed with. It is on the B.B.C. band and below that this arrangement will be found invaluable.

Test Report

On test 40 miles S.E. of London 2LO could be comfortably heard at 50 yards in the open air. All B.B.C. stations were audible on the loud-speaker, Cardiff, Newcastle, Aberdeen and Birmingham giving plenty of volume to fill a fairly large room.

Of the Continental stations, Radio-Paris, Eiffel Tower, and the Petit Parisien came in well on the loud-speaker with very little interference.

Selectivity on this set was of the highest order, Cardiff being quite clear without the faintest trace of London on the loud-speaker, although on the average set on this aerial 2LO absolutely swamps Cardiff and Bournemouth.

On a small indoor aerial seven miles from London a big loud-speaker was overloaded by signals from 2LO. Aberdeen could be heard comfortably on 'phones using a two-foot frame.

As an interesting experiment the aerial coil was removed and aerial and earth disconnected, so that the secondary coil was left to act as a frame aerial.

2LO was successfully tuned in on the loud-speaker, though faint. On rotating the whole set so that the secondary and anode coils became directional to 2LO, signals increased in volume sufficiently to be heard comfortably in an ordinary room. Reaction control was delightfully smooth, even though the aerial load was removed, all tendency of the high-frequency valve towards self-oscillation being completely eliminated.

The weird collection of instruments used to Broadcast "Hyperprism" a futuristic musical item, from the 2LO studio recently. Listeners were uncertain whether to take this music seriously or not.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

Stabilising a Tuned Anode Circuit

A POPULAR method of stabilising a tuned anode circuit is that illustrated in the accompanying figure. It is extensively used, commercially, in the United States. The circuit given is an arrangement which may be tried out very readily. It will be seen that the arrangement involves tuned anode coupling between the valves, a tuned anode circuit consisting of the inductance L3 shunted by the variable condenser C2. Between the anode and the circuit L3 C2 is a reaction coil L2, which is coupled to the aerial inductance L1. This coupling is reversible so that reverse reaction may be obtained if desired. This, in fact, is the main object of the coil L2 in the American form of the circuit. Provided the general circuit is designed to obtain the greatest efficiency, there will be a tendency for the tuned anode circuit to set up oscillations due to inherent capacity coupling between the circuit L3 C2 and L1 C1.

Self Oscillation

I would mention, at this point, that because a tuned anode circuit arrangement oscillates it does not mean that the set has been efficiently designed; it means that either the set has been badly designed or extremely well.

This seems paradoxical, but the explanation is very simple. If all principal losses are eliminated from the circuit by using thick wire, etc., the small natural capacity coupling between the anode and grid circuit will be sufficient to set the valve into oscillation. On the other hand, if no precautions are taken to minimise magnetic coupling between L3 and L1, and if no precautions are taken to reduce the capacity between different leads, the valve will tend to oscillate readily, but this time the oscillation is due, not to decreasing the losses, but to the increasing of incidental capacity couplings.

Methods of Stabilising

Whatever the cause of self-oscillation may be, a reverse reaction coil L2 of small dimensions, if coupled to L1, will stabilise the circuit. If, on the other hand, the circuit is quite stable without the necessity for reverse reaction, the coil L2 may have its leads reversed, or its direction reversed, so as to introduce a real reaction effect into the aerial circuit of the valve. It is desirable, in any case, to keep the coil L2 of small dimension and to enable this to be done the damping of the aerial circuit must be kept within reasonable limits. This may be effected by the use of a constant aerial tuning condenser.

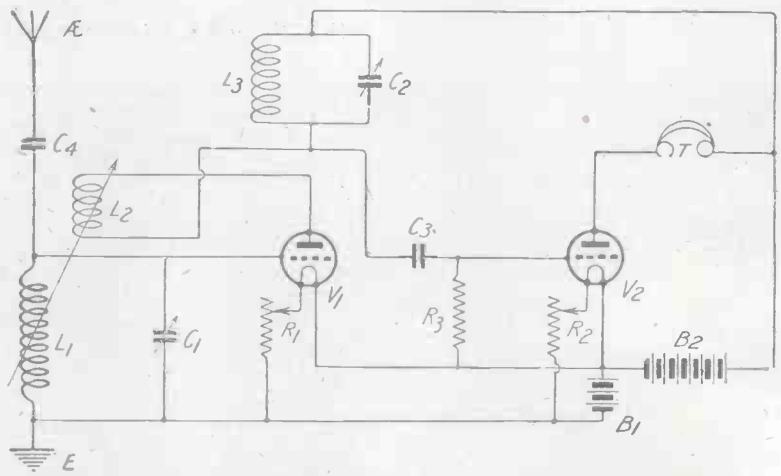


Fig. 1.—A popular method of stabilising a tuned anode circuit which is in common use in America.

Can You Answer this Question?

Why is it that the currents induced in the two sides of a frame Aerial do not neutralise one another?

Because the induced currents are not "in step" or "in phase," to use the correct term. Consider this from the point of view of time. Although the difference in time is only a very small fraction of a second, it is nevertheless true that the wave strikes one vertical side of the frame before the other, that is, when the frame is pointing towards the transmitting station. This time difference means that there is a difference in potential between the two vertical edges of the frame winding, and, in consequence, a current is set up, which reverses in direction at a frequency corresponding to that of the inducing waves.

Unsuspected Causes of Distortion

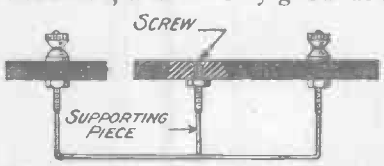
SO much has been written on the subject of low-frequency amplification of late that most amateurs are tolerably familiar with the main causes of distortion and understand how to deal with them when they occur in receiving sets. There are, however, some which are rather puzzling since they are of comparatively rare occurrence. Their effect when they do happen is most unpleasant, and should you at any time find that your set is not giving its accustomed volume of pure sound the reason may possibly be found in one of these rather out-of-the-way factors. When reception is woolly or when certain notes are unduly emphasised one should always try the straightforward remedies first.

Capacity Experiments

Experiments should be made with various capacities in shunt with the primary of the low-frequency intervalve transformer; the effect of shunting the secondary with an anode resistance should be tried, and one may also experiment with shunt condensers and resistances across the primary and the secondary of the second LF transformer, where two stages of note magnification are in use. With low-resistance phones a great improvement will often be effected by using a very large condenser across the output of the telephone transformer. Care must also be taken to see that proper grid bias is being given to the low-frequency valves and that the high-tension battery is delivering sufficient voltage for their needs.

A Peculiar Case

If all these experiments fail and if distortion still persists we are up against a rather difficult problem. A case of this kind occurred to me quite recently. The set in use was a recently constructed five-valver fitted with two stages of H.F., a rectifier and two note magnifiers. In all previous tests it had done extremely well, the tone being excellent, and there being a complete absence of "gramophonics." During the afternoon various combinations of valves were tried on speech, but not on music. In the evening when 2LO's orchestra was playing reception was found to be far from good. The volume was there all right, but there was a very unpleasant resonance on certain notes and no depth of tone. Any alterations in the high-frequency valves, which were changed several times, had no effect, nor did an adjustment of the variable gridleak of the rectifier or of the grid voltage of the low-frequency valves. These were both small power valves rated for a filament voltage of 5.5, and as a 6-volt accumulator was in use there appeared to be nothing wrong with the filament supply. All kinds of things were tried without effect. Eventually the under parts of the set were examined, and more by good luck



Showing how long leads may be supported to overcome microphonic effects caused through the wire.

than by good judgment the rheostat of the first low-frequency valve attracted attention. It was found that the arm had got out of adjustment, so that when the rheostat was turned towards the on position it actually came to a full stop with several turns of the resistance wire still in circuit. The accumulator had been in use for some time, and its voltage under load had fallen to 5.5. Therefore this valve was receiving only a little more than 4.5 volts. The result was, of course, to lower the saturation point in the grid volts anode current curve and so to cause distortion by deforming oscillations. When the rheostat was put right the set worked as well as ever.

A Faulty Rheostat

Now this kind of thing may occur in any set, not only through a defect in the rheostat, but from a variety of different causes. Should the pins of the valve be dirty the bad contact between them and the legs may be responsible for a drop in voltage large enough to cause distortion, especially if the accumulator is not quite up to the mark. The same thing may happen if very long leads of thin wire are used from the low-tension battery to the set, if the accumulator terminals are dirty, or if the LT connections are not properly screwed down. Distortion due to too low a filament current is most liable to be met with in dull emitters, whether they are power amplifiers or ordinary valves. One does not want to run the filaments too brightly, and therefore reduces the voltage to the lowest possible amount that will give good signal strength. A tiny movement of the rheostat towards the on position may be sufficient to remove all traces of distortion.

Valve Ageing

Another cause of distortion which may take a little finding lies in the ageing of a valve. Most of the valves on the market to-day are so well made that even after they have done a very great deal of work the degree of vacuum remains very much as it was originally, although the filament may consume more current to produce a good electron emission. On occasions one comes across a valve which has not been properly cleaned up during the process of manufacture. Such a valve as this will certainly change its nature when it has been used for some time. The vacuum may soften. If this happens the valve will give very curious results, especially if it is on the low-frequency side of the set. The softer the valve is the larger is the flow of grid current, and the presence of an appreciable grid current in note magnifier circuits is quite certain to give rise to distortion. Some time ago I traced very bad distortion in a receiving set to the softening of a not very old valve, which was used as first note magnifier. If therefore you find that distortion is occurring and that no reason for it can be found, try the effect of changing the low-frequency valves. A valve that has softened should not be discarded as useless, for it will give excellent service as a rectifier.

A rather strange source, not of actual distortion but of a most unpleasant microphonic quality in the set, is to be found in bare wiring that has not been very carefully done. Should there be very long leads beneath the panel supported only at either end these may ring very badly whenever their own natural note occurs in the loud-speaker. I have always found it best to support any lead more than five or six inches in length which shows any signs of ringing in the way shown in the drawing. A countersunk 4 B.A. screw is inserted at an appropriate point into the panel, and a supporting piece is taken from its top to the lead. One can always see whether leads do ring by removing the valves from the set and then rapping the panel fairly hard with the knuckles.

Lastly we have the form of distortion introduced by a loud-speaker horn, which is either badly shaped or made of unsuitable material. In this case there is resonance on certain notes, the horn actually ringing when they are struck. The best remedy is to obtain a new horn, but something can be done to damp out this resonance by bandaging the offender puttee-wise with a strip of fairly thick material, or by fitting a diaphragm of stiff paper just inside the mouth of the horn.

R. W. H.

Aids to Easy Soldering

THE soldering which the constructor of wireless sets or components is called upon to perform is usually of a very simple kind consisting of no more than connecting wires to terminals or to other wires and occasionally of joining two pieces of brass or copper. At the same time it must be well done if efficient results are to be obtained. A properly-soldered joint offers a resistance which is so small as to be practically negligible. If soldering is badly done such a joint is little better, and certainly no more secure, than one made by clamping the wire down with a nut placed upon the shank of the terminal. The construction of a large set may necessitate the soldering of a hundred or more connections; the amateur therefore requires to develop a method which will give him speed as well as certainty in the use of the soldering iron. The object of the present note is to point out one or two ways in which quickness can be acquired, and to show how perfectly secure joints may be made throughout the set.

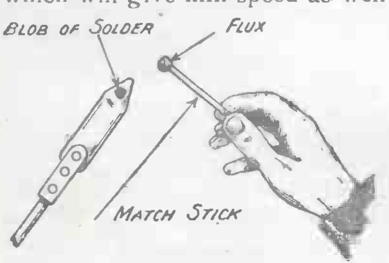


Fig. 1.—A suggested method for tinning the iron.

Reference has been made on more than one occasion in *Wireless Weekly* to the desirability of using a hot iron. When one makes the statement that the iron should be hot one is frequently asked what its proper temperature is, and whether there is any simple indication to show that it has been reached. It is a little difficult to give exact instructions without a practical demonstration, but the following hints may be found useful. In the first place the iron should be left to heat until a blueish or greenish tinge is seen in the flames surrounding it. When it is in the proper condition for easy soldering it should singe a cotton rag at once. Solder should flow on to it as soon as its point is applied to the stick, and the metal should run instantly into the joint when soldering is done. If it takes a second or two for the solder to run into the joint then the iron is too cold. The solder when applied to the joint should be quite liquid, and should not have a pasty or putty-like consistency. If these points are observed it will be found that wires can be soldered to terminals so quickly that the brass does not heat up, and therefore there is no loosening in the ebonite.

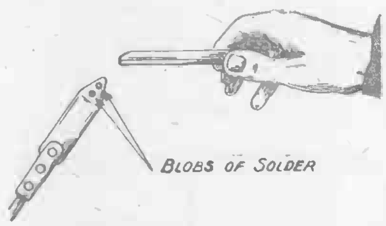


Fig. 2.—Illustrating how blobs are formed if the iron has not been properly cleaned.

Quite important as heating the iron to the proper temperature is keeping it absolutely clean. You will never do either good or quick work with an iron whose surface is at all dirty. Therefore, keep a rag beside you on the table and wipe the point on withdrawing it from the flame before you use it. An iron cannot be kept clean unless to begin with it is properly tinned, and it is impossible to tin it well unless the surfaces are perfectly smooth and free from pits. The first process is to file up the faces at the point of the iron with a medium-cut file in order to remove all pits —even a brand new iron will occasionally be found to contain pits when its apparently beautiful surface is scratched with a file. Next use a fine file, and lastly polish the iron with a piece of emery cloth. Place the iron so treated in the cleanest possible flame and have on the table a piece of emery cloth, a supply of flux, some solder and a few match sticks. On withdrawing the iron from the flame rub one of its faces on the emery cloth until it is quite bright. Then hold this surface uppermost and let a little blob of solder about the size of a split pea run on to it. Now take a match stick and dip it into the flux. With its point work the solder about over the bright surface, spreading it all over until a good layer has been formed. Then deal with each of the other surfaces in the same way. The

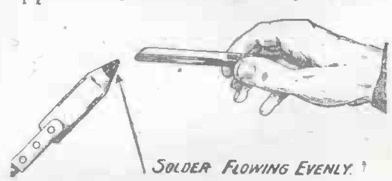


Fig. 3.—Showing how the solder will run freely when the iron has been cleaned before tinning.

match may char a little, but this will not matter, for when the iron is heated up any little pieces of burnt wood that have been deposited will float to the top of the melted solder on the surfaces and can be wiped off by rubbing the iron with a rag. This is the easiest and most effective way of tinning a soldering iron. Try to keep the tinning of the point intact, but if any sign of pitting appears use a file at once and re-tin the iron again.

Whatever kind of flux you prefer do not use too much of it, otherwise you may make your panels rather messy. The writer employs either Fluxite or Baker's soldering fluid for wireless purposes, and finds both perfectly satisfactory. It should, however, be noted that all fluxes appear to contain a little acid which, unless neutralised, may lead in time to corrosion at the joints. With certain fluxes there is so much acid that joints made with their help may come adrift after a few months. Whether a flux contains acid or not can easily be ascertained by the constructor if he obtains a book of blue litmus paper from the chemist. The presence of acid causes the litmus to turn red, whilst it will retain its blue colour if none is present. Acid can be neutralised by the application of an alkali. Strong ammonia has been recommended for the purpose, but this does not seem quite satisfactory, for it has an action of its own upon brass and copper. Perhaps the best neutraliser for general use is a strong solution of washing soda and water. It is recommended that the constructor should apply the flux not with a match stick as is customary, but with a small paint brush which will be found a much more satisfactory method. A little of the alkali solution can be kept in a saucer upon the table and applied to each joint with a second small brush.

It should be noted that it is essential for the bit of the soldering iron to be of pure copper. There are, unfortunately, upon the market numbers of cheap soldering irons provided with bits containing a large proportion of impurities. Soldering with these is a most difficult business, and satisfactory joints are the exception rather than the rule. A good test both for the quality and for the condition of the iron is the way in which solder runs on to it when the point is applied to the stick. On to a clean iron of good quality the solder flows quite evenly just as water would on to an absolutely greaseless surface; but if the iron is either of poor quality or is not very clean then the solder will form little blobs upon the bit very much as water does upon a greasy surface.

R. W. H.

□ □ □

The Care of Valves

VALVES which are not in use should always be stored with a certain amount of care. It is surprising when one comes to think of it how careless we are about these delicate pieces of apparatus. Even though the cheapest of them cost 12s. 6d., even though we know that they are fragile things, we leave them lying about in the most amazing way on the wireless table—and then wonder why some of them are so short-lived! The writer used to favour storage boxes which would take half-a-dozen valves in padded compartments. However, since he was unlucky enough to drop one of these when full he has now become converted to the policy of storing valves singly, for if many are placed together their owner may one day have a surprising illustration of the truth of the old proverb about the inadvisability of placing all one's eggs in the same basket. The boxes supplied by the makers are excellent for the purpose, particularly those in which the valve is suspended between springy strips of cardboard.

Do not keep your valves in a damp place, for if you do the contacts, whether they are pins or bosses, will corrode, and when the valves are brought into use again you may be puzzled either by poor signal strength or by a practically incessant fusillade of "atmospherics."

Wireless is becoming increasingly popular in churches and chapels for the reception of special religious items, the aerial being inconspicuously arranged between the pillars.

Keep your valves as much as possible free from jolts and jars, whether they are upon the set or stored away in a cupboard. Even though a valve seems no worse after receiving a knock, it has probably sustained some slight injury which, though not apparent at the time, will have an effect upon its endurance. When valves are in use upon the set be very careful of the filament voltage. In spite of the opinions which many beginners seem to entertain upon the subject, the makers really *do* know what they are talking about. You may obtain rather louder signals by increasing the voltage on a 3.5-volt filament to 4, but you will certainly very much reduce the life of the valve by so doing.

Unless you are a millionaire do not throw your old valves away. Broken filaments can be repaired nowadays at small cost and with quite satisfactory results. In fact, even if the glass is broken the valve is not beyond hope, for some repairers are prepared to deal even with casualties of this type.

R. W. H.

A New Type Crys

A DUSTPROOF INSTRUMENT

By H. BRA

Experimenters will be intereste tuning

Fig. 1.—Terminals, coil and detector are all contained within the dustproof case.

THE receiver about to be described has in it several very novel features, being designed on lines somewhat different from those of the usual types of crystal receiver.

Although small and compact, the receiver described herein does not fall into the category of toys of the "Complete Receiver in a Matchbox" type. Several points have been carefully considered in the design. Firstly, the whole set is contained in a neat box, which when shut completely covers all the components, even terminals being enclosed. It should be pointed out to those who intend making this receiver that care and neat workmanship are essential. The receiver is capable of working on a wavelength of 1,600 metres, and with an ordinary indoor aerial it functions quite favourably six to ten miles from the local broadcasting station. Photographs of the complete receiver are shown in Figs. 1 and 2. Several circuit arrangements may be obtained with the use of a variable condenser as an extra unit. The operation of these circuits will be explained later, the constructional details being given first consideration.

Materials Required

20 in. of ebonite 3/16 in. thick × 1 in. wide.

9 in. of ebonite ¼ in. thick × 1¾ in. wide.

1 brass slider bar ¼ in. square, drilled one end.

1 "G.W." slider (John & James Laker & Co.).

2 oz. No. 28 or No. 30 S.W.G. S.S.C.

1 oz. No. 30 S.W.G. S.S.C.

10 Valve sockets.

2 Valve pins.

5 Clix plugs with insulating bushes in 5 colours.

1 Burndept micro crystal detector.

Small quantity of insulated flex.

8—6 B.A. screws (C/sk.).

1—4 B.A. cheesehead screw.

1 Terminal (small).

Ebonite, fibre, or cardboard 1/16 in. thick × 2 in. wide × 4 in. long.

American whitewood ⅜ in. thick × 6 in. wide for box.

The Sliding Inductance

Full details of the sliding inductance are shown in Fig. 3. The construction of this portion of the receiver will require great care, so far as the winding is concerned, as fine wire has been chosen for the purpose. It is difficult to make an ordinary slider function satisfactorily on a fine wire winding, and for this reason the "G.W." type of slider has been chosen. The ordinary plunger type of slider should not be used, its movement resulting in a forced drag over the wires.

First make the former, which should be of ebonite strip, 3/16 in. thick × 1 in. wide. Cut off two lengths 7⅜ in. long, and two further lengths 2 in. long for the side pieces. Cut a further piece ⅝ in. long to act as a centre support. Now clamp the two side pieces together, seeing that they do not overlap at any point. Drill four holes in the position shown in the end view in Fig. 3

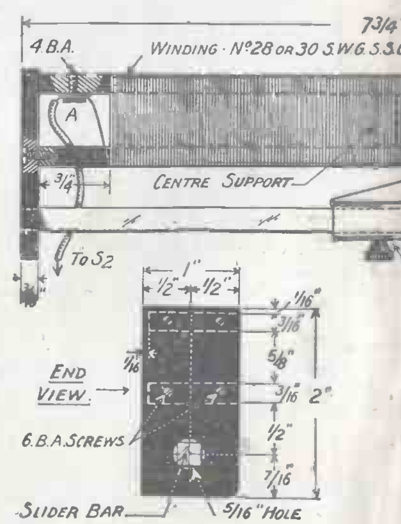


Fig. 3.—Details of the c

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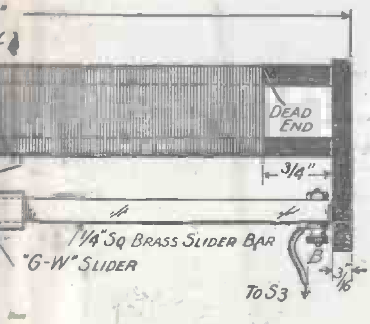
to clear 6 B.A. screws. Remove the clamp and countersink the holes, which have been drilled with a countersinking bit, to a sufficient depth to allow the head of a 6 B.A. screw to come flush with the surface of the ebonite when assembled. Next drill a hole to receive the slider bar. For this a 5/16 in. drill should be used, which will be found to give a forced fit for the $\frac{1}{4}$ in. square slider bar. The two pieces which have been cut off to a length of $7\frac{3}{8}$ in. should now be planed or sawn down to a width of 15/16 in. and the end edges drilled to correspond with the drillings in the end pieces, seeing that there is a 1/16 in. clearance between one edge of the long stays and the edge of the end



oil former and fittings.

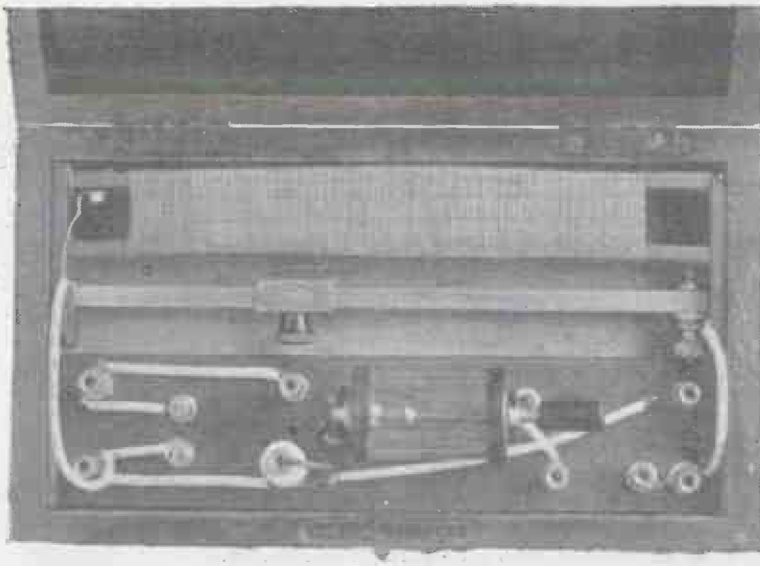


Fig. 2.—Several different circuits are available by a few simple changes.

pieces as shown in the diagram. This is to allow the wire winding to clear the bottom of the box in which the former is to be placed. Assemble the four pieces of ebonite by means of the eight 6 B.A. countersunk screws, and place the centre strut in position, as shown. This piece may be secured by making two pinhole drillings through the former and tapping a small pin well in through each hole. To wind the inductance, drill another pinhole $\frac{3}{4}$ in. from the left-hand side piece to secure the beginning of the winding. Wind in a clockwise direction until within $\frac{3}{4}$ in. distance from the other end piece, and secure the finish of the winding by passing through a further pinhole drilled at this point. The whole of the winding must be close and firm, as any slackness will result in an unsatisfactory contact between the wire and the slider. A 4 B.A. screw is next screwed into the former $\frac{3}{8}$ in. from the left-hand end piece, as shown. This is to secure the beginning of the winding and also to pass a connection from thence to socket S2 of the panel.

The Slider

The finish of the winding is a dead end, having no connection to any point. To assemble the slider, procure a $\frac{1}{4}$ in. square slider bar 12 in. long, drilled at both ends. Cut off to a length of $7\frac{5}{8}$ in. Pass the bar through the 5/16 in. hole in the left-hand end piece of the former, slip the slider on the bar on the inside, attach a small terminal through the hole in the bar, and then push the bar right in until it lodges in the hole in the right-hand end piece. See that the bar is now quite secure, if not, plug the 5/16 in. holes with small pieces of wood, or matchsticks. Now move the slider to one end of the former, right off the winding. To make the winding firm, give it a good coat of shellac, and leave until thoroughly dry, then wrap a piece of emery paper round the slider contact and move backwards and forwards across the wire until the silk covering is entirely removed, taking care not to sever the wire at any point This obviously bares the wire along the path of the slider only, resulting in a neat and finished

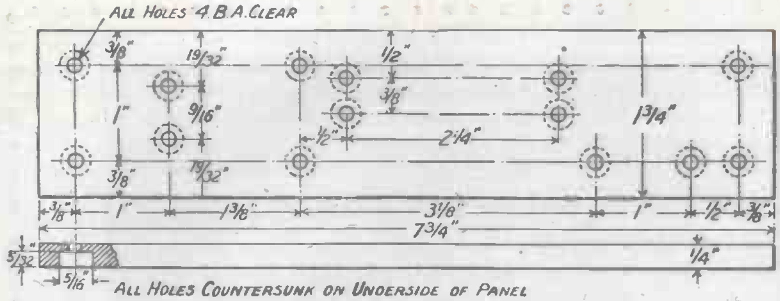


Fig. 4.—Drilling diagram of the ebonite strip.

appearance This part of the set is now ready for the box.

The Panel

The next item to be considered is the panel. For this a piece of ebonite $7\frac{3}{4}$ in. $\times 1\frac{3}{4}$ in, $\times \frac{1}{4}$ in. will be required. The drillings are made as shown in Fig. 4. All the holes are recessed on the underside of the panel to the dimensions shown in the section. This is to allow the securing nuts of the panel fittings to finish flush with the under surface. In Fig. 5 the assembly of the components and the connections are clearly shown. First assemble the valve sockets marked S1–S7 next the two valve pins marked P1 and P2. As an alternative to the two valve pins, P1 and P2, a fixed coil holder may be assembled to the panel in a corresponding position. In this case a plug-in coil of some commercial type would be used instead of the one described in this article. Those desiring to receive Chelmsford or increased range of wavelengths should employ the use of a fixed coil holder for preference as it affords a selection of plug-in coils for experiment. All that now remains to be assembled is the crystal detector. The connections for the detector are made as follows. Pass a wire from socket S1 to S6 and on to the pin P1. Pass a further wire from the pin P2 to socket S2, and on to S7, and on again to S8. The detector is connected on the right hand side to the telephone socket S4, the other telephone socket S5 being connected to S3. A short flexible lead which is provided with a clix having a white insulating bush is connected to the left-hand side of the detector. Two further connections are made when the set is assembled in the box.

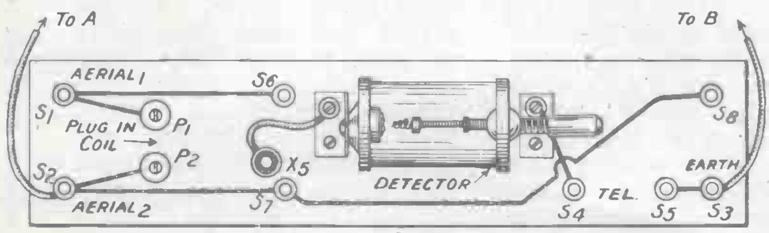


Fig. 5.—Connections and socket lettering.

Loading Coil

The plug-in loading coil is constructed as shown in Fig. 6. First make the two pieces upon which the windings are made. These may be cut to the dimensions given from either cardboard, or, ebonite 1/16 in. thick. Each piece is provided with 7 slots, and two holes are drilled in each in the position shown to clear 4 B.A. screws. The relative positions of these holes must be the same in each case, and for greater accuracy the drillings should be made with the two pieces clamped together. Next cut the centre piece as shown from some $\frac{1}{4}$ in. ebonite and drill as before. The three pieces are now assembled by means of the two valve sockets, which pass the holes drilled and are secured on the other side by means of two terminal heads, the shorting switch being attached under one of them. The shorting switch is cut from thin brass strip. The winding is executed as follows :—Take some No. 30 S.W.G. S.S.G. and secure the beginning to the input terminal then pass through slot No. 1. Pass the wire diagonally to slot No. 2 on the other side and pass in again through slot No. 3, pass diagonally again to slot No. 4 on the first side, and so on, until the former is wound full. Secure the end of the winding to the output terminal. This completes the construction of the loading coil, which plugs on to the valve pins P1 and P2, when in use. The shorting switch is connected across the two loading coil terminal heads when it is desired to eliminate the use of the coil, without detaching it. This loading coil does not greatly increase the wavelength range, but affords a variation of tuning arrangements as described later.

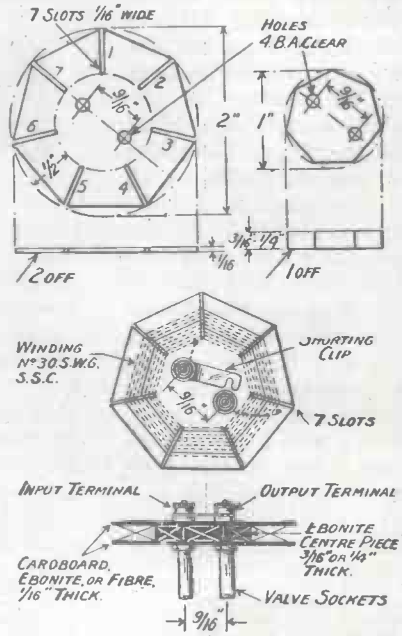


Fig. 6.—Details of additional coil.

(In next week's issue will be given further constructional details, together with various circuits obtainable.)

Fixed Condenser Capaci ties

On page 400 of our issue of July 30 we published an article under the above title. The omission of three words was unfortunately misleading. The last lines in the first column should read " This condenser should *not* be of the square law rotary type, *but one* which," etc.

How every Crystal User may become a Valve Expert

By E. REDPATH, Assistant Editor

In this present article is explained the action of a three electrode valve when used as a detector

In previous articles of this series the fundamental principles of the three-electrode valve have been explained, also the action involved when a valve is employed as either a low-frequency or a high-frequency amplifier.

The essential rule may conveniently be repeated, namely, the flow of electrons from filament to anode is controlled by the potential of the grid, and, under proper working conditions, a small change of grid potential causes a large variation in anode current.

It will no doubt be understood that the actual effect upon the anode current will depend to

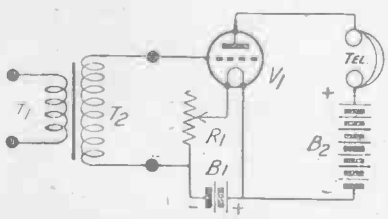


Fig. 1.—Maintaining the grid at a negative potential.

a very large extent upon the initial or normal grid potential. For instance, in the arrangement illustrated in Fig. 1 herewith, in which a valve is employed as a low-frequency amplifier, the grid of the valve is connected to the negative side of the filament lighting battery via the secondary winding (T2) of the step-up iron core transformer T1 T2.

In this way the grid is maintained at a negative potential with respect to the negative end of the filament equal to the voltage drop in the filament resistance, and electrons intercepted by the grid have an easy discharge or overflow path which prevents any accumulation.

In the circuit arrangement of Fig. 2, in which the valve is functioning as a high-frequency amplifier, the grid is again electrically connected to the negative side of the filament via the aerial tuning inductance L,

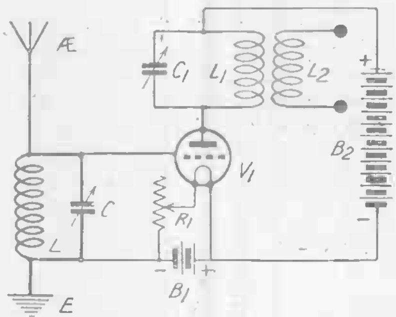


Fig. 2.—A high-frequency amplifier arrangement.

with similar results as far as the prevention of any accumulation of electrons on the grid is concerned.

In both of these cases, therefore, provided that the normal grid potential is such that the anode current is maintained at a steady value about the centre of the straight part of the characteristic curve, variations of potential in

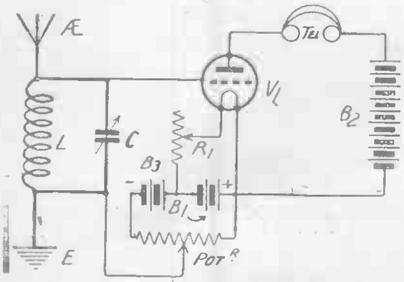


Fig. 3.—Rectification by the potentiometer method.

the input or grid-filament circuit will be accurately reflected, but on a magnified scale, in the output or anode circuit.

The Critical Point

Rectification, however, consists in the production in the output or anode circuit of different current variations from those originally applied to the input or grid circuit. That is to say, *oscillating* potentials are applied to the grid and filament of the valve, and it is desired to obtain *uni-directional pulses* in the anode circuit.

In the case of a valve which has a clearly defined characteristic point in the anode current curve, rectification may be obtained by adjusting the initial grid potential, so as to cause the valve to operate at this critical

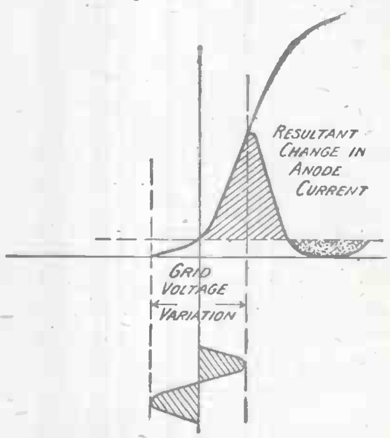


Fig. 4.—Effect of variation of grid potential.

point, usually at the lower end of the characteristic curve. Valves with a grid having a fairly close mesh can be made to give very satisfactory results by this method, the adjustment of grid potential being made by means of a potentiometer, as shown at P in the circuit diagram Fig. 3.

The effect of variations in grid potential due to one complete oscillation is shown in a somewhat exaggerated form in Fig. 4. The incoming oscillation applied to the grid and filament of the valve is indicated by the small wavy line about the vertical axis, whilst the changes in anode current, obtained by projecting the maximum positive and nega-

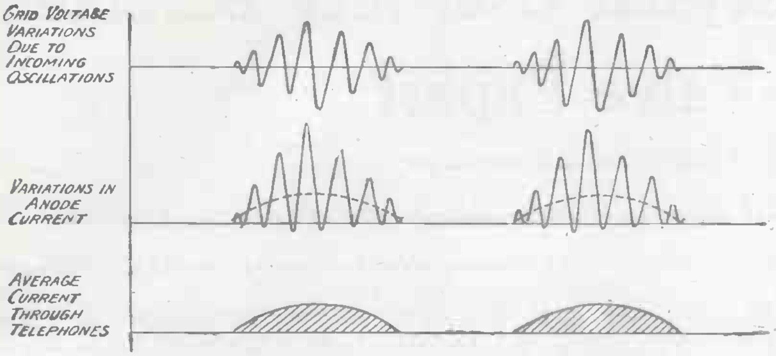


Fig. 5.—Effect produced by two complete trains of waves.

tive values of the oscillation upon the anode current curve, are shown to the right of the curve itself, the amount of movement to the *right* corresponding to the time period of the oscillation. The shaded area represents the useful increase in anode current and the smaller stippled area below the normal line the decrease, representing the imperfection of the rectification.

Rectification of Spark Signals

Whilst Fig. 4 represents the action due to one complete incoming oscillation only, Fig. 5 shows the effects produced by two complete trains of damped waves. The first line represents the oscillations applied to the grid and filament of the valve; the second line the rectified pulses of current in the anode circuit, and the third line the resulting variation in telephone current.

Grid Condenser Rectification

The absence of a clearly defined critical point in the characteristic curve of the modern three-electrode open grid hard valve led to the introduction of another method of rectification. In Fig. 6 is shown an inductively coupled tuner, the secondary circuit of which is connected to the grid and *positive* side of the filament lighting battery, the former connection being made via a small fixed condenser C2 shunted by a very high-resistance R having a value of about 2 megohms (2 million ohms).

By connecting the grid (through the resistance R) to the positive side of the filament, the grid is maintained at a potential which ensures a steady flow of electrons through the valve corresponding to a steady normal anode current well up on the steep part of the characteristic curve. Further, the slight positive potential of the grid facilitates the interception and accumulation of negative electrons thereon, this latter ten-

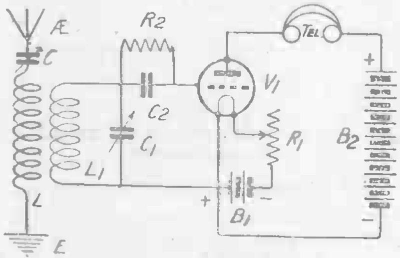


Fig. 6.—Grid condenser rectification.

dency being assisted by the high resistance leak R, which prevents the instantaneous discharge of any accumulated negative charge on the grid.

Working Conditions

Incoming signals set up oscillations in the aerial circuit LC, which are transferred to the secondary circuit L1 C1, and applied to the grid and filament of the valve via the fixed condenser C2, which offers very little resistance to the passage of high-frequency currents.

Each positive half-oscillation applied to the grid causes the latter to collect electrons. Each negative half-oscillation produces no effect beyond a temporary increase of negative grid potential. (Electrons, of course, can only flow *from* the hot filament *to* the grid and anode.) The cumulative action of a complete wave-train, therefore, is to reduce grid potential and consequently to reduce the anode current. As these anode current variations occur at high frequency, they do not individually actuate the telephone receivers, which respond only to the average current change of each complete wave-train.

Upon the cessation of each wave-train the surplus electrons on the grid leak away through the resistance R, and the grid is restored to its normal potential. Without the grid leak R, a strong signal would probably cause a momentary paralysis of the valve.

The complete action involved will perhaps be more clearly understood on reference to Fig. 7, in which the first line represents the oscillatory potentials applied to the grid and filament of the valve; the second line represents the intermittent fall and recovery of grid potential; the third line, the amplified

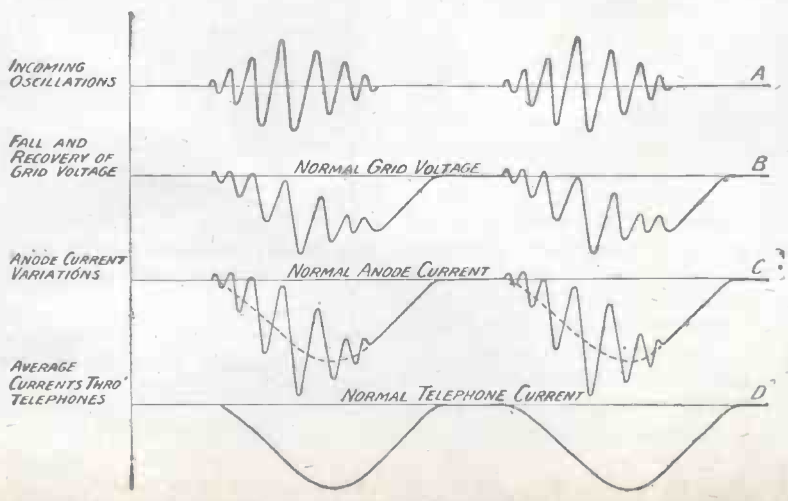


Fig. 7.—A fuller explanation.

variations in anode current which falls below and returns to its steady normal value; and the fourth line, the average *reduction* in telephone current, from which it will be seen that the telephone diaphragms will give one to-and-fro movement for each complete wave-train.

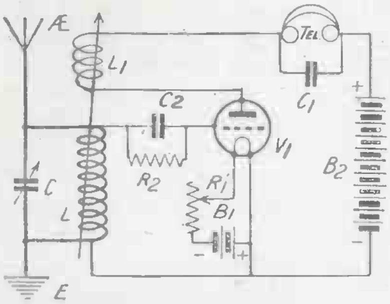


Fig. 8.—How continuous oscillations can be generated.

Radio Telephony

In the case of radio telephony, the explanation of the action involved is rendered more complex by the varied and minute changes due to the wave form of different sounds, but the essential principle remains the same. Instead of the comparatively regular changes in amplitude of the spark or damped wave, as indicated in the first line of Figs. 5 and 7, an otherwise steady continuous wave is irregularly varied in amplitude by the action of the sounds applied to the microphone, and, via the necessary amplifiers, to the transmitting apparatus.

Continuous Wave Reception

From the foregoing it will, no doubt, be understood that the production of sounds in the receiving telephones is dependent upon some low-frequency (sometimes termed audio-frequency) variation in the incoming oscillation. Pure continuous waves, as transmitted from the aerial of a modern valve or arc station, have only one frequency, and that a *radio* frequency, dependent upon the wavelength employed. There is no equivalent to the wave-train or group frequency of a spark transmitter or the audio-frequency variations in the sound-modulated wave of a radio telephony transmitter.

Therefore, the ordinary type of receiving apparatus employing either a crystal or a valve detector is useless for the reception of continuous waves, unless special means are provided whereby the incoming oscillations are mechanically interrupted at frequencies within the audible limit, or, alternatively, additional apparatus is employed as will be described presently.

The only result that would be produced in the telephone receivers of an ordinary receiving set would be a click when the continuous waves commenced to arrive upon the receiving aerial, and another click when they ceased. A slight breathing sound might be heard, due to slight and unavoidable irregularities in the radiated waves, as, for instance, in the case of the carrier waves received from most broadcasting stations when no speech is actually being transmitted.

Heterodyne Reception

A well-known physical law states that if any two waves, of air, water, or anything else, differing slightly in frequency, and not differing too greatly in amplitude, are superimposed, they give rise to "beats."

Examples of this phenomenon occur in several instances, *e.g.*, two violin strings *very slightly* out of tune, when bowed together, give rise to noticeable "beating," the frequency or pitch of the "beat note" increasing as the distuning is made greater.

In radio telegraphy, of course, one set of waves is radiated from the transmitting aerial. The frequency of these waves is definitely fixed as far as the receiving station is concerned.

By means of the circuit arrangement, shown in Fig. 8, continuous oscillations can be generated in the aerial circuit by suitably coupling the reaction coil L1 to the aerial tuning inductance L, as explained in previous articles. In the aerial circuit of this receiver, therefore, we may have oscillations due to the incoming waves and, simultaneously, locally generated oscillations, the frequency of the latter being controlled by the variable condenser C (Fig. 8).

Fig. 9 represents graphically the action which occurs when the condenser C is so adjusted that the two sets of oscillations differ slightly in frequency. The resulting "beat" oscillations, as indicated in the third line of Fig. 9, are then applied, via the grid condenser and grid leak, to the grid and filament of the valve, the subsequent rectifying action being as illustrated graphically in Fig. 7.

If the frequencies of the two waves coincide exactly, no "beats" will be produced, and consequently no sound will be heard in the telephone receivers. As the condenser C is varied, so increasing or decreasing the frequency of the locally generated oscillation, a pure musical note will be heard, which, commencing very low in pitch, will rise rapidly until it passes beyond the upper limits of audibility.

(*To be continued.*)

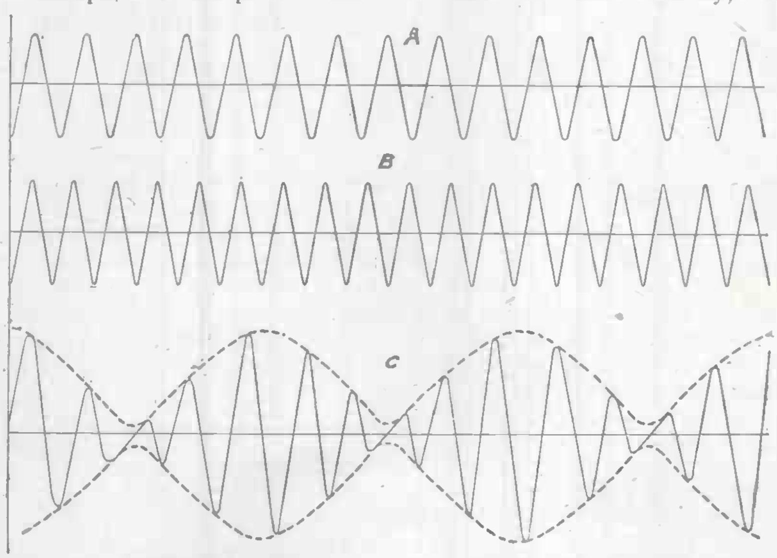


Fig. 9.—Showing "beats" produced by interference between superimposed oscillations of slightly different frequencies.

Wireless in the Empire Pageant

Reception of the First Transatlantic Signals.

THE contribution of wireless telegraphy to Empire development is represented in the British Empire Pageant at Wembley by a reconstruction of the historic scene at Signal Hill, Newfoundland, in December, 1901, when Senatore Marconi for the first time received wireless signals across the Atlantic Ocean.

The actual apparatus which was used on that notable occasion has been reassembled for the purpose of the Pageant, and Mr. G. S. Kemp, who was Senatore Marconi's assistant in his Newfoundland experiment, is demonstrating to the public how the successful result was achieved.

The scene first shows the experimenters with the balloon and kite intended to support their aerial. The balloon is launched, but breaks away, and rises above the neighbouring mountains; whereupon the kite is sent up, and the aerial is secured. The experimenters are then seen arranging the receiving apparatus and the printer, and while one listens, by means of a telephone earpiece, to the audible signals(transmitted on the actual occasion from the Poldhu station), the other draws forth the tape on which appear in ink the corresponding dots and dashes of the Morse code.

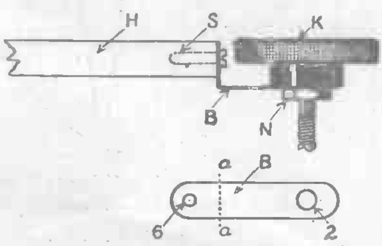
The apparatus with which Senatore Marconi conducted this experiment is on view in a showcase in the Newfoundland Pavilion, when not in use in the Pageant. The case also contains a sketch of the aerial system used at Poldhu in 1901, and the track charts of the *Philadelphia* and the *Carlo Alberto,* in which Senatore Marconi made voyages, and conducted further experiments, in 1902. During these voyages readable messages were received up to a distance of 1,551 statute miles, and signals up to a distance of 2,099 statute miles from Poldhu. These experiments led up to the establishment of commercial wireless telegraphy between England and Canada. A photograph of the "tapes" received on the *Philadelphia* shows how remarkably clear were the signals received by means of this early apparatus.

A Simple Anti-Capacity Handle

THE knobs usually found on condensers, coil - holders, and the like, are not machined from ebonite, but are moulded from an insulating composition into which it is well-nigh impossible to drill and tap satisfactorily. For this reason it is difficult to fit a long handle to such a knob by the obvious method of inserting a short length of screw into the end of the handle, and screwing this into the side of the knob; and even if the operation is successfully performed, the result is not strong enough to withstand that accidental blow on the extending handle which is inevitable sooner or later in the manipulation of one's apparatus.

The following is a simple method of overcoming the difficulty, and has the advantage that the resulting handle is proof against an accidental blow. As will be seen from the drawing, it consists in attaching the handle by means of a bent strip of brass to the condenser stem immediately beneath the knob.

A strip of soft brass B that will bend without breaking is cut 1¾ in. long and ⅜ in. wide, using metal shears. About 1/32 in. is a suitable thickness. The end 2 is drilled to clear a 2 B.A. thread (3/16 in. drill), and the end 6 to clear a 6 B.A. thread (Morse drill 34). The strip is trimmed up with fine sandpaper, and is then bent at a right angle along a line *a-a,* ½ in. from the end drilled for 6 B.A. This operation is neatly performed by clamping the strip in a vice so that the line *a-a* is level with the jaws, and beating the projecting portion over gently with a hammer.



Details of the anti-capacity handle.

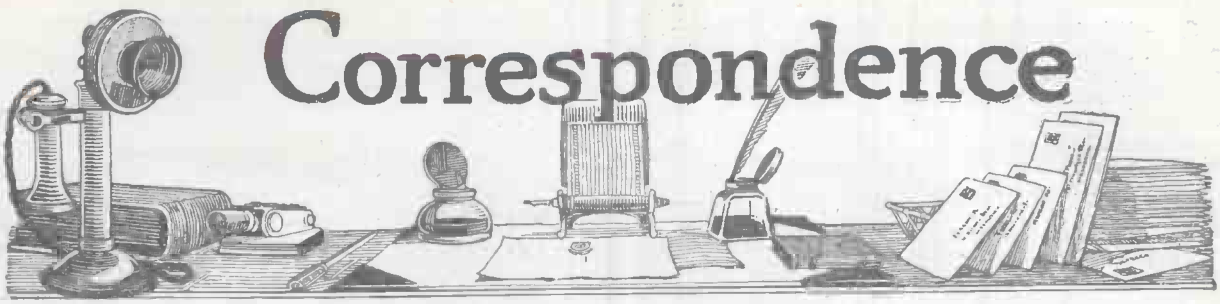
The end of the handle H, which is of ⅜ in. ebonite rod, is then drilled out to receive a 6 B.A. screw-thread (Morse drill 44). This is not difficult if the handle is held vertically, and care is taken throughout that the drill is held vertically. The drill should be driven slowly, without undue pressure or side-strain, and should occasionally be carefully withdrawn to clear it of ebonite fouling. To ensure that the drill starts properly, the centre of the end of the handle should be pricked with a sharp-pointed tool, and the drill turned slowly in the hole for a few turns by manipulating the drill-chuck—*not* the handle. The hole should be made about 1 in. deep to allow sufficient margin for tapping to receive a ½ in. 6 B.A. screw, this being the final operation.

Assembling is simple. The shorter arm of the strip is secured by a ½ in. 6 B.A. cheese-headed screw S to the end of the handle. The knob K is screwed off its spindle, and a 2 B.A. nut N is screwed on as far as it will go, followed by the end 2 of the brass strip. The knob is then screwed on, not quite right home, and the nut N is turned with a spanner hard up against the base of the knob, thus clamping the brass strip tightly in position.

The elasticity of the brass strip renders the handle indifferent to any amount of mishandling.

A. J. W.

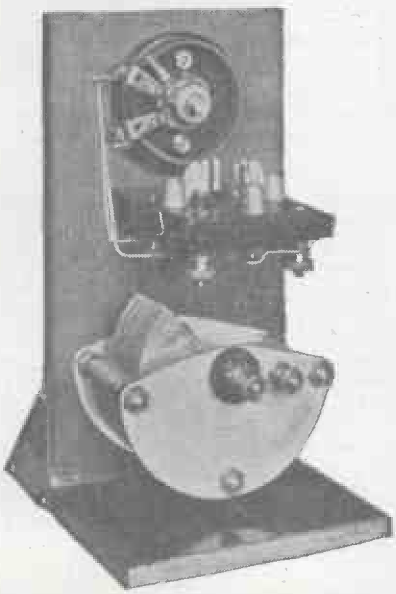
Correspondence



VALVE HOLDERS

SIR,—Noticing in a recent issue of *Wireless Weekly* your remarks to the effect that there is room for improvement in the ordinary type of valve-holder, I send you herewith a type of holder I am trying out.

The actual valve sockets are made from wing nuts with one wing removed and a piece of rod silver soldered to the other wing and afterwards drilled.



Photograph showing the valve-holder designed by Mr. Townson.

As this might be of interest to you or your readers, I have roughly mounted it on a mahogany panel which may be seen in the photograph. The condenser on the panel was for tuning the secondary of a loosely coupled transformer, the two-coil holder for which is on a similar panel.

I find the arrangement of terminals very convenient for trying out circuits, and is as indicated in the diagram.

One small advantage is when HT– is connected to LT+ and connections are made as in Fig. 3 there is small possibility of accidentally putting the HT current through the filament when connecting up, as the HT+ could make contact with any wire or terminal within reach without damage to the valve.

When HT– is connected to LT– it would be advisable to make connections as in Fig. 4.

For a fairly permanent "hook up" these terminals could be eliminated altogether.

I have also tried putting terminal tops direct on the valve socket threads, but it is inconvenient to use, although it looks much better and is more efficient.—Yours faithfully,

L. T. TOWNSON.

Sanderstead.

5XX

SIR,—Referring to a letter in last week's number by Mr. C. P. Brown, stating that he is unable to get 5XX satisfactorily, I beg to give you my experience.

Tavistock is about 200 miles from Chelmsford and 15 from Plymouth. Using a one-valve set with reaction on the aerial (this circuit was described in *Wireless Weekly* of February 13 last by Mr. Rattee, with instructions for building the set), I get 5XX loud enough to take three phones well, being as loud as Plymouth. With this set I also get Eiffel Tower and Radio Paris on three phones. Last Sunday Konigswüsterhausen and The Hague came in faintly.

My aerial is a particularly good one, and my house is well placed above the town, which no doubt contributes to my good results.

Allow me to congratulate you on your paper, of which I am a regular reader.—Yours faithfully,

W. E. CREE.

Tavistock.

SILVERTOWN FIXED AND VARIABLE CONDENSERS

SIR,—With reference to your recent editorial you will perhaps be interested to know that we guarantee both our fixed and variable condensers to be accurate to within 5 per cent. of their stated capacity.—Yours faithfully,

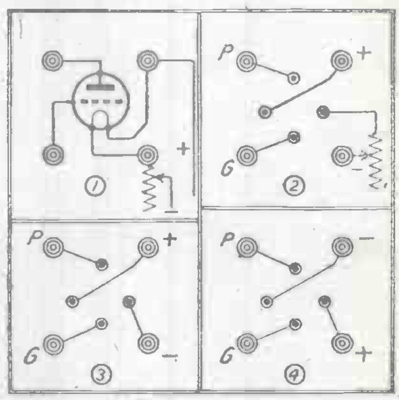
THE INDIA RUBBER, GUTTA PERCHA AND TELEGRAPH WORKS CO., LTD.,
GEO. A. PHILPOTT,
Sales Manager.

THE "SUCCESS" TRANSFORMER

SIR,—We wish to here record our thanks and appreciation of your trouble and courtesy in further testing our "Success" transformers.

Your remarks which appear in the current issue of *Wireless Weekly* we note with interest and pleasure, and we greatly appreciate your valuable advice. In this attitude we are second only to the public, and can assure you that the criticisms as appear in *Wireless Weekly* have greatly helped us to attain and maintain the standard of excellence that we desire in our "Success" components.

In our opinion, the impartial reports of tests as published in *Wireless Weekly* tend to inspire confidence not only in the public when purchasing advertised goods, but also in trader and manufacturer alike.



Figs. 1, 2, 3 and 4 referred to by Mr. Townson in his letter.

Again thanking you.—Yours faithfully,

BEARD AND FITCH, LTD.
L. A. SHARLAND.

APPRECIATION

SIR,—About a week ago I purchased—with some doubt I do contess—one of your Radio Press Envelopes and a Simplex Radio Chart, and out of a sense of fairness I must beg you to accept my very best compliments for both.

No other publication of the kind could be as clear, as simple or more successful for any wireless amateur even at the first stage.

Please accept once more my compliments, and with best regards.—Yours faithfully,

A. S. PESARO (Capt., M.C.).
Como, Italy.

A CRYSTAL SET HINT

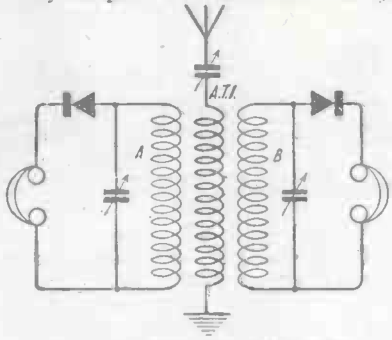
SIR,—Wireless enthusiasts who are in the habit of experimenting with, or make alterations to, their sets, may find the following of some interest.

When adding a second pair of telephones to a crystal receiving set, a reduction of signal strength will in all probability take place, owing to the extra resistance being put into the circuit, and the conditions for receiving not being of a high standard.

With a really efficient aerial and earth system this extra resistance will not usually cause any appreciable difference, but if the aerial in use is an indoor one, or an outdoor one badly screened, then the weakening of signals will be more pronounced.

Signals will also be noticeably weaker in one of the pairs of telephones if the resistances of the two pairs are not quite equal. To counteract this difference in signal strength the circuit shown in the diagram is to be recommended, and with a little practice in tuning will allow each pair of 'phones to give the same volume of sound as when they are being used singly on a set.

From the diagram it will be seen that the A.T.I., which is tuned to the incoming wavelength, is inductively coupled to the coils A and B,



The circuit referred to by Mr. Ingleton.

which form two separate closed circuits, each with a crystal detector and a pair of telephones. The method of operation is as follows: Ignore one closed circuit for the time being by making the coupling with the A.T.I. as loose as possible, and then tune in to the required wavelength, with the aerial condenser, closed circuit condenser and the varying of coupling, in the same way as with the usual loose coupler type of circuit, until signals are being received to satisfaction. Now bring the second closed circuit into action, tuning this in a similar manner to the first, and when both circuits are in tune, each pair of 'phones should be acting at full strength. When the second circuit is being brought into tune with the A.T.I. it will be noticed that the first tuned circuit will become detuned until the right degree of coupling is found. This is where practice and patience will be needed, but after a short while the circuit will not present a very great difficulty.—Yours faithfully,

F. G. INGLETON.

Fortis Green, N.2.

[We do not necessarily agree with our correspondent's conclusions, but publish them as a matter of interest. —ED.]

THE FOUR-VALVE FAMILY RECEIVER

SIR,—I have built the four-valve family receiver as designed by Mr. Percy W. Harris (Envelope No. 2), and I wish to inform you that I had excellent results. Here in Salzburg, Austria, I get every B.B.C. station (the Savoy Band even on the loud-speaker), France, Italy and every German station. I rarely use less than 6-10 pairs of headphones. No apparatus in this town gives such good results as mine. I am using an outside aerial, single wire 100 ft. long and about 10 ft. above the roof. My earth connection is a very bad one, so that I am certain that the results would be improved if I could get a better earth. I also had to build with Austrian manufactured parts which, especially transformers, are rather doubtful.

Wishing you every success with your organisation.—Yours faithfully,

DR. S. C. LIVERMAN.

Austria.

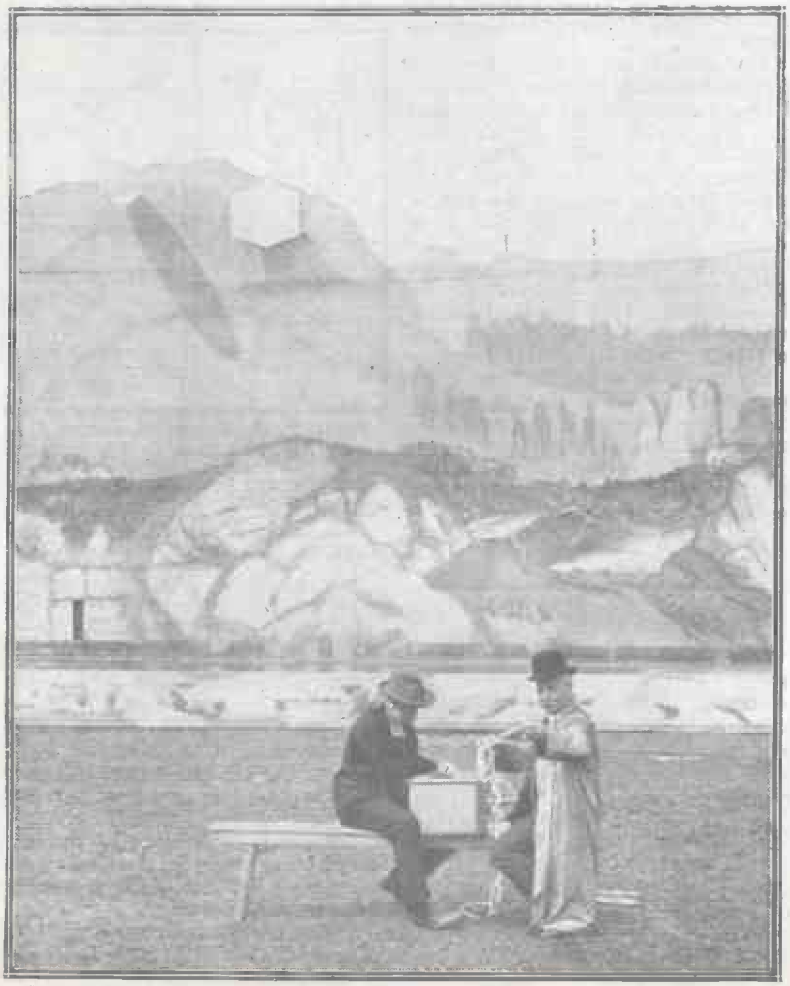
ENVELOPE No. 1

SIR,—I want to thank you for your excellent weekly and to let you know the success I have obtained. I am in the process of making a ST100 set from your Envelope No. 1.

I decided to commence by making a single-valve reflex circuit, but could find nothing to suit me. I therefore modified the circuit given by Mr. G. P. Kendall on page 510, Vol. 3, No. 16, by cutting out the aperiodic aerial coil and simply joining aerial and earth to the opposite ends of L2.

Working on local amateur transmissions I got quite good results, and found, to my amazement, that the best results were obtained *without an earth connection.*

Later using a 75 honeycomb coil and 80 basket coil (both of my own make), I tuned in JB (Johannesburg) 850 miles air line. In all my trials



The reception of trans-Atlantic signals as acted at the Pageant of Empire, Wembley, see page 490.

I have used a Marconi D.E.3 and two dry cells, with 60 volts on the plate. This reception of JB was at the tail end of the evening after listening in to amateur transmission.

To me the most remarkable part is that this is the first valve set I have used and then only for a fortnight, so that I am hardly an expert.

I give all the credit to your excellent journal, through which I have obtained a great deal of information. I found your series of lectures on dual amplification most instructive, and I always read with avidity any practical hints which are given.

It was quite by chance that I happened to start subscribing to *Wireless Weekly.* I was going on a journey and wanted something to read. No. 1, Vol. 3 of your journal caught my eye, and ever since then I have had it every week and look forward to every Monday and the arrival of the mail.

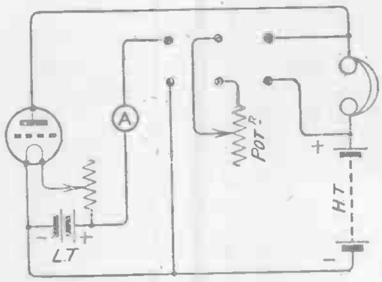
Wishing your paper every success.—Yours faithfully,

Maitland, S.A. CHAS. NYMAN.

MEASURING SIGNAL STRENGTH

SIR,—Many amateurs are no doubt unaware of any simple method of measuring signal strength; this is very useful for comparing reception of the same station at different times and thus collecting data about fading. Here is a simple method; it is not absolutely accurate, but quite reliable for the wants of the ordinary amateur.

The materials required are a potentiometer, a double pole double throw knife switch and an ammeter.



The arrangement advocated by our correspondent A. S.

These may all be incorporated in the set, or mounted on a separate panel.

The potentiometer should be of a non-inductive type, and have a high resistance (about 400 ohms). Connect these up as in the diagram.

Now tune-in the required signal with the switch open, *i.e.*, with the switch arm making contact with neither side. When the maximum signal strength has been obtained. switch the potentiometer in circuit; now commence to reduce the resistance in shunt until the signal just disappears.

Next switch the ammeter, and low tension battery in, and read the ammeter; it is now comparatively simple to determine the value of the shunt by Ohm's Law $\left(R = \frac{E}{C}\right)$

From this, by using the formula $S = \frac{R + S_1}{S_1}$ in which S = signal strength, S_1 = shunt (in ohms), and R = resistance of phones (in ohms), we may obtain the number which represents the signal strength.

It will be obvious that this must be done in a quiet room, or the threshold of the sound is lost. In using Ohm's Law, care should be taken to see that the actual current, due to discharge, is used. If preferred, a separate battery may be used for this reading.—Yours faithfully,

A. S.

[We do not agree that any reliable quantitative result is obtained by this method. The idea, however, is interesting.—ED.]

ST100

SIR,—Noticing your reply to A. B. G. (Charlton) in last week's *Wireless Weekly, re* the ST100 receiver, I think the following will interest you.

I constructed the set from the directions in Envelope No. 1 in March in wireless. From the first I have had excellent results. I only have an indoor aerial, fixed in an up-stairs passage, first floor, consisting of three lengths of ribbon aerial on spreaders. I have received all the B.B.C. Stations, Petit Parisien, Ecole Superieure, and Radio-Paris; with other foreign stations I have been unable to identify. The only difficult stations to get are Aberdeen and Cardiff. A friend, who has also built up the same set, has tried his on my aerial, and he tells me that the results I get are in no way inferior to his, and he has a particularly high one, with all joints soldered, and the whole thing finished off in a workmanlike manner, which mine is not.

I have difficulty, however, in getting stations near 2LO at times, and I have been experimenting for about a month in trying to make the set more selective. Loosely coupling the aerial circuit seems likely to be the best solution, but I have had some good results with the coils described by Mr. Chapman in a one-valve set in *Modern Wireless*. I have also tried the third coil just shunted with a .0003 condenser and closely coupled to the aerial coil. This cuts out 2LO with ease, but I am not sure that it does not also affect other stations such as Bournemouth, which I can easily get, mixed up with London, at any time.—Yours faithfully, H. LUFF.

Kingston-on-Thames.

LACONIC

SIR,—No. 18, Vol. 3, *Wireless Weekly*. Just put circuit together and have had Aberdeen and London on loud-speaker.

Consider it a grand circuit. Best of luck. Newcastle loud on two valves.—I am, yours faithfully,

HY. C. T. IRELAND.

Newcastle.

COMMON NEGATIVE FOR L.T. AND H.T.

SIR,—The following may be of some interest as bearing upon a point you recently raised with regard to whether the H.T. and low-tension batteries should be joined in series or connected to a common negative.

I was recently called upon to advise upon a three-valve set that had suddenly burnt out its valves (.06 dull emitters). The voltage of the L.T. battery (dry cells) was found to be O.K. About 2.9 volts and the high- and low-tension battery connections had not inadvertently been wrongly connected. The internal wiring of the set was O.K. Further inquiry, however, elicited the fact that a telephone circuit had been run to other rooms with suitable plugs and an attempt had been made to use this telephone circuit simultaneously for aerial and telephone circuit, the result being that the high-tension battery circuit was completed across the valve filaments and the L.T. battery, and as the latter consisted of fairly high-resistance dry cells, the filament went first.

The two batteries in the case were coupled in series—*i.e.*, H.T. negative to L.T. +; if they had had a common negative this could not have occurred.

Whilst experiments of the above type are naturally rare, yet the fact remains that when the batteries are in series, if any part of the circuit connected to the H.T. + should be accidentally earthed, the valves will almost certainly be burnt out.

Congratulating you on your very excellent paper.—I am, yours faithfully,

EDGAR R. KELMAN.

Apparatus we have tested

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

A Micrometer Adjustment Two-Coil Holder

We have received from C. Bristow a sample of a two-coil holder which provides a micrometer adjustment of the coupling between the coils, in addition to the usual coarse adjustment by the pivoting of one coil.

An ebonite frame 2½ in. by 2 in. is adapted for mounting on panel or cabinet by four small screws tapped into the ebonite, and carries the usual pivoted coil-plug with its long control handle. The other coil-plug has a limited rocking motion, and is advanced against the tension of a spiral spring by a finely-threaded ebonite rod tapped through the end of the frame, thus providing a fine adjustment over a limited range. Connection is made to each coil-plug by small screws, which can be considered as adequate if the instrument is permanently installed in a receiver.

A special point is made of the provision of a tension adjustment regulating the grip of the moving holder when heavy coils are to be used; in practical trial it was found that the largest sizes could be handled safely in any position.

In actual reception, the fine adjustment of reaction coupling made possible by this micrometer device was appreciated, and the instrument was found to work smoothly. The insulation resistance on test was found excellent. The general finish and workmanship are unusually high for a moderately-priced article. It can certainly be recommended for incorporation in any permanent receiver of conventional design using plug-in coils.

"Simplaerial"

WITH reference to our test report on the "Simplaerial" in *Wireless Weekly* of July 9, an interesting fact has come to light—namely, that there are two firms trading under the name of the Radio Transformer Co., one only being a limited company. The makers of the "Simplaerial" are the Radio Transformer Company, manufacturing radio engineers, Burton Chambers, Norton Street, Liverpool, to whom all letters *re* this aerial should be addressed.

The other company is the Radio Transformer Company, Ltd., 3, Stanwell Street, Colchester, Essex, and is not in any way connected with the former company.

"C" Valves

MESSRS. LESLIE DIXON & CO. have submitted samples of the well-known "C" type of valve used by the R.A.F., of which this firm hold large stocks, and which they are now supplying to the public at an extremely moderate figure.

The "C" valve is of the low-capacity type, which is normally mounted on the panel between four small clips (provided by the dealers), or it can be used in a simple adaptor in existing valve-sockets. The filament is rated at 5 volts and .68 amperes. In one sample tested the filament was very bright on five volts, and the plate current under these conditions prodigious; 4½ volts on the filament seemed quite adequate, so that the characteristic was determined and the qualities in actual reception observed at this voltage. The filament current was then approximately .8 amperes.

The characteristics on 60 volts anode potential, and on 100 volts, show an unusually liberal emission, and a long straight portion so desirable for distortionless amplification. The 100 volts curve was almost entirely to the left of the zero-grid-potential line, indicating that heavy negative grid-bias would be needed in L.F. amplification. This was found to be the case in practice, as much as 10 volts negative grid-bias being applied with advantage, with reasonably high H.T. voltage. Most excellent L.F. amplification resulted, Big Ben, e.g. (which generally blasts when L.F. amplification is employed) coming through loudly and clearly on the loud-speaker in a two-valve set at short range with no sign of the effects of the partial rectification at the top of the characteristic so commonly observed.

The amplification factor was found to be around 5 in the specimen tested, the A.C. impedance at 60 volts plate potential being 11,000 ohms—fairly low.

As a detector-valve no advantage was observed in using more than 30 volts H.T., and the filament could be dimmed appreciably; under these conditions good rectification and smooth reaction resulted. In H.F. amplification, a moderate H.T. value sufficed, with rather brighter filament; and good amplification (in comparison with a standard R valve) was obtained. No sign of softness was observed on any value of H.T. applied.

In general, whilst being a little greedy in the matter of filament current, these "C" valves are excellent all-round valves, when proper values of H.T. and grid bias, suitable for the particular working conditions, are applied; and are rather unique in that they can be used for an effective stage of real power amplification as well, handling a relatively very large amount of signal-energy.

Radio Press Information Dept.

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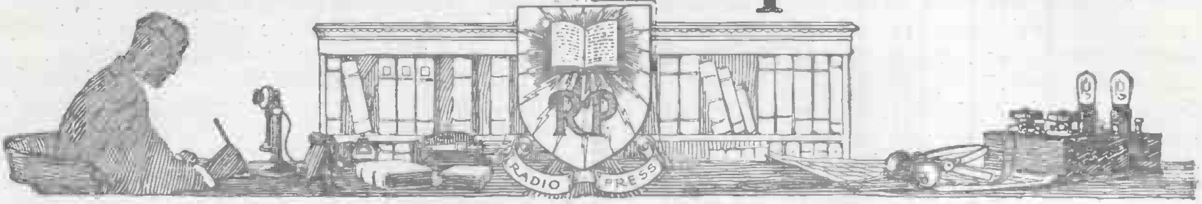

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H. G. (CANTERBURY) states that he is very much troubled by hand capacity effects in his three-valve set, the set often breaking into howls when he places his hand near to certain of the controls.

Hand capacity effects in the sense of alterations of tuning when the hand is placed near the condenser dials, can be considerably reduced by connecting the fixed plates of the condenser to the aerial, and the moving plates to earth, especially if the condenser is one of the type with either a metal dial or a metal screening plate, which latter, of course, should be connected to earth. Hand capacity effects in other parts upon the set, such as the tuning coils cannot actually be eliminated, but their inconvenience can be very much reduced by proper design of the receiver. For example, the coil holder should be placed at such a distance from the condenser dials that the hand does not affect it appreciably in manipulating the condensers. In the case of a tuned anode condenser, of course, the moving plates should be connected to the high tension positive, to which also any screening metal plate should be connected.

These devices should be quite sufficient to reduce hand capacity effects to reasonable proportions, but such troubles as howling when the hand approaches the controls should be eliminated by other methods. This usually means that the set is being worked much too close to the oscillation point, and usually that it is actually oscillating all the time, and that tuning is simply done by setting the control to the silent point of the carrier wave. The only remedy here is to weaken the reaction until self-oscillation just ceases. It will be found that the signals are then not quite so loud, but are superior as regards quality.

E. H. T. (IPSWICH) states that he is about to put up a rather small indoor aerial, which he is going to use with a fairly sensitive multi-valve set, and asks whether it is worth his while to make the aerial system directional for any one of the broadcasting stations.

With small aerials of this type, any directional effects which may be present are exceedingly slight, and it is not worth while to consider them. Incidentally, it is very doubtful whether even with the standard outside amateur aerial, the directional effects are at all noticeable, since directional reception is only effective with aerials whose length is very much greater than their height.

Keep the wires of this aerial well away from walls and ceiling, and take pains with their insulation, and it will be found that equally good results are obtained from almost any direction.

M. S. R. (WEYBRIDGE) is proposing to construct a crystal set for reception of both 2LO and 5XX and submits diagrams and details of his main tuning unit. This consists of a cardboard tube 4 in. in diameter and 12 in. long, wound with a single layer of No. 24 D.C.C. wire, the usual system of tappings being employed to two separate switches.

Since the total number of turns will be in the neighbourhood of 300, and since, when receiving 2LO only perhaps 40 or 50 of these will be in use, it is to be expected that dead-end losses will be serious. Even if some sort of dead-end switch is employed to cut unused turns out of circuit, real efficiency is still not likely to be obtained, since the mere proximity of the dead turns in many cases will act harmfully in absorbing energy.

A much better plan is to design a suitable tuner for 2LO, having only perhaps 75 turns as a maximum, and to use a double-pole change-over switch to bring in the larger coil when 5XX is to be received. The two coils can then be placed at some little distance from one another, and arranged at right angles.

E. A. V. (CAMBRIDGE) asks for an explanation of the rustling noise heard when tuned to the carrier wave of a broadcasting station when the latter is not actually transmitting. He points out that this noise is heard when the microphone switch has been opened at the transmitting station, and therefore it can hardly be said that the noise is being actually transmitted from the broadcasting station.

A certain proportion of this noise may actually be due to irregularities in the carrier wave, but it seems probable that the greater part of it is due to the heterodyne action of the wave upon all the miscellaneous spark and atmospheric waves which are always being picked up, but under normal conditions are not noticed. It will be observed that the same rustling and hissing noise is heard when the set is made to oscillate.

Wireless Weekly

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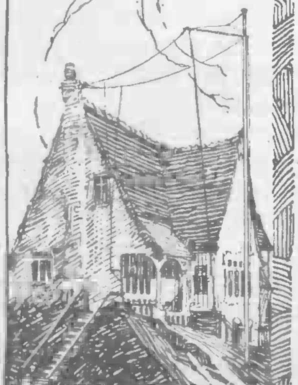

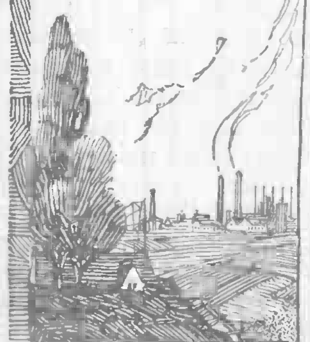

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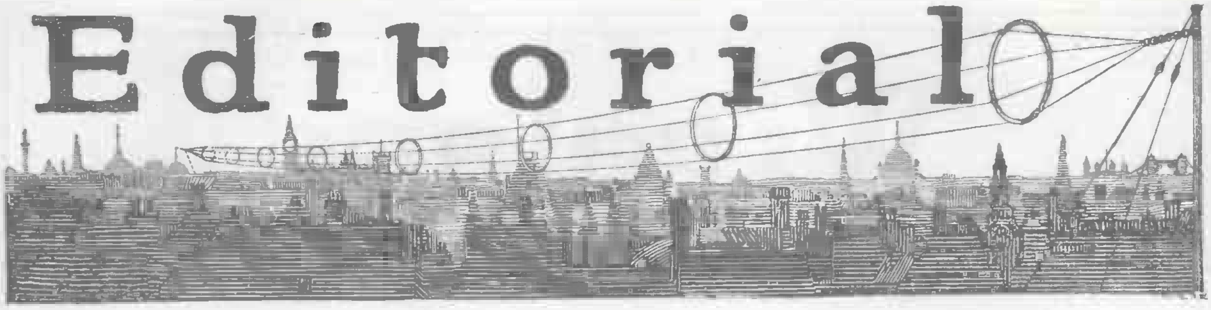


"Lost Opportunities"

On several previous occasions we have commented on the extraordinary lack of enterprise shown by wireless manufacturers generally, in catering for the requirements of the amateur constructor class. In some quarters our remarks have had effect, but in others, regrettably, there is still the same lack of vision. This is all the more astonishing when it is considered that wireless is a new industry.

No section of the buying public is keener in its appreciation of a new idea than the home constructor, yet there are still a number of pressing needs unfulfilled. Take, for example, the question of valve rheostats for bright and dull emitters. These can be divided into two main classes of the " carbon compression " type and " wire." Whatever the merits of the former, there are a large number of users who prefer the wire type of rheostat, yet we have only one or two makes which can be used successfully for either bright or dull emitters. The great majority of rheostats are made for bright emitters alone, so that if the user of this type of resistance desires to make a change to a dull emitter valve he must take out one resistance and substitute another. The position is not met by the provision of an extra series resistance, for if this is added there will not be sufficient variation of total resistance to give adequate adjustment.

Again, take the subject of variable condensers. The ordinary variable condensers, when placed across an inductance coil and used for tuning to various wavelengths, will, within the range of the coil, give a thoroughly bad distribution of wavelength for tuning purposes. The bottom end of the scale will be congested, and the upper limit widely spaced. Seeing that it is nearly always desirable to use as small a capacity as possible in shunt with an inductance coil, the great bulk of our work is done on the lower ranges. With the square law type, wavelengths are distributed far more equally on the scale, and if the condenser is used to tune a secondary circuit, an anode coil or a transformer, the wavelength scale plotted against the condenser degrees can be drawn as a straight line. When an aerial is attached the line is not quite straight, but far straighter than is obtainable with the ordinary type of condenser. For wavemeters, of course, square law condensers are ideal, enabling the home constructor to calibrate his instrument with the greatest ease. A further advantage of this type of condenser is that generally the minimum is lower than with the ordinary type, owing to the form of construction. Users of square law condensers never revert to the old type, yet the great majority of firms making variable condensers still adhere to the old-fashioned kind.

Again, where is the filament resistance which incorporates an on and off switch. In a critically adjusted set it is most inconvenient to have to upset the filament adjustment when we turn off the current. A simple on and off switch could be incorporated in the average filament resistance with very little additional expense.

OUR NEXT ISSUE.

Two special articles of particular interest to the home-constructor will appear in our issue of August 27th.

A REMARKABLE NEW BUZZERLESS WAVEMETER.

A SIMPLE RECEIVER FOR USE WITH INDOOR AERIALS.

KDKA's Powerful Short Wave Station

The Station with a Vertical Aerial of Copper Tubing

Very little has been told of the wonderful work that the Westinghouse engineers have accomplished in short wave transmission. Something of the work that they have done manifests itself between the lines of this most interesting description.

THOROUGHLY aware that short-wave or high-frequency wave broadcasting will bring forth the greatest future development in radio broadcasting, the Westinghouse Electric and Manufacturing Co. has completed and has been operating for some time past a new specially designed radio experimental station, erected at a cost of several thousand pounds.

The new station is a one-story concrete and brick structure, situated on the Greensburg Pike, about a mile east of the Westinghouse Company's East Pittsburg works. The site chosen is within a few yards of being the highest spot in Allegheny county, and is one of the level spots available in the hilly locality.

The New Site

The new site of the short-wave station of KDKA is in direct contrast to its former position where, despite some known drawbacks, transmitting with Hastings, Neb., and England was carried on nightly. When first installed, the short-wave transmitter was situated on the top of a nine-story building directly in the heart of the East Pittsburgh Works. Steel buildings known to have a decided absorbing effect on radio waves, completely surrounded the set and, in addition, it was situated in a valley with hills on three sides. As a matter of fact, the main transmitter of KDKA is still in the same place, and it is a matter of radio history that all of KDKA's transmitting achievements have been accomplished from this set. However, there is a probability that the 326 metre transmitter will also be moved to this district.

The new radio experimental building has been so designed that all apparatus contained within it is located symmetrically with respect to all other apparatus.

The mobile station seen on the road on the occasion of the Field Day held recently by the Golders Green, Hendon, Hounslow, Hampstead and St. Pancras Radio Societies. Further particulars are given on page 516.

The basement is divided into several rooms. The main basement chamber contains the high-power transformer plant, motor generator sets, filters, chokes and other apparatus. One of the rooms contains a transformer station of the Duquesne Light Co. The remainder of the basement is occupied by the battery room, furnace room and storage space. Power is brought into the basement through underground ducts from two separate sources, both of which are 4,000 volts, three phase, 60 cycles. This current supply may be stepped up or down as required. The available power supply is in the neighbourhood of 250 kilowatts, which can be increased, however, should it be necessary.

With this basement arrangement all bulky apparatus is kept out of the transmitting room and is never in sight.

Main Apparatus Room

The main apparatus room on the first floor of the building in which are the oscillator, modulator and rectifier panels, is large and spacious, and having windows on all four sides is well lighted by day.

The rectifier which furnishes high voltage to the plates of the water cooled valves is mounted in a specially designed frame so that every part of the apparatus is accessible. Replacement and observations can be conveniently made, because every part of the unit is in full view of the observer. The rectifier has a capacity which can be pushed to 150 kilowatts, if it is necessary, and is the result of the several years' experimenting and pioneering of the Westinghouse company in short-wave broadcasting. The rectifier is of the three-phase type, having a valve on each side of the line of six water-cooled rectifier valves. In front of each valve is a helix of rubber tubing to permit the use of city water to cool the valves. On the front of the panel is a row of knife switches used to regulate the voltage of the transformers, thus governing the output of the rectifier.

Oscillator Panel

The oscillator panel is of the same general construction as the rectifier panel and makes use of Westinghouse high-power, water-cooled, copper-anode transmitting valves. They are not ordinarily worked at maximum capacity, but are usually paralleled. Thus each valve is subjected to about half of its rated capacity and an unusually long life results. Another reason for paralleling valves is that operating on the high-frequency waves causes unusual stresses and strain to develop, not encountered in the ordinary broadcasting wavelengths, and some safety factor is desirable. Immediately behind the valves is the tuning inductance. In the front of the panel are the various indicating meters. As in the case of the rectifier, every part of the oscillator panel can be observed and replacements made without difficulty. The modulator panel, using the same general type of valve, has a switching arrangement whereby the number of valves and the amount of power used can be regulated. Indicating meters are mounted on the front of the panel, and there is also a modulation meter which shows how strongly the energy generated by the oscillator is being modulated.

Control Room

Adjoining the main room and extending a few feet into it is the control room. The front and extended sides of the room have glass windows so that every part of the apparatus room may be constantly seen by the operator. This room is equipped with amplifying apparatus consisting of two units, one using five-watt valves, and the other using 50-watt valves. The start and stop control switches, line terminals, amplifying connections, etc., are all located in this room. Thus the engineer at his desk can control everything in the station. He also can listen in and hear the signals, thus judging them for quality.

Other rooms on the floor include the main office, sleeping room and shop.

One of the most distinctive features of the station is the extremely unique short-wave aerial, a special type perfected by Frank Conrad, assistant chief engineer of the Westinghouse company, who made most of the present records possible through a short wave development. The aerial is a copper tube erected vertically with respect to the ground and supported from a pole about 50 feet high. The aerial, which is quite rigid, has a ball on its one end, to prevent its swaying. Extremely fine results have been obtained from this perpendicular type of aerial. Though only one is now installed, there will be several erected at various points about the station to take advantage of the directional effects possible through the different locations.

Daylight Transmissions

Wonderful results have been obtained from broadcasting from the new site of the short-wave station. As an example, it is only necessary to state that daylight transmitting was successfully carried on between this station and station KFKX at Hastings, Nebraska, in order to repeat from Hastings, the Republican Convention proceedings at Cleveland and the Democratic Convention proceedings at New York. Such a feat of daylight broadcasting would not have been believed possible on any wavelength by radio experts a year ago. It is quite safe to say that there is no other station in the world now capable of doing such work.

The Radio Society of Great Britain Trans-Oceanic Radio Tests

THE Radio Society of Great Britain, and its Transmitter and Relay Section, are again organising trans-Oceanic tests this year, and the following particulars are announced for the information of members :—

A Sub-Committee, consisting of Mr. Gerald Marcuse (Chairman), Mr. W. K. Alford, Mr. Maurice Child, Mr. P. R. Coursey, B.Sc., and Mr. J. A. Partridge, has been set up, and is now busy with the task of making the necessary arrangements for putting the tests into successful operation.

An essential condition for participating in the tests is the possession of a Heterodyne wavemeter which will cover a wave range of at least 80 to 180 metres. These wavemeters must be sent, or brought, to the offices of the Radio Society of Great Britain, 53, Victoria

(*Concluded on page 507*)

Holiday Time

At this season of the year most people are taking a rest which they flatter themselves is well earned. You, no doubt, are lying upon your back on the beach allowing the sun to bake you brown, or perhaps you are letting your offspring bury you beneath a mound of sand. At all events, you have nothing to do but enjoy yourself, whilst I must needs stay here and work. This, I think, is most unfair, especially as I have a constitutional dislike of work of every kind. But it occurred to me that it would not be at all a bad idea if I got some of my friends to help me out and to do some of the toil for me. I therefore raised the point with Professor Goop, who promised at once to write the whole of "Jottings by the Way" to relieve me from the necessity of plying the pen this week. This morning the Professor arrived with his contribution, with which he seemed very pleased. That it consisted of only one paragraph did not appear to worry him very much, for he assured me that I could have the remainder in a fortnight at the latest. His face fell when I told him that this would be thirteen days too late for this evening's post. However, he has now gone back to do next week's for me, and I am using his one paragraph with the utmost gratitude.

Professor Goop Calling

Here is what the Professor has for you. "As the result of no inconsiderable process of cerebration I find myself forced to the conviction that the weekly paragraphic farago which my associate, who is pleased to style himself 'Wireless Wayfarer,' indites for the mental relaxation of earnest students of the science of radio telegraphy and radio telephony is such as can be produced with facility by any member of what I may call, for lack of a better term, the literate or enlightened section of the community. All that is required, so far as I discern after my preliminary inquiry into the subject, is a certain degree of verbal fluency combined with a flavouring of Attic salt and the avoidance, so far as is humanly possible, of all sesquipedalian terminology. Since 'Wayfarer,' during the hot weather, is constitutionally inclined to inertia he has approached me with a request that I should fill his place for the time being and should essay to divert you by writing a few pages in lighter vein for your delectation. I propose, therefore, to entertain you in his stead.

A Story

"A delightful little story that occurs to my mind, and which it is my intention to transfer *currente calamo* to paper for you to enjoy to the full, is one which concerns my esteemed friend the late Professor Lumpit, who prided himself upon his intimate acquaintance with the theory and practice of logarithms. Upon one occasion, whilst he was instructing a class, the Professor was asked by a student to elucidate fully the process whereby, with the aid of logarithmic methods, the product of 3 and 5 was arrived at. Lumpit, a noble soul, though given at times to absentmindedness, seized the chalk and proceeded in his stately way to the blackboard. At the end of half an hour he proved conclusively to his delighted class that the product must be 1.5. You perceive at once the rich humour of the situation; you visualise the exuberant demonstrations of youth; your mental ear records the outburst of cachinnations which followed this declaration. You picture the discomfit of the unfortunate Lumpit. This, I think, is a story which will evoke side splitting laughter and cause our friend 'Wayfarer' to look to his laurels."

Sold Again

M'yes. Quite so; quite so. No; after reading this over I fear that Professor Goop has hardly found his true *métier* when he attempts to write brightly. On second thoughts I have decided that I will not ask him to do next week's instalment and have sent him a postcard to say that his splendid paragraph has had such a bracing effect upon me that I now find myself positively burning for work. It is a little hard, I feel, that one's friends cannot do better than this. Perhaps Poddleby would rise to the occasion if I put it to him. I would like to approach General Blood Thunderby, but I am afraid that his professional training has not made for literary fluency, and I am sure that he would automatically write "Passed to you, please," on my letter and send it on to somebody else, these being the only four words that his pen has ever traced during his many years of distinguished service.

Once More

Hundreds of readers have sent letters testifying to the wonderful results obtained with the Goop-Wayfarer No. 761 circuit. I regret to tell you that such is the jealousy of the other members of the staff that they have used up all available space for letters praising sets that they have designed, and have crowded out every one in which due credit is given to the modest inventors of the finest circuit ever seen. Many letters have contained a request that the Professor and I should publish a description of how to add a note magnifying valve to the existing circuit. This we have the greatest possible pleasure in doing. In the first place, we must discuss the question of components. Reference to the circuit diagram given will show that you require another . . .

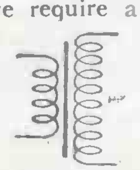
This should be of the three-electrode type with grid, filament and plate. Be very careful to see that the glass is not cracked, for otherwise some of the vacuum may leak out and make a mess on the carpet. You have, no doubt, realised before now how appropriate wireless names are. The grid, for example, is so called because it is exactly unlike a grid iron, and the term plate is equally fortunate. Can you imagine any cook grilling a steak in a spiral of wire and serving it up on a cylindrical plate?

Home-made Valves

Valves can be made at home by any who will take the necessary trouble, and if they are constructed in this way their cost will not be more than two or three times that of buying them. Obtain first of all a common electric light bulb. Then fuse into the glass near the top a spiral of fine wire. It is as well, by the way, to purchase at least a dozen bulbs, for a little practice is necessary before fusing can be done with success. Having got your grid into place, cover with a layer of melted glass, and then purchase an electro-plating outfit and a book of instructions. With the help of these you will have no difficulty in depositing a metallic layer on the top of the bulb which will form your plate. When the home-made valve is finished you will probably be able to swop it for another one with somebody else.

And the Next

Next we require a . . . . . .



which can be made at home by anyone who does not mind putting about a million turns of wire on to an iron core. I have never myself made a hobby of doing this kind of thing, but I believe that there are people who like it.

Methods of Acquisition

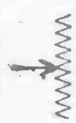
One of the most interesting ways of acquiring a transformer is to go to some rather shoddy wireless shop and to play the idiot boy. You can open the ball by saying, "I want one of those little things that you use in wireless sets. I have forgotten its name, but it has four brass knob things and it goes between two valves." On hearing this the salesman's face will light up, and you may see his lips frame a silent thanksgiving for the arrival of such a priceless sheep for the shearing as yourself.

The Apple Once More

Many transformers are designed upon the lines of the schoolboy's apple, the guiding principle being that the core should be as small as possible. Your salesman will produce a wonderful array of these little horrors, each one of which he will guarantee to be the very finest thing on the market. Presently he will show you one more loathsome in appearance than all the rest, which he will say he can let you have as a very special favour. He ought not really to sell it, for the makers have not yet released it. Still, he feels that an expert like yourself must have the best, and therefore it shall be yours if you say the word. Lead him on, and let him do quite a lot of talking whilst you listen with round eyes and half-open mouth. Then start in yourself and speak rapidly about the insulation resistance in megohms, about hysteresis losses in badly-designed cores, and about the distributed capacity of the windings; pull out a pencil and make horrible calculations, explaining them to him as you go. When you have quite finished with him you can purchase a good transformer of a well-known make, and leave him a perspiring wreck. This kind of thing is exceedingly good for the would-be flat-catcher.

Look out for This

We have now seen exactly how to acquire the valve and the transformer. Next I will show you how to deal with the



and the other necessary components.

WIRELESS WAYFARER.

A NEW B.B.C. DIRECTOR OF EDUCATION

Our photograph shows Mr. J. C. Stobart, the new Director of Education of the B.B.C., who has practically settled all his plans for next winter. There will, we understand, be the usual school transmissions, and an important development will be the inauguration of a series of simple and practical agricultural talks, for which the co-operation of the Ministry of Agriculture has been obtained.

Valve Notes

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

Modifying the ST100 Circuit

EXPERIMENTERS who find that they do not get sufficient selectivity with the ST100 circuit may care to try out the circuit modification given in Fig. 1.

In the first place it would be as well to point out that it is not possible to say offhand why, in some cases, selectivity with the ST100 is not up to standard. I have known cases where a proper degree of reaction was not obtained. This fault may be due to the condenser C2 shunted across the secondary T2 of the step-up transformer T1 T2. The capacity of C2 should be about .001 μF; if less than this the choking effect of the secondary T2 may prevent the first valve from producing an adequate amount of reaction to increase the selectivity of the grid and anode circuits. Some constructors persist in buying cheap fixed condensers which may look all right from the outside, but are of very inferior construction internally, and in some cases entirely devoid of metal plates. It almost seems inconceivable, but in a number of cases which I have personally seen the condenser C2 consisted of little else but a couple of terminals mounted on moulded insulating material. In other cases the value has been entirely different from that stamped on the condenser; frequently perhaps only a couple of plates separated by mica, or an inferior substitute, have justified the name "condenser" being given to the component, but the capacity value has been entirely inadequate and incorrect.

Variable Stabilising Resistance

Another point to look out for is the 100,000 ohm resistance connected across the grid circuit. A fixed resistance of 100,000 ohms manufactured by a really responsible firm and guaranteed is safe enough, but, on the other hand, there are certain advantages in having this resistance variable, but there is no really positive variable 100,000 ohm resistance on the market; the usual resistance consists of carbon pellets which are pressed together under variable pressure by turning a knob. After a time, even in the case of the best makes, packing occurs, the pellets sticking together and the resistance remaining more or less stationary at some value well below 100,000 ohms. When this happens the experimenter can either take the resistance to pieces himself and separate the pellets with a penknife, or send the resistance back to the makers for replacement.

There are certainly a large number of cases where an improper value of resistance is being used by an experimenter without knowing it.

A stabilising resistance of too low a value will not only give weaker signals, but will also prevent a full reaction effect being obtained, and consequently there will be a loss of selectivity.

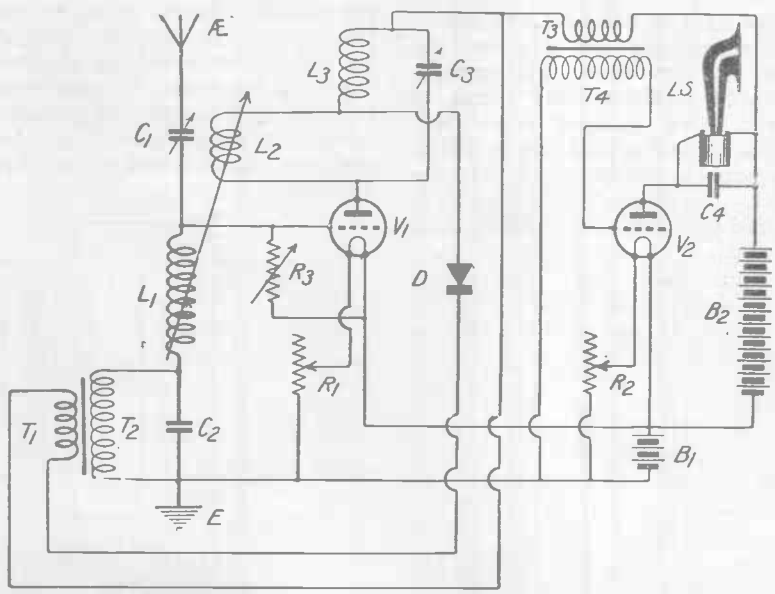


Fig. 1.—The ST100 circuit, showing the variable resistance R3 and arrangement of anode coil for obtaining selectivity.

The selectivity is usually noticed on the tuned anode circuit, and this is largely due to the damping effect of the crystal detector. To reduce this the crystal may be connected across only a portion of the tuned anode circuit, and the accompanying figure shows such an arrangement. The anode coil is now split into two, and two separate plug-in coils may be used. One of these coils, L2, is used for obtaining a reaction effect, while L3, the other coil, the crystal detector and the primary T1 are connected.

A.C. Mains applied to Receiving Sets

By FLORIAN J. FOX.

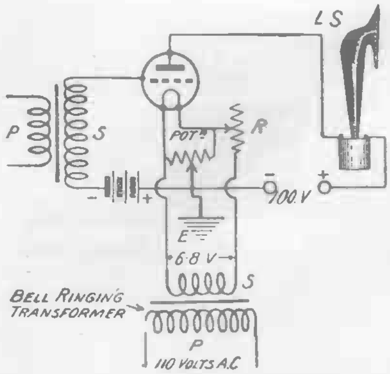


Fig. 1.—Circuit arrangement used to supply the filament current from the A.C. mains. The step-down transformer and potentiometer make this possible.

THE use of rectified A.C. for supplying plate potentials is by no means new. Amateurs, as well as many American broadcast stations, have used rectified A.C. to supply plate voltage for transmitting sets for some time. The application to receiving sets seems to have been delayed somewhat. This may be in part due to a lack of popular literature on the subject. This article has been prepared with the idea of filling such a need.

The following description should prove of special interest to users of dull emitter valves, who are wondering how to get more volume without distortion, due to overloading. Most users of dry cell valves have learned by this time that their valves will not handle the same output as the larger valves. With the use of A.C., the broadcast listener using dry cells can add power amplification. Before describing how to obtain rectified A.C. for the plate supply we shall point out briefly how to operate an amplifier filament on A.C.

Procure a good bell ringing transformer and a 200-ohm potentiometer. If a B4 valve is to be used, almost any bell ringing transformer rated from six to eight volts will carry the load nicely. A resistance with a mid-tap may, of course, be used in place of the potentiometer.

Since the voltage drop in the rheostat cannot be used for furnishing a negative grid biasing potential, it will be necessary to use a good battery of about 4½ to 6 volts. This assumes that the plate voltage is between 90 and 130.

The Circuit

Fig. 1 shows how the circuit of an amplifier must be modified when lighting the valve with alternating current. The changes are extremely simple.

It might be added at this point that it is not advisable to operate a detector valve on alternating current. It will be too noisy. Keep the stepdown transformer as far away from the set as practicable. Leads going to the filament of the amplifier should be twisted to minimise electromagnetic induction. If some care is used, even two stages of audio frequency amplification may be operated satisfactorily in this manner.

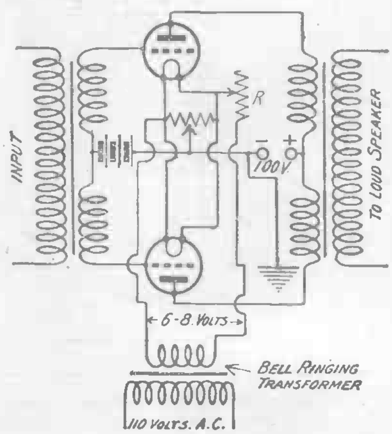


Fig. 2.—The circuit employed to supply current for the filaments of the valves in a push-pull amplifier from an 110 v. A.C. main.

Fig. 2 shows how "push-pull" amplifiers may be adapted to operate on alternating current.

We shall now show how A.C. may be used for furnishing plate voltage for the amplifiers.

The following equipment will be required:—

One rectifier valve.

Four 2-mfd. condensers.

One bell ringing transformer (8 V.).

One valve socket.

One choke coil (10-15 henries).

Suitable mounting material, wire, terminals, etc.

The rectifier valve may be any six-volt amplifying valve for this purpose. Valves having a relatively *low* plate filament impedance are desired because the internal voltage drop will be less, thus leaving more voltage available for the amplifiers. When using amplifier valves as rectifiers connect the grid and plate terminals of the valve together.

Having decided upon the type of valve to use, choose a bell ringing transformer which will light the valve to somewhere near its proper brilliancy without overheating. Care should be used in selecting this piece of apparatus because the voltage regulation is generally poor. A transformer which may deliver eight volts on open circuit may only deliver three or four volts under a one-ampere load.

Cheap Condensers Available

The 2-mfd. condensers are of the paper type. Do not buy C.W. filter condensers rated at high voltages. Such condensers are quite expensive and are much better than those required for this purpose. There is no need to buy condensers rated to withstand more than 500 volts.

The choke coil is part of the low pass filter circuit. It was found that the primary winding of a bell-ringing transformer has close to 10 henries inductance and, therefore, serves the purpose very well indeed. One of the smaller types may be purchased for this purpose. The windings of a discarded amplifying transformer may also be used. In most cases the primary winding will have sufficient inductance. The secondary winding will generally have too much resistance, thus cutting down the available voltage materially.

It will be noticed that the voltage is taken directly from the line, no step-up transformer

Contrary to the belief of some people, alternating current can be successfully employed for furnishing the plate and filament voltage for the valves in a receiving set. There are, however, limitations, but Mr. Fox has well covered the subject in this article.

being used. The writer does not wish to create the impression that such a transformer is not desirable. It was omitted for the sake of economy. The circuit shown delivers about 100 volts to one or two valves, and this is usually sufficient for most purposes.

High Voltages

If more than 90 to 100 volts are desired, a step-up transformer must be used. Either buy or make one that has a ratio of 1 to 2. If a small core is used, the primary should contain about 1,000 turns of No. 30 S.C.C. wire, while the secondary should be wound with No. 32 or 34 S.C.C. wire (2,000 turns). It is desirable to take out several taps on the secondary winding so voltages of from 100 to 175 may be obtained. Due to resistance losses, the voltage of the rectifier will be about 175 instead of 200 when using the step-up transformer described. Fig. 4 shows how a step-up transformer is connected or added to the rectifier circuit.

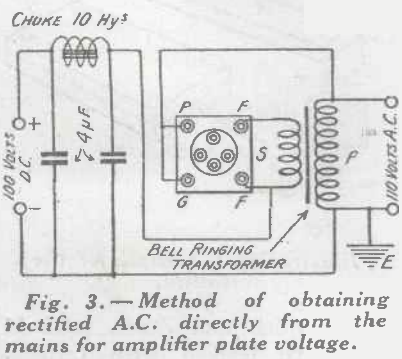


Fig. 3.—Method of obtaining rectified A.C. directly from the mains for amplifier plate voltage.

The details of mounting the rectifier will be left to the builder. The writer mounted his first model on a board 8 × 6 × 1 in. Since then another arrangement has been used. The equipment was mounted on a 9 × 9-in. ebonite panel fitted with a sub-base. The panel and base fit into a mahogany cabinet which matches the receiving set. The filament heating transformer, which lights the power stage of the receiving set, was also placed in this cabinet. All connections were brought to terminals inside the cabinet through holes drilled in the back.

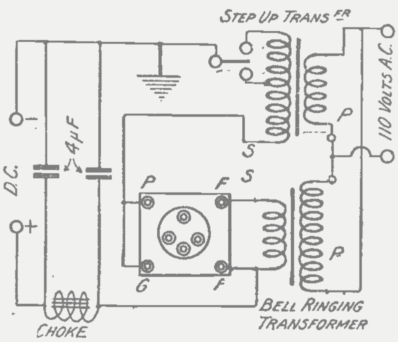


Fig. 4.—Method of obtaining rectified A.C. when using a step-up transformer.

A Caution

It is very important to note that when no step-up transformer is used, the earthed side of the A.C. supply leads must be found and connected exactly as shown in Fig. 3. The earthed side of the A.C. supply can be found by connecting one end of the filament of a 110-volt lamp to some other earth, such as your receiving set earth, and connecting the other end of the filament in turn to each of the two power leads. One lead will light the lamp and the other will not. The lead that does not light the lamp is earthed. This wire should be marked in some way. If a plug is used for connecting to the lighting circuit it should be a "polarity" plug, so that it can never be reversed if it is taken out and plugged in at some other time. "Polarity" plugs are those on which the contacts are placed at right angles to each other. The two parts will only fit one way. When a step-up

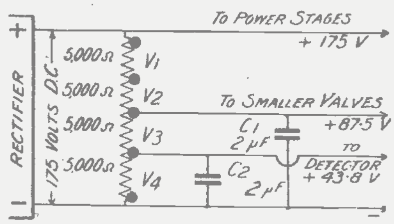


Fig. 5.—Potentiometer for obtaining several values of plate voltage simultaneously. C1 and C2 are bye-pass condensers.

transformer is used, these precautions are not necessary because the transformer insulates the 110-volt circuit from the rest of the set.

The voltage produced by this rectifier is quite smooth and can be used on several stages of either radio or audio frequency or both. This presupposes that the valves used will stand the voltage delivered by the rectifier. It is, of course, possible to obtain several plate voltages simultaneously by means of a potentiometer. Such a potentiometer may be made up of several resistances. (See Fig. 5.) However, for the sake of simplicity, the writer recommends the use of 45 volts supplied by the H.T. battery for the detector and amplifier (dry cell valves) and the use of the rectified A.C. for the plate of the power stage, or stages.

The Radio Society of Great Britain Trans-Oceanic Radio Tests.

Concluded from page 502.

Street, S.W.1, for check calibration (which will be carried out gratis), not later than October 15, 1924. All wavemeters so sent or brought must be complete with coils, if loose, and the valve, or valves, with which the wavemeter will be used. The working values of L.T. and H.T. must also be stated.

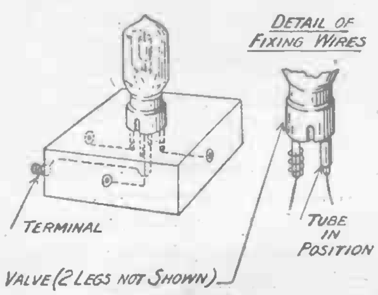
All members of the Radio Society of Great Britain and the Transmitter and Relay Section, who are desirous of participating, and who can comply with the above conditions, are invited to communicate with the Hon. Secretary, the Radio Society of Great Britain, 53, Victoria Street, London, S.W.1, as early as possible, but in any case not later than September 15, 1924.

An Emergency Valve-Holder

THE writer was once called upon to devise a simple valve-holder for temporary use, no valve sockets or ebonite holder being available. It was accomplished in the following extremely simple manner.

A small wooden box about 2 in. × 3 in. without lid (or cardboard might serve if of the stiff brown glazed variety) is obtained, four terminals with nuts and washers, short length of suitably sized insulating rubber tubing and the necessary connecting wire; bell wire will do very well.

Lay box bottom upwards on table, and place valve approximately in centre, mark off centres for the four legs, and drill holes to suit. These holes must be of sufficient diameter to admit the legs after they have been encased with the tubing, the object, of course, being both for insulating purposes, and also to secure connecting wires. Before slipping on tubing the end of connecting wire must be inserted in the split shank of valve pin, opening slightly with thin knife blade if necessary, and the free end must be wrapped around pin for a few turns as tightly as possible, but great care must be taken not to injure the fine wires soldered to pin and leading to filament, etc. Gently pull out wire straight, leaving 3 in. or so for connecting up, and thread tubing over the connecting wire and well down upon the leg; flush with insulating base of valve if possible. The tubing must not be too tight a fit, or forcing and consequent injury to valve may result. This tubing will make all tight.



The method of mounting the valve may be seen above.

Repeat this procedure for remaining three legs.

Having attached the four wires as just described, thread them through holes drilled in box top. The valve should be a nice fit in holes, no undue pressure must be used. The four terminals may now be inserted in box, one in centre of each side, as shown in sketch. Make the connections to respective terminals and the holder is complete. It might be mentioned that this simple expedient gave very good results in the case of adding an H.F. one-valve amplifier to an existing crystal set.

The writer used no insulating tubing, but doubtless better results would be obtained by its use, and if desired, the terminals could also be bushed, but as this arrangement is only intended, as previously stated, to be of a temporary nature, the terminals can be left unbushed.

T. M. E.

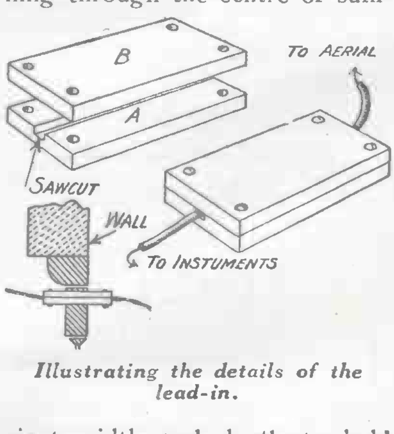
A New Lease of Life for Valves

NOT long ago, if we were unlucky enough to burn out the filament of a valve, we regarded its career as finished, and consigned it forthwith to the dustbin. Then some genius devised a method whereby fresh filaments could be inserted. When it first came the process was not particularly satisfactory, for two reasons. In the first place, the new filament frequently consumed so much current that the repaired valve was very costly to use upon the set and was certainly not worth its keep. Secondly, repairers in those days had not at their disposal proper means of exhausting the bulbs. Repaired valves were sent back after receiving what is known as a "lamp exhaust," that is to say, they were pumped in the same way as the bulbs of incandescent lamps; a process which leaves a considerable amount of air behind. Such valves might work well for a short time, but they very soon began to misbehave. Valve repairing has now been brought to a fine art, and the writer has recently had the opportunity of seeing what the repairer of to-day can do. Two burnt-out valves sent up for treatment were returned in a few days, and it was found in both cases that the valve was very nearly as good as new. Its appetite for current had not increased, and it worked extremely well. Experimenters who have large batches of burnt - out valves in their scrap boxes might do well to have some of their old favourites repaired. So skilled are those who preside over the valve hospitals nowadays, that even if the bulb is broken as well as the filament, the case is not hopeless—it can be rebulbed as well as refilamented.

A Neat Form of Lead-in Insulator

THE drawings indicate the construction of a simple and reliable lead-in insulator. Two pieces of $\frac{3}{8}$-in. or $\frac{1}{4}$-in. ebonite are cut $1\frac{1}{2}$ in. wide, and of sufficient length to be clear of the window frame when in position.

It will be seen that the piece of ebonite A has a saw cut running through the centre of sufficient width and depth to hold the bare lead-in wire tightly. The piece of ebonite B is then clamped down with four brass nuts and bolts, as shown. These nuts and bolts may be countersunk with advantage if desired. The insulator is then complete, and may be screwed to the woodwork of the window in any convenient position.



Illustrating the details of the lead-in.

F .D. C.

Some Further Ideas for Inventors

By OSWALD J. RANKIN

In which the author gives some further suggestions to would-be inventors.

Aerials

I AM one of those semi-fantastical individuals who believe that the ordinary outdoor aerial will be rendered obsolete just as soon as someone tackles and masters the problem of all-round reception on directional indoor aerials. I do not consider frame aerials because, in my opinion, these do not present one-half the amount of scope and possibilities of the simple indoor aerial used in conjunction with the usual and *natural* earthing arrangements; relatively they are inefficient, in fact the only real admirable feature about them is their directional properties, and when we consider that the same effects can be embodied in a much more simple *and* efficient arrangement, it is really surprising to find that inventors have almost entirely overlooked the matter.

An indoor aerial can, of course, be designed in many different ways, and can be easily made variably directional. Think of the enormous amount of scope in this direction. There is, indeed, practically no limit to their designs and mechanical features, the design of fittings, and of suitable circuits and receivers. Insulators and wire coverings could be coloured to either match or contrast artistically with any existing decorating effect, and this field alone opens up many opportunities for the enterprising section of manufacturers.

We are told that the man who first really *noticed* a kettle of boiling water invented the steam engine, yet when we are *told* (please note the difference between noticing and being told) that good results are often obtained by connecting wireless receiving sets to a spring mattress, or to a piece of wire netting placed under the drawing-room carpet, nobody seems to notice or even dream of the possibilities thus presented. The observant and imaginative person to-day has opportunities which might be profitably pursued—better opportunities and chances than inventors have ever had, for before Stephenson could build his steam engine he was faced with the problem of obtaining the necessary parts and materials—of introducing and founding the engineering profession, in fact; whereas to-day it is only necessary for the wireless inventor to slip round the corner to the nearest store (which is *not* far away) and buy almost anything he requires.

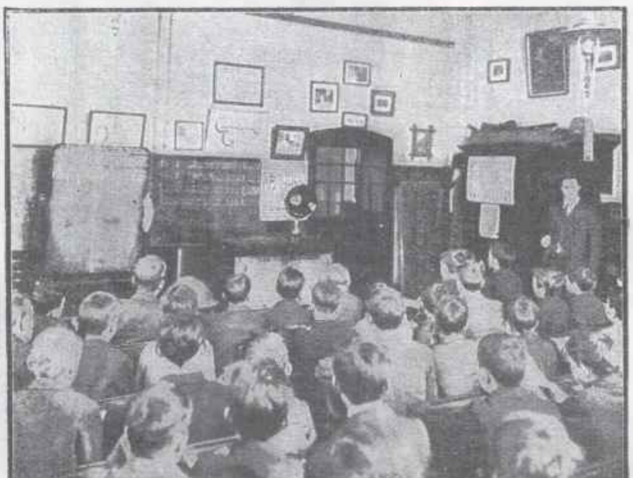
Coils

The home-made basket coil is often more efficient than some of the commercial articles, for the simple reason that in certain cases it becomes necessary to heavily "dope" the latter with a shellac binder in order to protect it during its voyage through the usual trade channels, whereas no shellac need be applied to the home-made coil providing it is properly constructed and carefully handled. On the other hand, if the manufacturer, in making a conscientious effort to retain their low capacity properties, made them as fragile as the average home-made coil, and sent them out so that the windings would work loose every time they were handled by factors and shopkeepers, plug-in coils would soon lose their popularity. What is wanted, then, is some kind of binding arrangement which effectively protects the coil mechanically, and which in no way tends to increase its capacity.

Plugs and Clips

Some simple plug or clip-connecting system would be appreciated by all experimenters, for I very much doubt if this class of enthusiast ever builds up a receiving set intending it to remain untampered with for any length of time, and it is neither pleasant nor convenient to be perpetually soldering, or adjusting terminal nuts. What is wanted here is a simple metal stamping in the form of a spring socket, or sockets, which could be easily and permanently attached to a terminal so that the connecting wires could be quickly joined up by means of contact plugs attached to their ends. The sale of one set of sockets would, of course, create an immediate demand for an assortment of leads, complete with plugs, and various adapters and extension clips would also be required.

EDUCATIONAL BROADCASTING



Our photograph shows a class room of children at the Wheatley Street School, Coventry, listening to a lecture being received by wireless. The loud speaker may be seen at the back of the room.

With such a system it would be necessary to use flexible leads. Here, again, we create a demand for some kind of insulated support, or separator, which could be clipped between leads, or mounted on slender pillars which could be conveniently attached to the interior of a cabinet, to obviate any trouble through the undesirable contact of sagging leads.

Odds and Ends

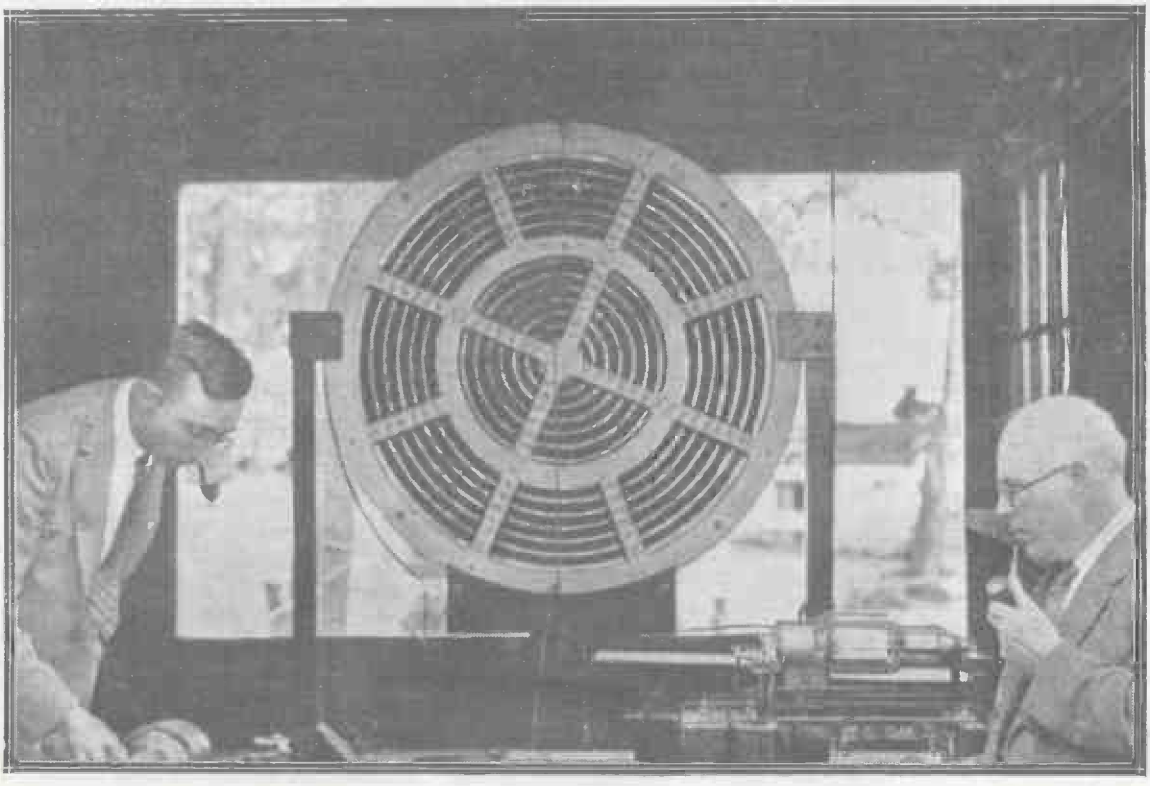
One often wonders whether a telephone condenser improves the tone of the signals or not. In most cases this component is quite unnecessary. Examine the internal construction of a pair of modern telephone cords, and you will see that you already have sufficient capacity across the phones. The cords act as the condenser, and anyone who cultivates the habit of noticing things could carry this idea much further.

As an example, a 200,000 ohm non - inductive resistance connected across the secondary winding of an L.F. transformer may eventually, become common practice. Think of one of the square section ebonite bars on the side of the transformer, cut a groove in it between the secondary terminals, insert the resistance element, and seal it up.

There is very little romance attached to a mere coil of black adhesive tape, but, nevertheless, if we could buy this in a slightly-improved form, so that we could unwind a portion without entangling ourselves in the yards of stringy mess which frays off at the edges, I am sure we should all be much happier.

There are many "situations vacant" for the modern inventor who is interested in wireless apparatus. It is a good plan to make out a list of the most obvious requirements, peruse it from time to time, and carefully study each subject in turn. Such a list might be arranged in the following order :—(1) A perfect interference eliminator, (2) a uni-control receiver, (3) a substitute for outdoor aerials, (4) a reliable variable grid-leak with an accurately graduated scale, (5) a more efficient and compact variable condenser, (6) a dry battery which will deliver a steady current, (7) a good cheap substitute for ebonite, (8) a really cheap general-purpose valve, (9) a loud-speaker on an entirely new principle, (10) a means of making the frame aerial more sensitive, (11) a simple form of liquid valve, and (12) a simple substitute for crystals.

The best advice I can give to any inventor is "don't dabble." Keep to one thing at a time and stick to it until you have really done your best. Nowadays, with the expenses of modern sales campaigns, the production costs of an article must be cut down to a minimum, and, as previously pointed out, this should be one of the first considerations. The real art of the business lies in embodying novel features with simplicity and cheapness, and the greatest difficulty of all is encountered when it comes to the final cheapening of the article.



A loud speaker measuring 36 inches in diameter and hornless, invented by Dr. C. W. Hewlett of the General Electric Company, on a new principle, has been installed in an American public park. Audiences rivalling those which listened to the town band in the old days, assemble nightly to hear the programme The loud speaker seen above is believed to be the only one in regular operation in a public park.

A Drilling Jig for Valve Legs

A GREAT many constructors find it very difficult to lay out and to drill correctly the holes required for valve legs. There can be no question that it is much better to employ separate legs than to use a holder in which they are embodied in insulating composition. With separate legs the capacity is comparatively small, especially if they are shortened and if those with shanks threaded 6 B.A. are used, but with a moulded holder capacity must always be higher than is desirable, owing to the large amount of ebonite, an excellent dielectric, which lies between them. If each set of valve legs is separately made up, even the most careful workman will find that he occasionally makes a bad shot and produces a holder into which valves have to be inserted by sheer brute force, which is far from being good for them. Here is a method of making a handy little jig which will be found useful by all constructors. If this jig is used it is impossible to make a mistake in drilling the holes for the valve legs.

Obtain a small piece of either brass or mild steel and square it up so that each of its sides is

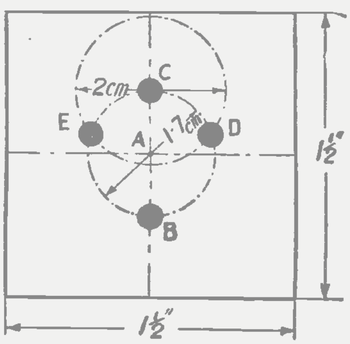


Fig. 1.—The position of valve legs is determined by measurement.

1½ in. With the scriber make two well-marked lines at right angles to one another passing through the middle point of the square. At the point where they cross (A in Fig. 1) make a punch mark. Now take a pair of compasses and set them so that they will make a circle exactly 1.7 centimetres in diameter. The circle should be made on paper first of all and measured carefully, the compasses being adjusted until it is exactly of the right size. Place the point of the compasses in the punch mark and draw a circle on the metal. At the points B and C where it crosses one of the scribed lines make further punch marks. These will denote the positions of the grid and plate legs. The positions of the filament legs are found by setting the compasses to scribe a circle exactly 2 centimetres in diameter and making this circle upon the metal with the point placed in the punch

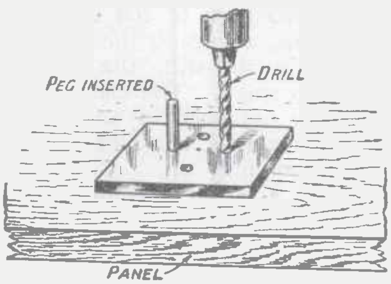


Fig. 2.—The jig in use.

mark C. Where the two circles cut one another, make punch marks D and E. To be quite sure that you have made no error in your marking out, take a valve whose pins are known not to have been strained and see whether their points rest upon the punch marks. If they do not, you have made some error in marking out and must try again until you get the positions exactly right. Be careful, though, that the valve *is* one whose pins are all that they should be. Now mount a No. 41 Morse drill in the chuck of your hand or bench drill and make a hole with it at each of the punch marks. Tap the central hole for 6 B.A. and insert into it a short screw, driving it in until the point protrudes a little on the far side. Cut off the head of the screw and lay the jig across the jaws of a vice which are open just sufficiently to allow the shank of the screw to pass between them. With the round end of a light hammer rivet over the protruding point of the screw so as to make it immovable.

Now make a little peg which will just fit tightly into the holes in the jig. The peg, which should be about ¾ in. in length, can be made from a piece of stout bicycle spoke or from a bit of brass or steel rod. It can be

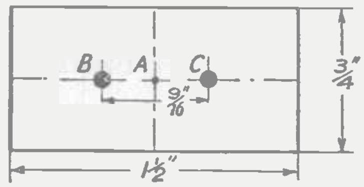


Fig. 3.—Dimensions for a jig for inductance coil sockets.

run down to the right size by placing it in the chuck of the drill and using either a small file or a piece of emery cloth to rub it down with. It is recommended that the holes B, C, D and E should be made with a No. 41 drill, since this is the size for 6 B.A. tapping. Should the constructor use 6 B.A. legs and make a practice of inserting them into clearance holes, B, C, D and E may be made with a No. 34 drill. Or, if his standard size for valve legs is 4 B.A., he can make the holes with a No. 34 drill, supposing that he uses taps, but with a No. 26 if he does not.

Fig. 2 shows the way in which the jig is used. Make a punch mark upon the panel at the point where you desire to have the centre of your valve holder. Drill here a 6 B.A. clearance hole (No. 34 drill) and insert the central screw of the jig into it. Square up the jig by means of the scribed cross lines, place your drill in the hole corresponding to the grid leg and drill right through the panel. Remove the drill and insert the little peg into the hole which has been made. The jig is now firmly fixed so that it cannot shift and you can run the other holes through without the slightest trouble. The central hole, drilled to take the screw of the jig, does not show if it is left as it is. But the best course is to enlarge it by putting a 5/32 or a ⅜-in. drill through it and then to make saw cuts between the legs in the way which has already been described in order to reduce capacity to a minimum. A similar jig can be made for drilling the holes for the plug and socket of coil mounts; the dimensions of this are shown in Fig. 3. The central hole A will again be 6 B.A. and a screw should be inserted as before. The other holes are ¼ in. in diameter. For this jig there is no need to make a peg, since the plug or socket can be used for the purpose when the first hole has been made. Like the valve legs jig it will save a great deal of trouble, and as it can be turned out in a few minutes it is well worth the constructor's while to make it up.

R. W. H.

Faulty Rheostats

A RHEOSTAT may play some scurvy tricks and cause all kinds of trouble without exciting any suspicion that it is the culprit. A case of this kind occurred only the other day to the writer. The set in use was a five-valver with two stages of high-frequency amplification, a valve rectifier and two note-magnifying stages. The valves were of a make which require a voltage of nearly four, and the 4-volt accumulator in use was quite up to the mark. This set is fitted with a "master" rheostat as well as a rheostat for each valve. The master is used to ensure gradual switching on and off; when the set is working it is always in the full on position, and it is not employed for regulating the voltage.

All had gone well on previous evenings, but one night, when 2LO was tuned in, the set promptly began to oscillate wildly. Nothing would calm it down, and it was hastily switched off in order to avoid causing interference with the reception of other people. During the following morning it was tested upon wavelengths that are not devoted to broadcasting, and the results were frankly horrible. Every possible remedy that suggested itself was tried without any result at all.

The cause of this fit of unruliness was eventually discovered by the chance use of a voltmeter. The instrument showed that though the voltage at the low-tension battery terminals of the set was rather more than four, the maximum obtainable between any pair of filament valve legs was only about 3.4. Since each of the "individual" rheostats was turned full on for the test, and since the voltage shown at each valve holder was practically the same, it was obvious that the master rheostat was to blame. A careful examination showed that the spindle was very wobbly in its bush, thus causing a bad contact and a voltage drop of about .6 volt. The filament potential of H.F. valves is usually rather critical on a large set capable of being finely tuned; the valves will oscillate if it is either too high or too low. In this case, owing to the drop in the main rheostat, the voltage was too small. The same effect may be produced in any set if one of the H.F. rheostats cannot be turned fully on.

With a 4-volt accumulator it is essential that there should be no resistance in series when the knob is in the "on" position. It is equally important that this should be so when dull emitter valves are worked from dry cells, for if resistance is there, cells may be discarded long before they are really "dead." It is quite a common fault in rheostats. One often finds that when the contact arm is resting against the stop pin, several turns of wire are still in circuit. In this case the best remedy is to short-circuit these turns by running a little solder over them with a hot iron.

R. W. H.

Three Simple Questions

What is meant when it is said that a low-frequency transformer has a ratio of 1 to 5?

Intervalve transformers have a definite voltage step-up ratio just like the ratio of stepping up or down of a power transformer, and the figures 1 to 5 mentioned indicate this.

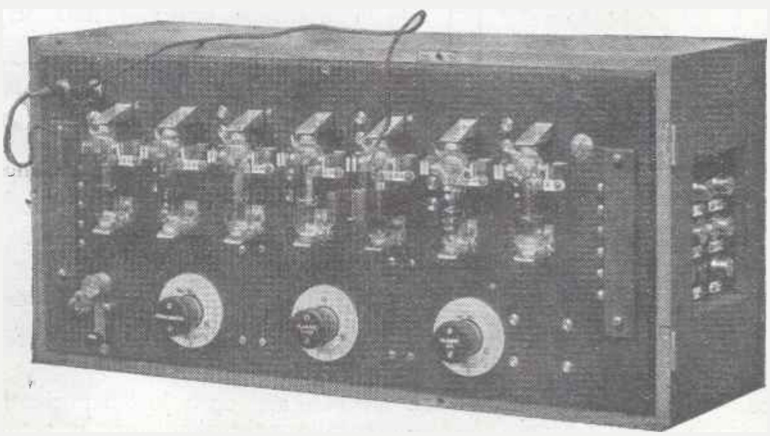
Is there a right and wrong way of connecting high-frequency transformers in circuit?

Yes, most decidedly, since to produce satisfactory intervalve coupling it is necessary to ensure that the magnetic effects between the windings shall act in the same direction as the induction that takes place as a result of the capacity between them. In practice it is customary to ascertain the correct connections by experiment.

What practical signal amplification per valve can be expected?

A good deal depends upon the valve itself, also upon the associated circuit, transformer, etc., but as a rule the actual signals in the telephone receiver should be increased from four to seven times by the addition of a valve, for instance, following a crystal detector.

A WEMBLEY EXHIBIT



A new seven valve amplifier, Type AG2, by Marconi's Wireless Telegraph Co., Ltd., which may be seen among their exhibits at the British Empire Exhibition

A Useful Three-Coil Tuner

By F. D. CROSS.

THE writer recently had occasion to construct a three-coil tuner. It was to be simple in construction and to embody no complicated parts, the tools available being of the usual household variety. At the same time it was to be easy of adjustment, and capable of being finely tuned. After some experimenting with various methods of coupling, the present tuner was decided upon and constructed. Although it is simple in construction, it gives very good results, and, in the writer's opinion, is quite equal to many far more complicated tuners.

The drawings will show the working of the tuner quite

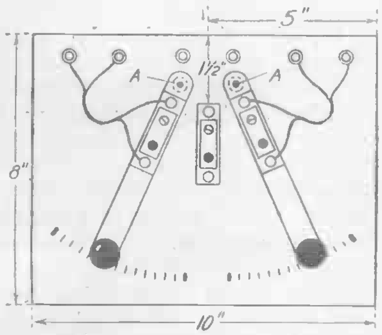


Fig. 1.—The panel layout.

clearly. The coil sockets are of the standard size, and may be purchased ready mounted on a strip of ebonite, and with a terminal at each end, as shown in Fig. 2. Three of these sockets or holders will be required.

The base of the tuner consists of a piece of ¼-in. ebonite 10 ins. by 8 ins. As will be seen, the fixed portion of the tuner is in the centre, and consists of one of the coil sockets mounted on an additional piece of ebonite (the same size as its base), and secured to the ebonite panel by means of two countersunk screws.

The construction of the moving arms may be gathered from Fig. 3. They consist of a strip of ebonite ¾ in. wide and 6 ins. long, and the ends are neatly rounded off with a file. The sockets are secured to these moving arms in the position shown, by countersunk screws. If the base of the purchased coil sockets is more than ¾ in. wide it must be filed down so that it is the same width as the moving

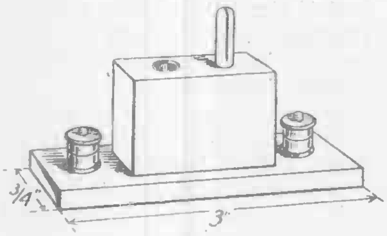


Fig. 2.—Details of coil-socket mounting.

arm. Small ebonite knobs are fitted at the extreme end of each moving arm. It will be seen from the drawings that these two arms radiate on either side of the

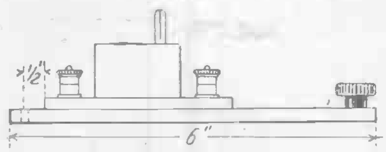


Fig. 3.—One of the moving arms.

fixed coil socket, with "A" as the pivot. This pivot is clearly shown in Fig. 4, and consists of a 1½ in. length of 2BA screwed rod passing through a hole in the moving arm and then through a similar hole in the ebonite panel. Two locking nuts secure at the top and bottom, and a large-sized brass washer separates the

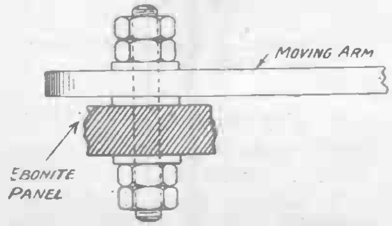


Fig. 4.—The pivot shown at A in Fig. 1.

moving arm from the panel. The tension at these pivots is so adjusted as to allow free movement to the moving arm.

When these moving arms are mounted in position, the next thing is to make the connections from the three coil sockets to the three pairs of terminals situated at the back of the panel. The two connections from the fixed socket are taken under the panel to the centre pair of terminals.

The two moving sockets are connected to their respective terminals, externally, by means of twin flexible wire, as shown. If desired, a scale may be marked on the panel along the arcs in which the moving arms move. This scale is always an advantage when making adjustments in the coupling.

In the writer's case, as may be seen, the tuner is mounted on a shallow box, of which it forms the top. However, the method of mounting is best left to the individual's own requirements.

Any type of compact coil may be used with this tuner, provided it is fitted with the standard size plug.

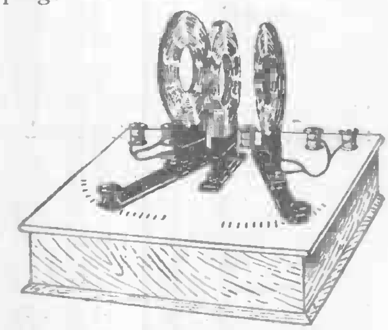


Fig. 5.—The tuner in its complete form with coils in position.

A Question on L.F. Transformer Ratio

Why cannot the step-up ratio of low-frequency transformers be increased above the conventional value of 3 to 1 or 5 to 1?

If the amount of wire upon the secondary winding is increased beyond a certain point, then the natural frequency of this winding approaches an audible note, and therefore the transformer tends to resonate upon certain notes, introducing serious distortion. Moreover, the natural tendency to oscillate is very much increased. If, on the other hand, the increase of the step-up ratio is brought about by reducing the number of turns on the primary, the transformer loses efficiency and nothing is gained.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

Some notes of interest to the home-constructor and broadcast listener.

WHY is it so few receiving valves are issued with curves to show their general characteristics? That such a scheme is practicable is shown by the fact that makers of dull emitters supply curves in the box. In the case of power valves it is essential that the user should have a curve before him when determining how best to use the valve, and the statements on the carton to the effect that the plate voltage can be so many volts to so many more volts is of very little practical use.

□ □ □

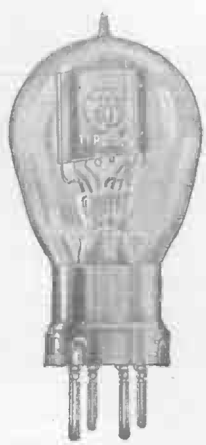
Many experimenters who began work about a year ago and have now reached the stage where they use four or five valves quite frequently, are beginning to realise the difficulties of obtaining a satisfactory high-tension supply. The ordinary type of high-tension battery obtainable in say 60 volts units at from 10s. to 15s. a unit is perfectly satisfactory for small sets using up to, say, three valves. When we go above this number the drain on the high-tension battery is quite considerable, and certainly more than the small cells used in these units will stand. Power valves in particular are quite extravagant in their consumption of current from the high-tension battery, and some such valves, such as the LS5 and its equivalent, may take as much as 12 or 15 milliamperes—a consumption which is ten times as great as an ordinary general-purposes valve may take when used in a similar circuit.

□ □ □

Now power amplifying valves have many virtues, and the experimenters in increasing numbers are adopting them for the last stages of their note magnifiers. When signals are very strong the length of the curve of the ordinary "general-purposes" valve is not great enough to give pure undistorted reproduction, and if the best results are to be obtained some kind of power valve is necessary. Power valves, however, must be used intelligently, and it is quite futile to buy an expensive valve of this type and substitute it for a "general-purposes" valve expecting at once to get greatly improved results.

□ □ □

It may be of interest to consider for a few minutes the possible sources of high-tension current for a multi-valve set. First of all we can use high-tension batteries made from dry cells of a much larger size than usual, so as to give ample output. Both Siemens and Ever-Ready will supply giant high-tension batteries suitable for the purpose. A 120 volt unit of this type weighs 27 to 30 lbs., and is certainly a large item. Secondly, if we have direct current, we may use the house supply, after it has passed through a suitable filtering device to smooth out the slight ripples which are present even with direct current. The Sterling people sell such a smoothing unit although its price is higher than the average man would care to pay. Thirdly, we can have recourse to a motor generator complete with smoothing unit, specially designed for the purpose, such as the "M-L" converter. This consists of a small motor driven from an accumulator and a d.c. dynamo giving a suitable voltage for the high-tension. To the output side of this dynamo is attached a special filter circuit so that the direct current provided at the output terminals is suitable for direct application to the set. The speed of the motor and therefore the voltage of the dynamo on the output side is varied by a resistance similar to those used for controlling the heat of a valve filament. These devices although very satisfactory in operation are still rather expensive.



A useful dull emitter power valve—the B4.

□ □ □

Finally there is the high-tension accumulator which, I gather, is selling in increasing numbers. The accumulator is simply a series of miniature cells of very low capacity—say two or three ampere hours at the most—joined up in series to give the voltage required. Such a battery will work satisfactorily for several weeks with heavy use, and is simply recharged at the end of the time like a filament accumulator. High-tension accumulators are cheaper than dynamos or converter units, but are somewhat messy devices and require careful attention when charging, if they are to be kept at their best.

□ □ □

By the way, there is a prevalent illusion that the addition of grid bias cells increases magnification considerably. Except in the case of dull emitter valves, if you are using much less than 100 volts, you will find very little improvement in quality or strength by adding grid cells. At voltages above this you will find the introduction of grid bias gives an improved quality by eliminating some forms of distortion; in very few cases will you find any actual increase in strength.

A New Type of Crystal Receiver

By H. BRAMFORD.

This article describes the various methods of operating the set, constructional details of which were given in the previous issue of this journal.

(Concluded from page 486)

Containing Box

The containing box is made as shown in Fig. 7. Any wood is suitable as the whole is finished in black enamel. The thickness of the wood is $\frac{3}{8}$ in. throughout. Full dimensions and method of construction are shown in the diagram. All that now remains is to assemble the parts made in the box. First adjust the sliding inductance, as shown in the photograph, and next the panel, which may be secured by means of two small screws if desired, although this is not necessary. The final connections are now made by securing an insulated wire from socket S2 to screw A, and another insulated wire from socket S3 to terminal B. The aerial and earth connections are provided with insulated Clix plugs in two different colours, and likewise the 'phone leads.

The Circuit

Although this receiver can be utilised as a simple crystal set, there are a number of ways in which it may be connected up, by employing a variable condenser as an extra unit. The theoretical circuit is shown in Fig. 8. It will be seen from this diagram that the aerial may be plugged into either socket S1 or S2, and in each case constant aerial tuning may be used by employing a fixed condenser of 0.0001 μF capacity externally. The earth in all cases is plugged into socket S3 and the 'phone leads into sockets S4 and S5. The detector, which is provided with a short flexible lead on one side, may be plugged into either socket S6 or S7. Where a loading coil is brought into use, the detector lead X5 is plugged into socket S6, and where the sliding inductance only is used, the lead X5 is plugged into socket S7. Sockets S1, S2, S3 and S8 are also available for the extra variable condenser unit leads, the variable condenser leads in

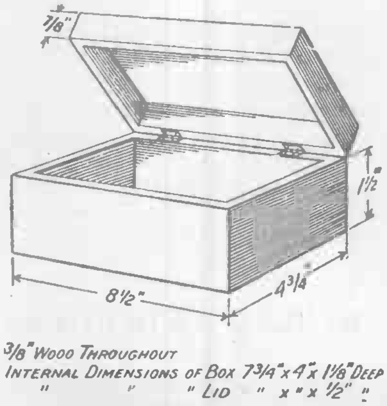


Fig. 7.—Constructional details of the containing box.

this case being provided with Clix insulated plugs.

For the reception of broadcasting from 5XX, a 150 loading

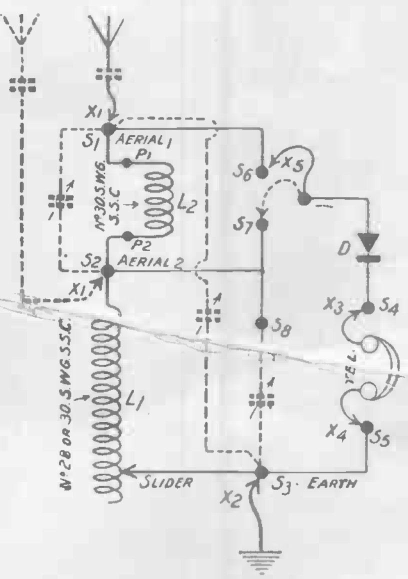


Fig. 8.—Theoretical circuit arrangement of the receiver.

coil is recommended, or a 200 coil with a fair indoor aerial. For cutting out interference it is advisable to employ the use of some form of wave-trap. A wave-trap used in conjunction with the circuit described herein in Example E, will be found to give satisfactory results.

Operation

Several examples of different types of circuits which may be used are shown in Fig. 9.

EXAMPLE A shows the sliding inductance in use only with the detector, which is the simplest form of crystal circuit. All that is necessary is to plug the aerial into socket S2, and the earth into S3. Lead X5 is plugged into socket S7, the loading coil being out. The slider is then moved from left to right until the most favourable results are obtained.

EXAMPLE B shows a similar arrangement to Example A, with the addition of a variable condenser of, say, 0.0005 μF, which is placed in parallel with the inductance by plugging the leads into sockets S2 and S3, this arrangement providing finer tuning. A fixed condenser of 0.0001 μF has also been interposed in series with the aerial for constant aerial tuning.

EXAMPLE C shows the loading coil and the sliding inductance in series for further range of wavelength. The aerial is plugged into socket S1 and the earth into S3. Lead X5 is plugged into socket S6.

EXAMPLE D shows a similar arrangement to Example C, but with the variable condenser in this case placed in parallel with both the loading coil and the sliding inductance. For this purpose the condenser leads are plugged into sockets S1 and S3.

EXAMPLE E shows a similar arrangement to Example B, with the addition of a wave-trap, which is formed by the use of the

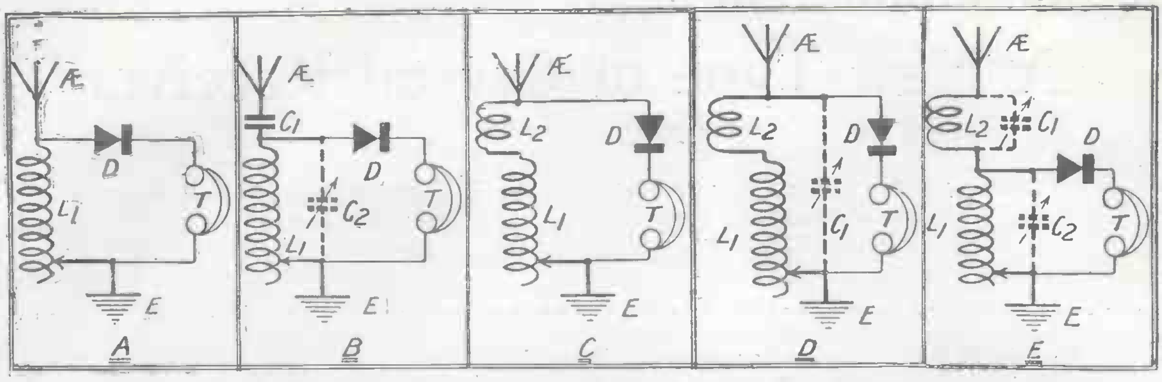


Fig. 9.—Examples of various types of circuits which may be obtained.

loading coil in parallel with the variable condenser. In this case the aerial is plugged into socket S1 and lead X5 into socket S7. The variable condenser leads are plugged into sockets S1 and S8.

Test Report

On a good and high aerial eight miles from 2LO the set gave excellent signals on the local station with the slider coil alone in use, and, on plugging in a 150 Burndept coil with the aid of an adaptor, 5XX came in at good strength, with severe interference from 2LO. Upon transferring the crystal and phones to a position across part of the total inductance (circuit E without condenser), 5XX was received without interference but with some loss of strength. On 2LO, with one stage of note magnification, adequate loud-speaker strength for the average room was obtained.

RURAL WIRELESS

The combined Golders Green, Hendon, Hounslow, Hampstead and St. Pancras Radio Societies recently held a Field Day in the districts surrounding Mill Hill and Hounslow Heath. The stations were erected at these places for sending and receiving, and in addition a mobile station, illustrated on page 501, also took active part. Our photograph shows a group at the Mill Hill Station.

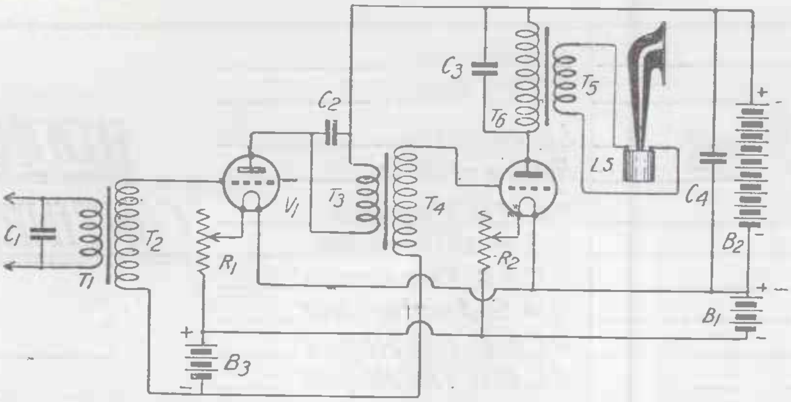


Fig. 1.—The circuit arrangement of the note magnifier.

Practical Back-of-Panel Wiring Charts

A Two-Valve Note Magnifier Circuit.

By OSWALD J. RANKIN

THIS amplifier gives powerful signals for loud-speaker work.

Special valves, called power valves, may be used instead of the ordinary receiving valves, when high plate voltages may be used without fear of distortion.

B1 and B2 are the intervalve transformers, the condensers C1 and C2 being connected across their respective primary windings. A suitable capacity for these condensers is 0.001 μF. These condensers need not necessarily be used. Their inclusion will depend on the particular make of low-frequency transformers purchased.

D is a telephone transformer, across the primary winding of which is connected the condenser C3 of 0.01 μF capacity. F is a Mansbridge condenser of 2 μF capacity placed across the high-tension battery.

The amplifier is connected to the receiver by joining the terminals A1 and A2 to the telephone terminals of the receiver. The high-tension battery should in the case of power valves have a voltage of 200-500 volts, according to the valves chosen for loudest signals. In the case of ordinary valves this voltage may be 60-100. The grid biasing battery may be an ordinary flash-lamp battery of about 10 volts, tapped in stages of 3 volts, and is connected to the terminals E. Generally speaking, an increase in the voltage of the H.T. battery necessitates an increase in the voltage of the grid battery. It should be noted that the object of the grid biasing battery is not to increase signal strength, but to eliminate distortion as far as possible. The correct voltage must be found by experiment.

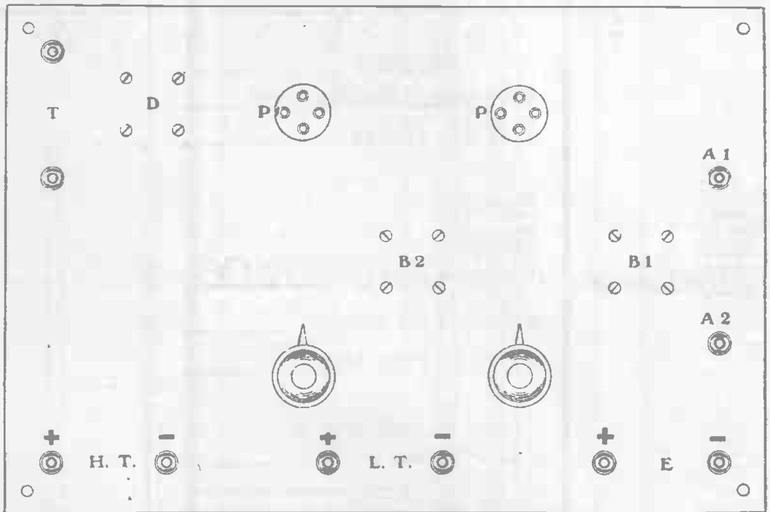


Fig. 2.—The layout of the panel.

In the wiring chart it will be noticed that the O.S. terminal of each transformer is connected to the *grid* of the valve above it, while I.S. goes to filament via the grid battery, and this arrangement is generally quite satisfactory. It is possible, however, that a reversal of the leads to the secondary windings of the transformers will result in louder signals, and this may be tried if desired.

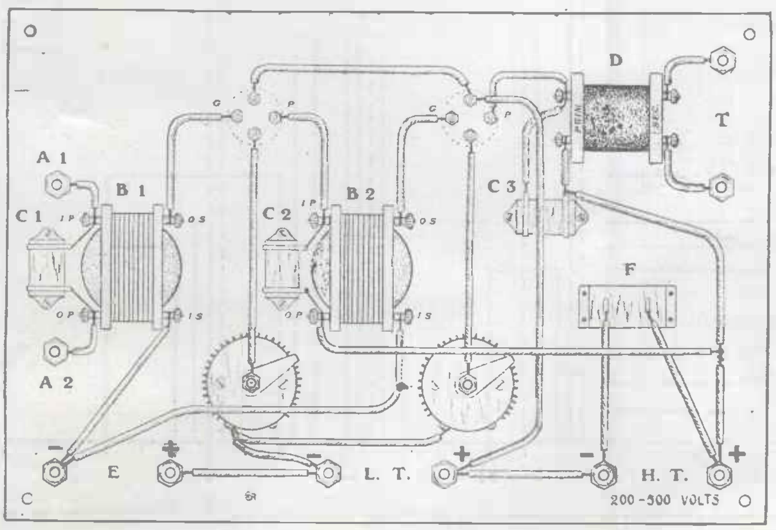
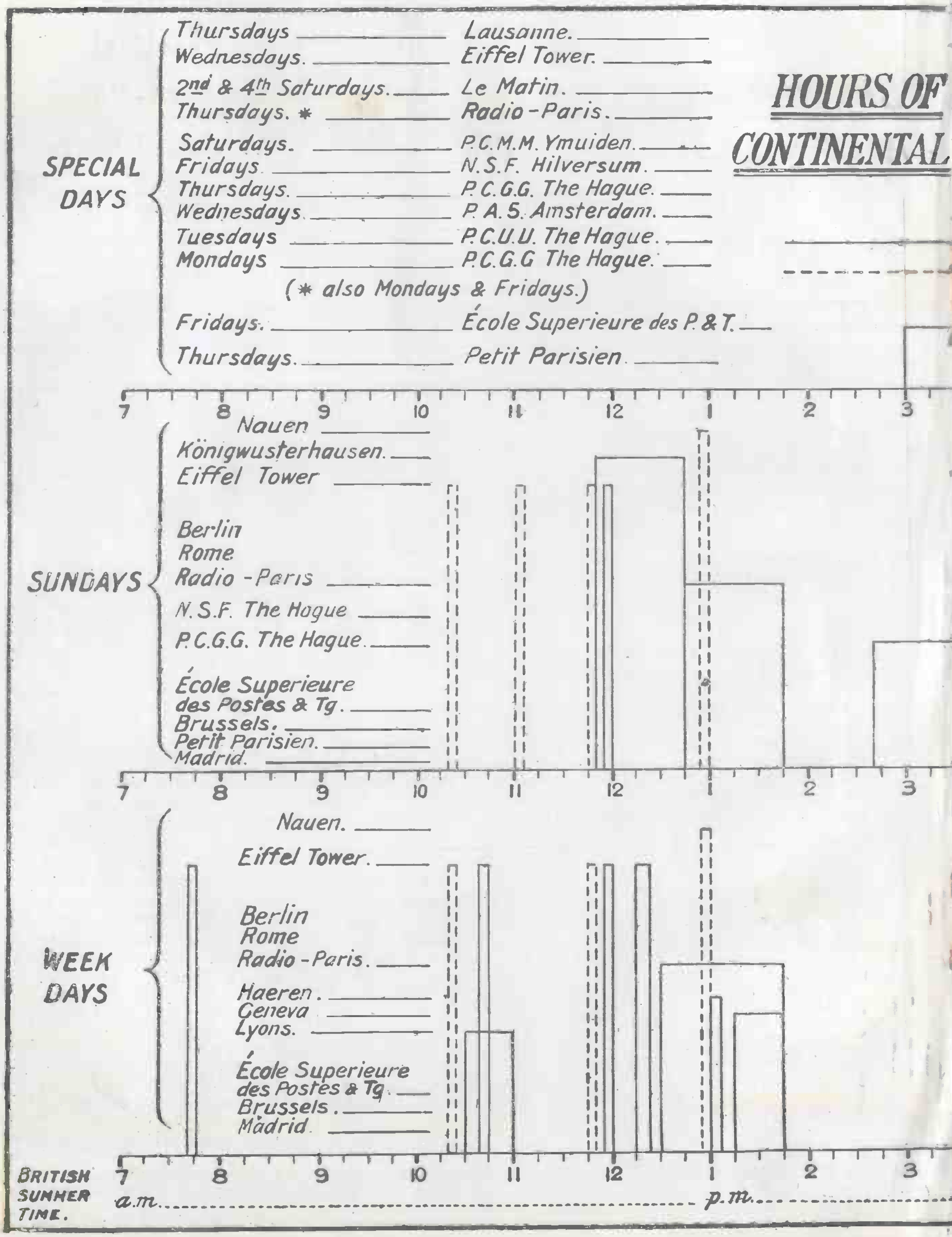


Fig. 3.—Practical back-of-panel wiring diagram.


HOURS OF
CONTINENTAL
SPECIAL DAYS
Thursdays — Lausanne.
Wednesdays. — Eiffel Tower.
2nd & 4th Saturdays. — Le Matin.
Thursdays. * — Radio-Paris.
Saturdays. — P.C.M.M. Ymuiden.
Fridays — N.S.F. Hilversum.
Thursdays. — P.C.G.G. The Hague.
Wednesdays. — P.A.5. Amsterdam.
Tuesdays — P.C.U.U. The Hague.
Mondays — P.C.G.G The Hague.
(* also Mondays & Fridays.)
Fridays. — École Superieure des P. & T.
Thursdays. — Petit Parisien.
7 8 9 10 11 12 1 2 3
SUNDAYS
Nauen
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Berlin
Rome
Radio-Paris
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P.C.G.G. The Hague.
École Superieure des Postes & Tg.
Brussels.
Petit Parisien.
Madrid.
7 8 9 10 11 12 1 2 3
WEEK DAYS
Nauen.
Eiffel Tower.
Berlin
Rome
Radio-Paris.
Haeren.
Geneva
Lyons.
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BRITISH SUMMER TIME.
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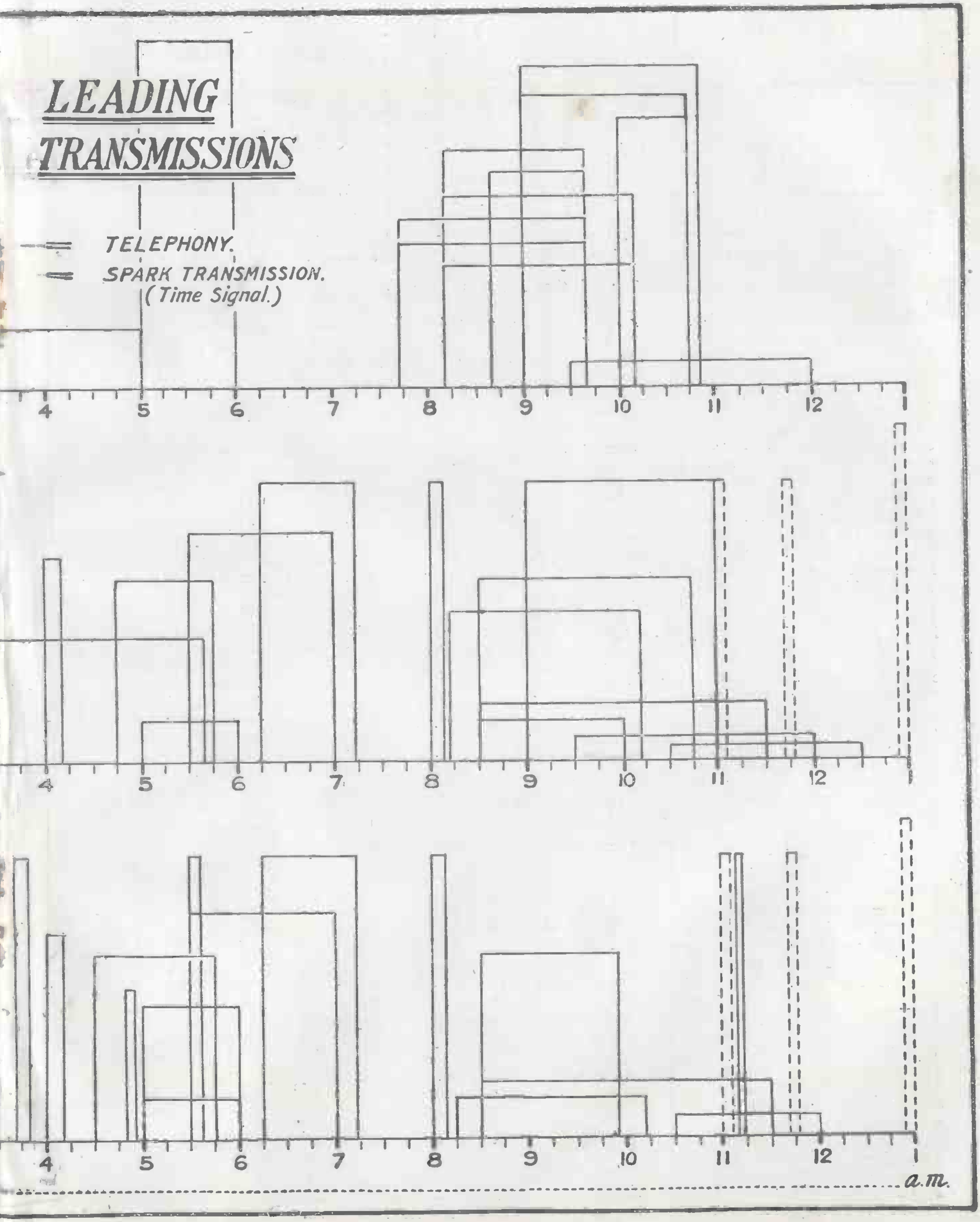

LEADING TRANSMISSIONS
TELEPHONY.
SPARK TRANSMISSION. (Time Signal.)
4 5 6 7 8 9 10 11 12
4 5 6 7 8 9 10 11 12
4 5 6 7 8 9 10 11 12
a.m.

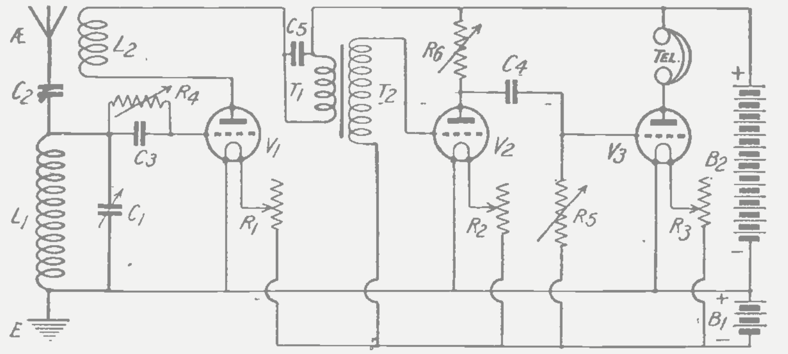


Fig. 1.—A circuit incorporating detector and two low-frequency stages.

Another Circuit on the Omni-Receiver

A further experiment which readers may try with this popular receiver

THE circuit depicted above consists of a detector valve followed by two note-magnifiers, but differs from the more usual arrangement in that the coupling between the two last valves is of the kind known as "resistance capacity" coupling.

Constant aerial tuning is used, the condenser C2 of .0001 μF being included for this purpose. L1 is the aerial tuning inductance, in parallel with which is the variable condenser C1 of .0005 μF capacity. The high-frequency oscillations are applied to the grid of V1 through the grid condenser C3, across which is placed the gridleak R4 of variable resistance. In the anode circuit of V1 we have the coil L2, and the primary winding T1 of the intervalve transformer T1 T2. The induced voltages in the secondary winding T2 are applied to the grid of V2, and result in amplified currents in the plate circuit of this valve. These currents set up potential differences across the anode resistance R6, which are communicated to the grid of the last valve through the condenser C4 of .002 μF capacity. The object of this condenser is to prevent the voltage of the anode battery being applied to the grid. The gridleak R5 is included, as is usual with this type of coupling. The telephones are placed in the plate circuit of the last valve.

It should be noted that somewhat louder signals are obtained with transformer coupling for the last valve, but the slightly improved quality resulting from the use of resistance capacity coupling will probably find preference with most readers.

Connections

The following is the list of connections necessary for the adaption of the circuit to the Omni receiver:—

51—11	22—24
3—17	30—14
25—52	29—48
17—18	6—36
18—19	36—45
27—12	44—24
19—35	46—16
43—27	16—5
25—26	13—48
25—40	8—23
4—9	31—24
1—21	32—40
21—37	38—22

Coils

Since constant aerial tuning is used in this circuit, it may be stated definitely that a No. 50 or No. 75 coil will be suitable for the aerial coil for broadcast wavelengths, the smaller coil being used when the wavelength required is below 420 metres, and the larger coil for wavelengths above 420 metres.

The reaction coil L2 may be a No. 50 or No. 75 coil.

Operating the Set

The aerial coil is plugged into the centre socket of the three-coil holder, and the reaction coil into the rear moving socket, and to commence with, they are kept well apart.

The knob of the 100,000-ohm resistance should be screwed down to make sure that there is some resistance in circuit, and the same process may be carried out with the two gridleaks. Tuning is carried out by adjustment of the middle variable condenser, and having tuned a signal to its greatest strength by this means, re-adjustment of the resistance knobs should be carried out.

The reaction coil should now be brought round towards the aerial coil, retuning on the variable condenser at the same time to retain the correct wavelength. Unless the connections to the reaction coil are incorrect, signals should increase in volume up to a point where they become distorted, and care should be taken to avoid this point after noting the relative positions of the coils, since interference with other listeners may be easily caused.

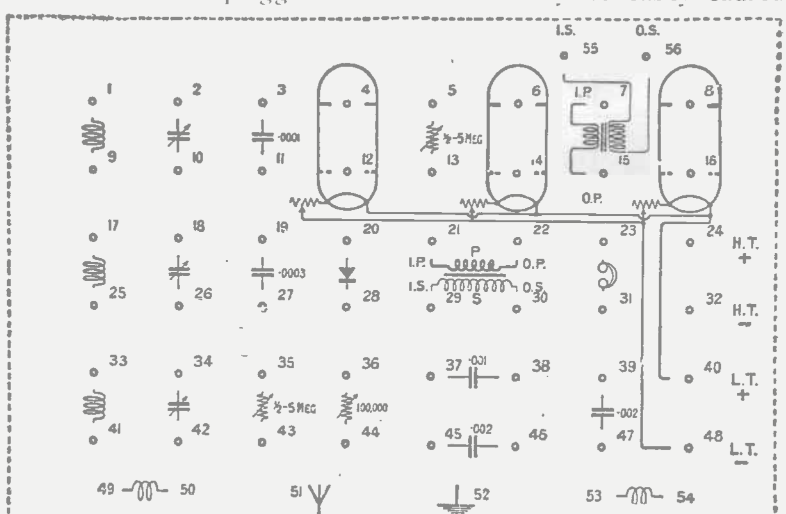


Fig. 2.—The terminal board.

If no reaction is obtained the connections to the reaction coil must be reversed, and this is carried out by disconnecting 4—9 and 1—21, and joining 21—9 and 4—1; the above procedure is then again carried out.

By experimenting a little with the circuit it is quite possible that improvements will be effected as regards both volume and quality.

Experiments to Try with the Circuit

The present form of tuning may be compared with series aerial tuning, by disconnecting 25—26 and 51—11, and joining 51—26.

The reversal of the connections to the secondary winding of the transformer may lead to increased signal strength, and may be carried out by disconnecting 30—14 and 29—48, and joining 29—14 and 30—48. If signals are weaker than previously, the connections should be reversed to their former positions.

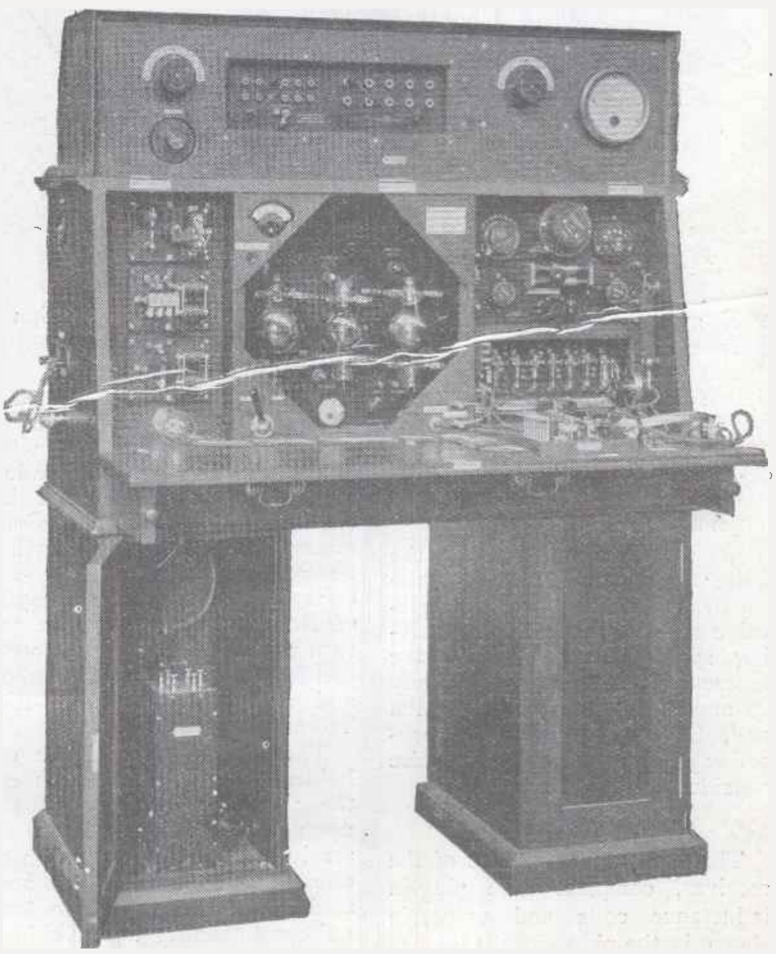
It will be seen that the coupling condenser in the resistance capacity coupled amplifier has a value of .002 μF. A higher capacity than this is preferable for low-frequency coupling, and an increase in the capacity of the condenser in use may prove advantageous. The desired effect may be obtained by connecting in parallel with the .002 μF condenser another condenser of the same capacity, the following connections being necessary:—45—39 and 46—47. The resultant capacity is merely the sum of the two capacities, viz., .004 μF.

The introduction of negative grid bias to improve the quality of the received signals is accomplished by disconnecting 29—48 and 13—48, and joining 29—13, 13 to the negative terminal of an external battery, and the positive terminal of this battery to terminal 48. The grid battery may be an ordinary variable high-tension battery, or, since a high voltage is not required, a flash-lamp battery, or two in series, will be suitable.

The detector valve may be given an anode voltage separate to that of the amplifying valves. This is a decided advantage, because the detector valve requires a much smaller voltage than that required for low-frequency amplifying valves, and this is especially the case where resistance capacity coupling is used. Disconnect 22—24, and take a flexible lead from terminal 22 to a point on the high-tension battery of lower voltage than that used for the amplifying valves.

Controlling H.F. Amplifiers

RECEIVING sets containing more than one stage of high-frequency amplification are not infrequently rather difficult to handle owing to their tendency to fall into self-oscillation at the slightest provocation. Increased stability can be obtained by careful adjustment of plate and filament potentials. The plate voltage for high-frequency amplifiers should not be too high. Should the set be unstable, try the effect of the following:—First lower the plate potential of the H.F. valves to about two-thirds of what was being used. Then tune to a strong signal and move the rheostat of the first valve gradually. It will be found usually, if the rheostat is turned slowly from the off position, that the valve gets nearer and nearer to the oscillating point until at length a howl is set up. Continue to turn the knob. A little further on the howl will die out and oscillation will decrease until finally there are no traces of it. If you turn on beyond this point the valve will oscillate once more. If the filament potential is either too great or too small the valve will tend to oscillate, but it will become quite stable if the adjustment which gives the golden mean can be found. R. W. H.



Our photograph shows a Marconi ½ kw. Cabinet telegraph and telephone transmitter and receiver which may be seen at the Palace of Engineering, Wembley.

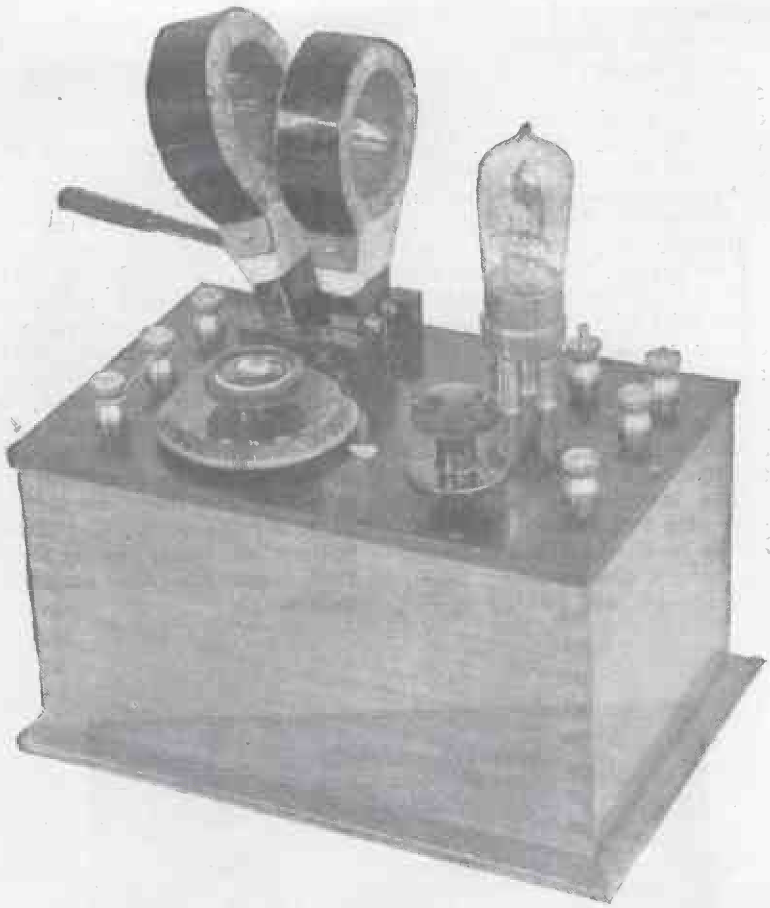


Fig. 1.—A single valve reaction receiver made up in a compact form for easy construction.

How every Crystal User may become a Valve Expert

By E. REDPATH, Assistant Editor.

The practical application of the theory explained in the preceding article, together with constructional details of an effective single valve receiver employing reaction.

IN preceding articles of this series, readers have been shown how to construct simple but effective apparatus to enable a valve to be employed in conjunction with an existing crystal receiver, either as a low-frequency or a high-frequency amplifier.

In the present article, the writer purposes describing the construction of a complete single-valve receiver capable of receiving spark or continuous wave Morse signals or radio telephony on any of the usual wavelengths and, by careful use of the reaction coil provided, from quite considerable distances.

General Description

The general appearance of the receiver, complete with plug-in inductance coils and valve, is shown in the photograph, Fig. 1.

Fig. 3 shows a plan view of the receiver with coils, valve, etc., removed, and indicates fairly clearly the disposition of the various components upon the ebonite panel.

The left-hand socket (the movable one) of the two-coil holder carries the plug-in coil which forms the aerial tuning inductance. The size of this coil (i.e., the number of turns) depends, of course, upon the wavelength to be received. 35- and 50-turn coils are required for reception of British broadcasting; a 100-turn coil for the Hague; 150-turn coil for Chelmsford and Radiola, and a 250-turn coil for Eiffel Tower, Paris.

The fixed socket of the coil-holder carries the reaction coil, the size of which also depends upon the wavelength to be received. Usually a reaction coil one size smaller than the aerial tuning inductance will be found quite satisfactory and avoids the duplication of coils in a set.

By the arrangement of terminals on the left-hand side of the receiver, the variable condenser immediately in front of the two-coil holder can be connected in series with the aerial tuning inductance (for short waves) or in parallel with it (for long waves).

A standard four-pin valve-holder is shown to the right of the two-coil holder, with the filament rheostat (of the Burndept dual type, so that a dull emitter valve may be used if desired) immediately in front of it. The three terminals behind the valve-holder are for the batteries, the left-hand terminal being the L.T. negative, the right-hand side one the H.T. positive, and the centre terminal the common L.T. positive and H.T. negative connection. The two terminals upon the right of the set are for the telephone receivers or loud-speaker, as required, it being quite possible to obtain medium loud-speaker results at distances up to about five miles from a main broadcasting station.

The Circuit Arrangement

The complete circuit arrangement is shown in the theoretical diagram, Fig. 2. Its extreme simplicity will no doubt be noticed, and on account of this, together with low initial cost, comparative ease of operation and the undoubted excellence of results obtainable, the construction of the set now under description is confidently recommended to all who are desirous of changing over from crystal reception, or who, taking up wireless for the first time, desire to commence with a single-valve set.

Referring to the diagram, Fig. 2, the three terminals already mentioned are shown at A, A1 and E. With the aerial lead connected to the terminal A1, the aerial circuit comprises the aerial, the series condenser C (0.001 μF), the aerial tuning inductance coil L, earth terminal E and earth connection.

With the aerial connected to terminal A, terminals A1 and E being connected together by means of the short-circuiting link indicated, the variable condenser C is connected in parallel across the aerial tuning inductance L and thus, with the same coil, a different and longer range of wavelengths is covered.

The aerial end of the coil L is connected via the grid condenser C1 (capacity 0.0003 μF) and gridleak R1 (resistance two megohms) to the grid of the valve, whilst the lower end of the coil is connected to the positive side of the filament lighting battery B1.

The Reaction Coil

Included in the anode circuit of the valve, between the anode itself and the telephone receivers, is another inductance coil L1, which is variably coupled to the aerial tuning inductance L. In this connection it is immaterial which of the two coils is movable, as long as their relative position

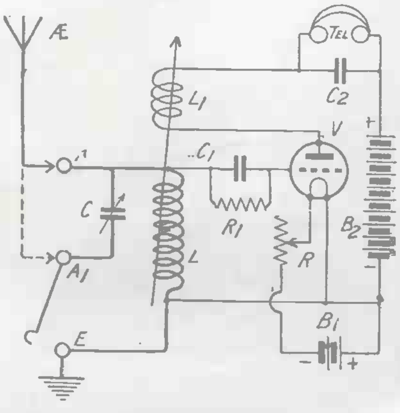


Fig. 2.—The theoretical circuit.

can be altered, thus varying the electro-magnetic coupling between them.

The telephone receivers TEL, shunted by a fixed condenser C2 (capacity 0.001 μF), and the anode battery B2 with its negative terminal connected to the positive terminal of the filament lighting battery, completes the anode circuit.

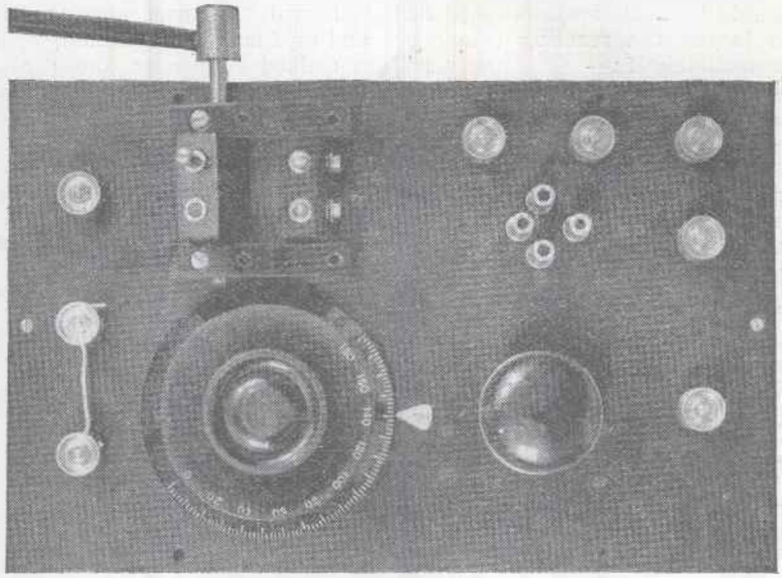


Fig. 3.—A plan view of the panel, the coils and valve being removed for clearness.

The Action of the Set

The variable condenser C being adjusted so as to bring the aerial circuit into resonance with the desired transmitting station, oscillatory potentials are set up across the inductance coil L, and are applied, via the condenser C1, to the grid and filament of the valve.

Owing to the action of the grid condenser and gridleak, as fully explained in last week's issue, the effect of the incoming signals (Morse, speech, etc.) is to cause a reduction of grid potential and, consequently, a reduction in anode current. It will no doubt be remembered that, although only the *low frequency* or average variation in current is indicated in the telephone receivers, there are high-frequency pulses of current flowing in the anode circuit. To facilitate the passage of these high-frequency pulses, the highly-inductive windings of the telephone receivers are shunted by a condenser.

These high-frequency pulsating currents traversing the reaction coil L1 induce currents of similar frequency in the aerial tuning inductance L, and, according to the *direction* of windings or connections of the coils L1 and L, so will the induced currents either assist and strengthen or oppose and reduce the oscillatory currents in the aerial circuit due to the incoming signals.

The transfer of energy from the reaction coil to the aerial circuit, if the coupling between the coils is correct, has the effect of reducing the apparent resistance of the aerial circuit. With the correct degree of coupling, the aerial resistance is reduced almost to zero, thus increasing considerably the sensitivity and selectivity of the receiver, which, however, remains quite stable, so that, upon cessation of incoming signals, grid potential and anode current return to normal values and all action ceases.

Further increase of reaction coupling reduces the resistance of the aerial circuit below zero, or, in other words, causes it to have negative resistance, under which condition continuous oscillations will be generated in the receiver itself quite independent of any incoming signals.

Causing Interference

If the receiving set is allowed to oscillate, continuous waves are certain to be radiated from the aerial, and, being received upon the aerial of adjacent receiving stations, even at distances up to two or three miles, will interfere with and, in some cases, may quite prevent pleasurable reception of broadcast transmissions.

Upon this one point therefore —namely, the adjustment of the reaction coupling—this otherwise easily operated and efficient receiver requires care, and, especially when first using the set, it should be made an unfailing rule to loosen the reaction coupling immediately if :—

(1) The received speech, etc., becomes at all harsh or unnatural.

(2) The "carrier wave" of the transmitting station is heard either as a low musical note or as a kind of drumming accompaniment to the speech or music.

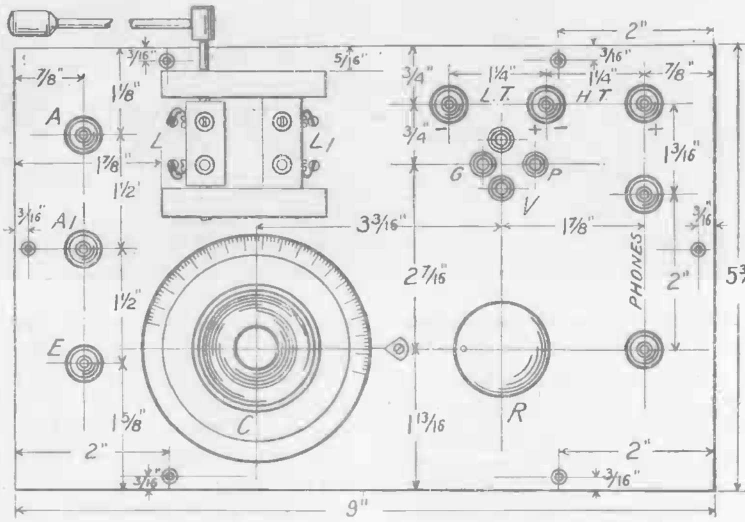


Fig. 4.—The layout of the panel showing dimensions and purposes served by the terminals.

(3) In the absence of (1) or (2), as, for instance, when searching for a station, touching the aerial terminal of the receiver with the moistened finger tip produces a characteristic "cluck" in the telephones.

Constructional Details

The components required in the construction of the receiver are as follows :—

1 ebonite panel, 9 in. by 5¾ in. by ¼ in. thick.

8 terminals.

1 two-coil holder, preferably with extension handle.

4 valve sockets.

1 filament rheostat.

1 variable condenser (capacity 0.001 μF). That illustrated in Fig. 5 is a Formodenser with single-plate vernier for fine adjustment.

1 grid condenser (0.0003 μF) and grid leak (2 megohms).

1 fixed condenser (0.001 μF). Condensers and grid leak are by the Dubilier Co.

Mounting the Components

Unless specially prepared ebonite is obtained, it is desirable to remove the original surface polish from both front and back of the panel by the use of the finest emery or carborundum cloth, subsequently polishing with metal polish and soft flannel.

If cloth of a suitable degree of fineness cannot be obtained, carborundum grinding paste, as used for grinding in the valves of internal combustion engines, may be used with good effect. In order to avoid any accidental marking of the panel, it is desirable to remove the original surface polish or, at all events, to complete the operation, after the panel has been marked out and drilled in accordance with Fig. 4.

Reference to the photograph, Fig. 5, in conjunction with Fig. 4, will show how the various components are to be fitted to the ebonite panel, and, although the general arrangement should be followed as far as possible, any slight modification due to the use of components other than those shown will not affect the final results.

NEXT WEEK. — *The wiring instructions, together with a practical wiring diagram. Testing and operating the set.*

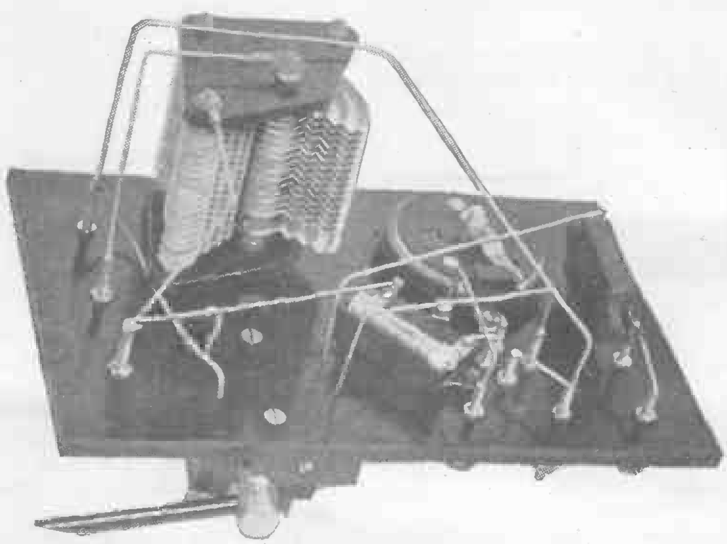
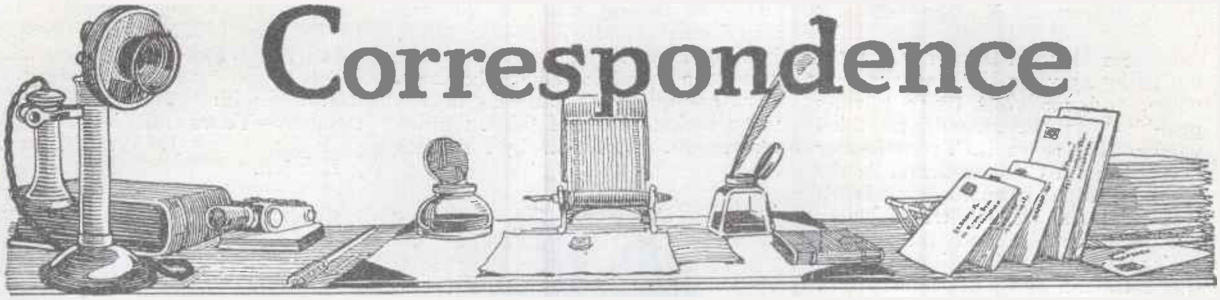


Fig. 5.—Photograph of underside of panel showing disposition of components and wiring.

Correspondence



TRUTH IN ADVERTISING

SIR,—With reference to your editorial notice in your issue of the 6th inst., on the subject of condenser values, we regard the testing of condensers for capacity as one of the essential operations in manufacture. To sell a variable condenser as .001 capacity value, when in fact it has only .0007 or approximately 25 per cent. less capacity, is the same as giving the public short weight, and should be made illegal by Act of Parliament. We believe, in many cases, the makers of variable condensers have neither the knowledge nor apparatus for measuring the capacity, but invariably the loss is on the side of the purchaser, as the condensers are below the figure, and never above the stated values.

We would recommend the public when purchasing condensers of an unknown make to insist on some guarantee as to their capacity, and to write to the Press when the articles have been found to be below the stated value.

Incidentally, we may mention that all our .001 variable condensers have an actual value of .0012, and are therefore 20 per cent. in excess of their nominal value. For ordinary tuning purposes in wireless apparatus the advantage of this will be readily realised. In the case of the smaller variable condenser, such as .0001 or .0002, the correct value is more important, and these are within limits essential for their efficient use, viz., 2.5 per cent. A limit of 2.5 per cent. in capacity or inductance is all that is necessary, and manufacturers should certainly guarantee this standard of accuracy.
—Yours faithfully,

RADIO INSTRUMENTS, LTD.,
J. JOSEPH,
Managing Director.

A REFLEX RECEIVER

SIR,—It is my misfortune to live in rooms. Because of this I have what must, I am sure, be the "world's worst aerial." It is a single wire of about eighty feet in length (including the lead-in). It takes the form of an inverted "L"—twenty feet high at the further end, and about thirty-five feet at the lead-in. The actual span of the aerial is only thirty or thirty-five feet, the slack being taken up by the wire being attached by sixteen loops to a supporting strand of "Electron" wire (the aerial wire is insulated electric-lighting wire!). Further, for half its length, the aerial lies within two feet of an outstanding wing of the house, and at one point comes within one foot of the telephone-wires, where they are attached to a corner wall-bracket!

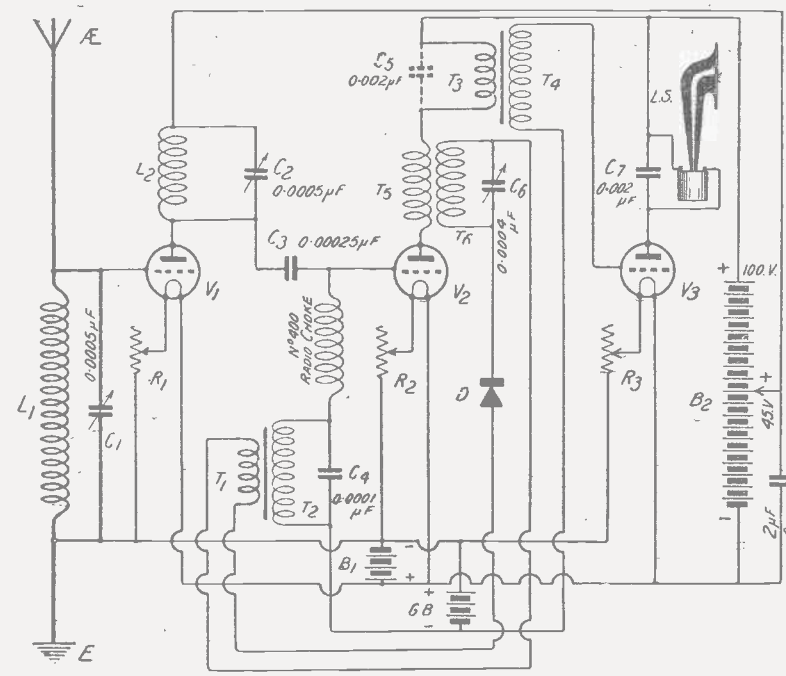


Fig. 1.—The reflex circuit referred to by "Medico."

I am not proud of this aerial (except as a curiosity), but the local conditions forbid any real improvement.

Although I made my first receiver as long ago as 1912, I felt little attracted towards "wireless" as a hobby until some four months ago. With 2ZY within a mile of me, I found crystal-reception simple with any sort of aerial and earth—or none at all. However, it was distance that I wanted. In the last four months, therefore, I have eagerly experimented with all types of crystal-circuits; all types of valve-circuits; with all types of valve-crystal circuits. I worked systematically through all the circuits given in Mr. Scott-Taggart's excellent books on the subject (up to three valves), and all those I came across in the wireless periodicals. None gave me the distance I sought; I could not get beyond 2ZY! I admit that I tested most of them unfairly, for I try all my circuits on a wonderful experimental board of my own contriving. On it I can rig up any and every circuit up to three valves, using standard components; the connections, I regret to say, are often lengthy, and there is full scope for interaction in the leads! I justify this method of testing by saying that any circuit that gives good results under such bad conditions is likely to give *extremely* good results under the conditions normally obtaining in a properly constructed set. Now at last, after all this attempting, I have designed my ideal circuit! I do not claim that my circuit is novel; it is certainly unusual, and I have not yet seen any other quite like it. I enclose a diagram of the circuit, with the hope that it may be of interest to your readers and—who knows?—to yourself.

I am using D.E. .06 valves throughout. The first H.F. valve is an Ediswan A.R., the reflexing valve is a B.T.H. B5, the L.F. valve is a Marconi-Osram D.E.3. I am using 45 volts H.T. on the first valve, and 100 volts (with 7 volts grid-bias) on the second and third valves. The reflex L.F. transformer is a "Eureka Concert Grand"; the second stage transformer is a "K.G."; the H.F. transformers are McMichael's, and the crystal cat's-whisker combination is synthetic Galena and stout silver wire. Placing a condenser across the primary of the second-stage L.F. transformer does—in my experience—make no difference whatever. The small fixed condenser across the secondary of the reflex L.F. transformer abolishes an otherwise incurable "tinniness" in the vocal and instrumental output.

I should like to put it on record that so far as my own reception is concerned, 5XX comes in very poorly up here. Some nights he comes in loudly, but is horribly "microphonic," other nights he is good in quality but little more than a whisper compared to Radio-Paris. It is interesting to note that in intervals in the programme of Radio-Paris, 5XX comes in over nearly 80 degrees of the T.A. condenser, the A.T. condenser and the condenser of the tuned circuit of the H.F. transformer, but when Radio-Paris comes back, he swamps 5XX and *his* tuning is really critical. Transmissions from Le Petit Parisien come in moderately well, but are with difficulty freed from B.B.C. programmes and, later, from a most obnoxious Morse interference.

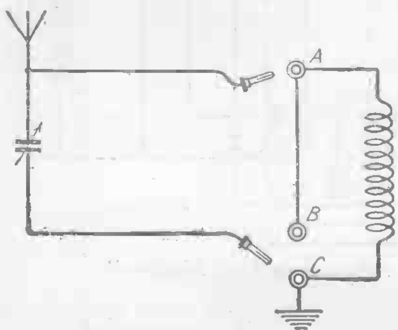


Fig. 2.—The series-parallel arrangement suggested by Mr. Kyffin.

In conclusion, I should like to thank you for producing the two best wireless periodicals Great Britain (or the U.S.A.) can show—*Modern Wireless* and *Wireless Weekly;* there is, in my opinion, no other papers with which they may be compared.—Believe me, I am, yours faithfully,

"MEDICO."

Manchester.

VALVE HOLDERS

SIR,—I have just finished Mr. Harris's Transatlantic V, and shall be testing when I get the transformers and valves for same. I send herewith a sample of the method adopted to reduce the capacity as much as possible in the valve sockets which I think will interest you. With straight sockets

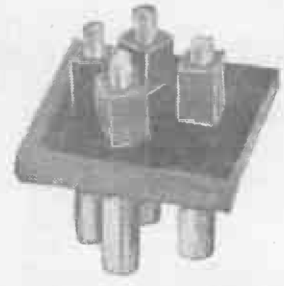


Fig. 3.—Method of mounting valve legs as advocated by Mr. Hood.

(without the shoulders) this makes an excellent holder. The nuts were made from odd bits of ebonite, and it is really surprising how they grip and make quite a firm job. I might mention that I had never done any tapping until I read an article on this subject in one of your papers. Now I tap everything I possibly can. The condensers, grid-leaks, and resistances are all tapped into the back of the panel. If you screw up the two filament nuts first it is quite an easy matter to mount the other two. Thanking you for publishing two excellent papers that give me hours of pleasure.—Yours faithfully,

JOHN HOOD.

Portsmouth.

A USEFUL TWO-VALVE SET

SIR,—I have made up in formal fashion Mr. Stanley G. Rattee's "Useful Two-Valve Set" as described in your journal of July 16. For some months I have been on the look-out for a circuit involving H.F. + Det. with air-core transformer coupling. This one looked highly practical, and I may say that the results have exceeded my anticipations.

For strength, extraordinary clarity and ease of handling it seems to be all that one could desire. I am seven miles from 2LO, but with 50 ft. in the horizontal of "Magniplex" aerial + 50 ft. single, 22 S.W.G. down-lead, that station is satisfactorily received on a Brown loud-speaker; 6BM, 5IT and 5WA come in at good 'phone strength, and I have received 5SC after 11 o'clock at night when Gleneagles' Hotel Band was being broadcast. I am looking forward to receiving some of the longer wavelengths of the Continental stations when I obtain the necessary transformers. At present I am limited to 300-600 metres. I am glad to congratulate Mr. Rattee upon the production of so interesting a receiver. It is well named "Useful." May I also wish every success to *Wireless Weekly,* which seems to grow more interesting and useful with each succeeding number.—Yours faithfully,

J. W. TIERNEY.

London.

SERIES-PARALLEL DEVICE

SIR,—A simple series-parallel switch can be made with two valve legs and three sockets. If the bottom pin is placed in B, Fig. 2, the condenser is in series, and if the top pin is placed in A and the bottom in C the condenser is in parallel.—Yours faithfully,

J. N. KYFFIN.

Hornchurch.

A CIRCUIT TO TRY

SIR,—I write on behalf of several friends and myself to ask you to give publicity to a type of receiving set which involves a circuit already published in most wireless journals some months back, but which does not seem to have the popularity which its excellence and simplicity warrant.

The circuit for one-valve is as given in Fig. 4.

It will be seen that this is a "one-valve and reaction" circuit, involving the use of a rejector circuit, C2 L2 across aerial and earth terminals of the series tuned cir-

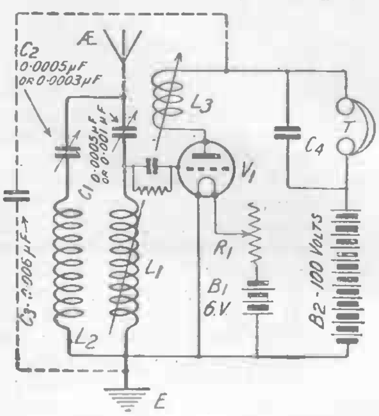


Fig. 4.—The circuit referred to by Mr. Stickings.

cuit C1 L1, ordinary reaction being secured by the coupling of coils L1 and L3. The rest of the set is perfectly normal with the possible exception of the condenser C3, to which reference will be made later. Low frequency amplifiers can be added in any of the normal ways.

Advantages.—For broadcast reception the advantage of this set is not confined to the mere elimination of a near station and reception of distant stations; its great advantage is that it gives the most satisfactory and simple method of *vernier tuning* I have ever experimented with for any wavelength, using, of course, suitable coils. The arrangement cuts out all body capacity effects, and fine tuning is accomplished over comparatively wide movements of the condenser C2, resulting in ease of manipulation, and above all, *maximum selectivity* and *signal strength.*

Method of Working.—For best reception of a *near* broadcasting station, condenser C2 is set near zero. Condenser C1 is then adjusted to give loud signals. Condenser C2 is now moved, and it will be found that a smooth fine tuning to a marked maximum is readily achieved. On removing the hand from the condenser knob there is no alteration in signal strength.

For best reception of *distant* stations the near station is first tuned in on condenser C1, and C2 is then moved round until signals are completely cut out. The reaction coil L3 is brought up and condenser C1 moved to "search" in the usual way. When the desired station is heard (the valve being kept just below oscillation point by means of reaction coil L3) a little movement of condenser C2 will be found again to give a very smooth fine tuning without spoiling selectivity, and, on withdrawing the hand, body capacity effects will be found to be negligible. The great point I wish to stress is that from the exactness of the tuning maximum signal strength and clarity are obtained.

Results.—My friends and I have used this type of receiver for upyards of a year now with consistently good results. Personally, I use one-note magnifier on London and get very strong loud-speaker results at ten miles—almost too strong, in fact; one valve alone gives quite pleasant though rather weak signals on a small Brown's loud-speaker, and is almost too strong for headphones with reaction coil at 90 deg. to the A.T.I. With two note magnifiers I get all other British broadcasting stations on the loud-speaker, hundreds of amateurs, aeroplane conversations, many French amateurs and Continental stations. Radiola on three valves is equivalent to London on two valves.

In experimenting on 100 metres I usually dispense with the standard London rejector as there is no interference, and in order to secure oscillation I place a .006 μF condenser in the dotted line position shown on the diagram. On these wavelengths, last winter, I was able to pick up WGY and KDKA regularly using home-made basket coils of 15 turns in the A.T.I. and twenty-five turns in reaction—these stations being quite audible on the loud-speaker, though rather weak and subject to fading.

We have tried out many circuits, but in our opinion none equal this simple arrangement, and it is because we think your readers ought to try it out that I am prompted to offer you these details. We have tried to add high frequency amplification to this set without success. Perhaps some of your readers may be able to do better in this connection.—Yours faithfully,

R. W. E. Stickings,
B.Sc., O.B.E.

Mitcham.

RECEIVING 5XX

Sir,—Judging from the letter published under the above heading in your issue of the 6th inst., it would appear that the writer and his other disappointed friends have not appreciated the effect of distance on reception. In the Clapham Common district, which is only about four miles from 2LO, and always supposing that the receiver was equally efficient on both the longer and shorter wavelengths, the strength of signals from 5XX can only be about one-quarter of the strength of those from 2LO.

I fear, however, that we less fortunately situated people cannot seriously sympathise with the disappointment of the writer of the letter and his friends, seeing that they are already efficiently served by their local broadcasting station with exactly the same programme, only more of it, and that, therefore, 5XX was not intended for their benefit.

The matter is regarded very differently by any distant listeners with whom I have discussed it, who express unqualified approval of the results received from 5XX.

In my own case, situated as I am, some 315 miles from 2LO and 350 miles from 5XX, the improvement is extraordinary. Whilst it has hitherto been possible to receive all the low-power B.B.C. stations with the exception of 5IT using three valves—H.F., Det. and L.F.—at good headphone strength, and at fair loud-speaker strength with five valves—2 H.F., Det. and 2 L.F.—(or under particularly favourable conditions after dark with only one L.F.), with critical reaction in all cases, I can receive 5XX in daylight at comfortable headphone strength on one valve with moderate reaction, strongly on three pairs of headphones with H.F. and Det. without reaction, at fair indoor loud-speaker strength with Det. and L.F. with moderate reaction, and at really strong outdoor strength on a Brown H1 loud-speaker, every word being audible at 60 yards distance without difficulty, using either H.F., Det. and L.F. with moderate reaction or the same valves without reaction, but in conjunction with a Brown microphone amplifier.

The improvement in the quality of the loud-speaker signals, due to the fact that it is no longer necessary to force the valves in any way or to use more than very moderate reaction under any circumstances, is very marked. Indeed, the quality both in headphones and loud-speaker reception is as nearly as possible perfect, which could hardly be said of even the best loud-speaker reception here of the low-power stations. Further, there is an almost complete freedom from spark interference which not infrequently renders reception from the low-power stations impossible, and except for atmospherics the background is almost completely silent. When 5XX was transmitting direct from Chelmsford freedom from ship interference was of course complete, but since they have been relaying the 2LO programmes I have heard both ship and land spark stations on their 1,600m. wavelength, although they have never been seriously annoying. As these did not seem to be harmonics, I can only account for their reception by supposing that transmission between 2LO and 5XX was by wireless and that the latter station received these spark signals at the same time as those of 2LO and relayed them both together. If my supposition is correct, the use of land cable communication between the two stations will avoid such little interference from these spark stations as has occurred.

Finally, I should like to emphasise the fact that 5XX brings to distant listeners for the first time the same perfection of reception which others more fortunately situated as regards local stations have enjoyed from the inception of broadcasting.—Yours faithfully,

MEADE J. C. DENNIS, Col.
(Late 2HY).

Baltinglass.

SIR,—It is difficult to understand the complaints of inability to receive 5XX Chelmsford. My experience is all in the contrary direction. Modulation is inferior to 2LO, but in all other respects reception is very satisfactory. Crystal sets, whether variometer, loose-coupler, solenoid-sliders, aperiodic tuned, give equally good results. On valve sets—ST100, Reinartz, Unit-panels, "Omni" principle, etc.—the results are uniformly good, with but a slight advantage to London. Aerial and earth system is first class.—Yours faithfully,

E. J. BRAY.

London.

SIR,—Regarding C. P. Brown's letter headed "Receiving 5XX" in

Wireless Weekly of August 6, as an experimenter and a regular listener, I cannot let his remarks pass without comment.

For him to say that he is expressing the sentiment of a vast majority is, to say the least, absurd.

On an inferior aerial (not 15 ft. high at the highest point) and with a one-valve set using reaction, in broad daylight I could get 5XX better than Aberdeen, which is 40 miles away.

I would ask Mr. C. P. Brown to have another look at his two sets and see what size of coils he is using. In the crystal set with a 200-plug in coil, and a .0005 μF variable condenser in parallel on a 100 ft. aerial, he should get 5XX excellently.

If Mr. C. P. Brown continues to be dissatisfied, let him leave 5XX to those for whom it is intended; that is, listeners outside the crystal-receiving range of 2LO, and those out of reach of regular valve reception of 2LO.—Yours faithfully,

"EXPERIMENTER."

Forfar, N.B.

SIR,—With reference to Mr. C. P. Brown's letter in August 6 issue perhaps my own experiences in receiving 5XX may be of interest.

At Hampstead, using an ordinary condenser-tuned crystal set, Chelmsford is received only slightly under 2LO's strength. Using ST100 on an Omni, Chelmsford is every bit as loud as London—filling a large room with undistorted music from a Baby Sterling. In fact, I find that with any set using a stage of high frequency, Chelmsford compares favourably with 2LO.

At Newbury, in Berkshire, we have to use three valves (H.F., D., L.F.) to receive London without forcing reaction, and four-valves for *clear* loud-speaker reception. London on two-valves without reaction (D. and L.F.) is not audible. Chelmsford, however, is easily obtained *on a crystal set*, and at comfortable strength when a favourable spot has been located on the crystal. With two stages of L.F. added to this, quite good loud-speaker results obtain—fully equal to London on four-valves, but with far greater purity. I think Capt. Eckersley has stated that 5XX is for those whose districts are not served by other stations, and I do not imagine any Newbury listener is disappointed.—Yours faithfully,

LINTOTT MITCHELL.

Hampstead.

SIR,—May I reply to Mr. Brown upon the subject of 5XX?

I venture to suggest that he has not read (or considered) P.P.E.'s remarks upon probable results from Chelmsford. This station is situated some fifteen times as far away from our receivers as 2LO. Consequently for purely arithmetical calculation the power should be fifteen times as great for *pro rata* reception. At present 5XX's power is but ten times as much as 2LO!!!

I am situated here favourably as regards height, but the lead-in runs from back to front of the house! On a crystal set 5XX has about 75 per cent. of 2LO value, whilst detector and L.F., using reaction, fills the room strongly on an amplion A.R.19; the quality being not quite so good (using reaction accounts for some loss of quality naturally).

I have found the addition of loading coils to be not absolutely successful for reception of the high power station. By this I wish to infer that reception is decidedly better upon a tuner capable of taking the required wavelength by reason of its construction.

In conclusion, we are judging results at the least favourable time of the year, and from personal experience I am led to believe we shall get some extraordinary results during the coming winter.—Yours faithfully,

H. SHEARMAN DYER.

Denmark Hill, S.E.5.

[Although we cannot strictly agree with the arithmetical reasoning of this letter we publish it as a matter of interest.—ED.]

Wireless Weekly

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Aug. 27, 1924

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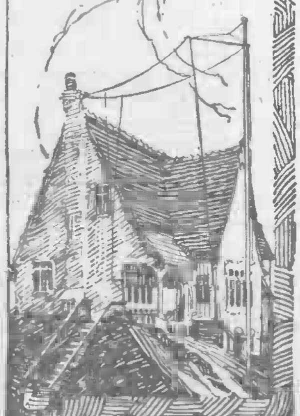

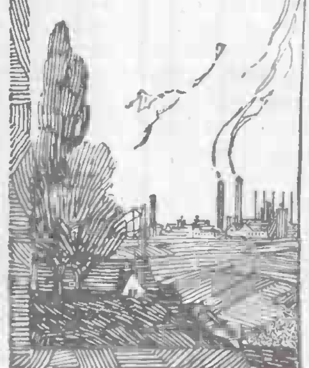

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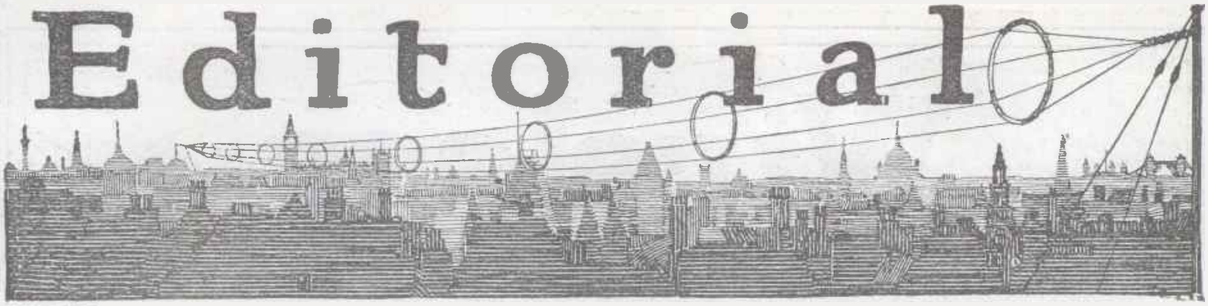


The Post Office and the Amateur Transmitter

IN the September Double Number of *Modern Wireless* there will be found a list, running to no less than ten pages of small type, of amateur and experimental transmitting stations in this country. To many newcomers to wireless the size of this list will be a great surprise, for it is not generally realised that an important section of the amateur community have been licensed to transmit wireless signals as well as to receive them.

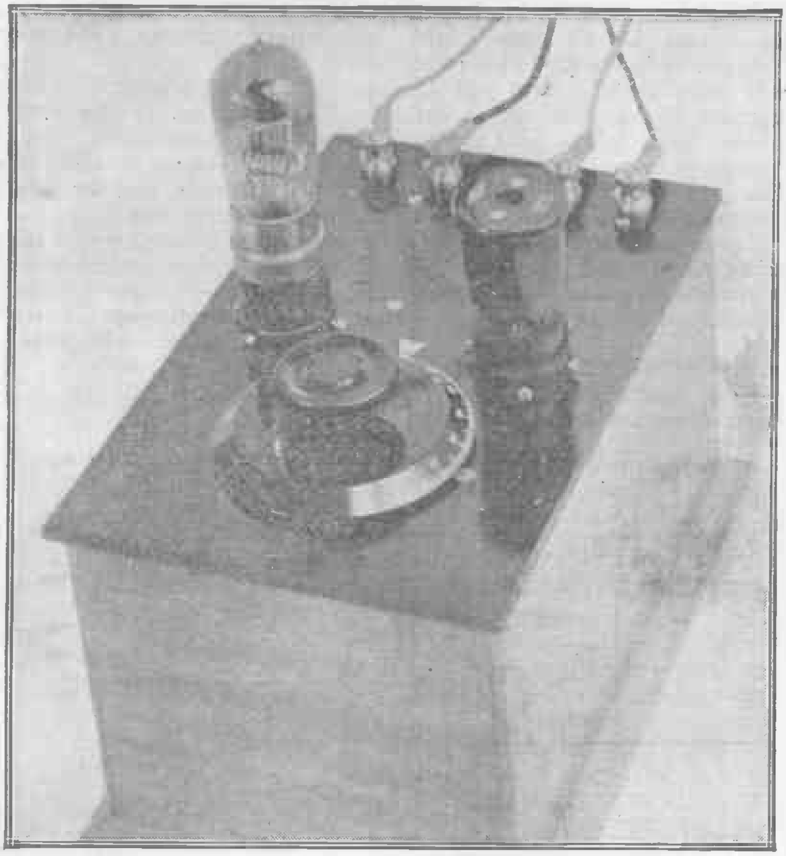
Since the Post Office has thought fit to grant transmitting licences to these hundreds of experimenters it might well be imagined that they fully realise the position of the transmitting amateur. Yet what do we find? The application form for permission to use transmitting apparatus is full of absurdities; any intelligent observer who listens in will rapidly form the opinion that licences have been granted to many people who are unfit to hold them, evidence is available that many thoroughly competent experimenters have been refused permission to transmit, and, finally, we have the ridiculous and cramping regulation that experimental communications must not take place with stations outside this country without express permission of the Post Office.

The form itself could be criticised from many points of view, but we will content ourselves here with pointing out a few of the absurdities. Seeing that the object of obtaining a transmitting licence is to experiment in wireless telephony, what is the object of requiring the applicant to state in detail the circuit he proposes to use? Surely the use of one particular circuit, day in and day out, and probably for the transmission of gramophone records to friends, is the last thing to be desired. The true experimenter will perhaps change his apparatus and his arrangement every night, aiming to get greater distance with lower power, and better modulation with simpler apparatus. Again, as the power limitations (with which we have no quarrel) are expressly stated in the licence, why should the applicant need to state (if he can so state when applying for the licence) whether his high-tension supply will be obtained from accumulators, dry batteries, the mains, or what-not? It is to be assumed that the honest and intelligent experimenter will not procure and instal his apparatus before receiving his licence, and until he has done some work it is unlikely that he will be able to decide which will best suit his means.

The form is full of such absurd questions as these. Even on receiving aerials, the applicant is required to state the exact dimensions and form of his aerial. What genuine experimenter can say beforehand exactly what he proposes doing in the way of his equipment in this direction? Who, but a prophet, can explain in detail the exact purpose of the experiments he proposes to conduct, and exactly what they are? If this question had been put to Senator Marconi himself in his early days, would he have been able to give detailed answers which would have satisfied the Post Office? The finest wireless inventions have often come from following lines of work suggested at the last moment by some erratic phenomenon.

Finally, we have the crowning absurdity referred to, which is making our transmitting regulations the laughing stock of the amateur fraternity in the United States. Although it should be noted that the power granted to the transmitter is stated specifically in this licence, he must not transmit to a station outside this country, without permission of the Post Office! John Jones, we will say, situated in a southern sea-port town with his 10-watt apparatus, calls a friend in the North of Scotland and succeeds in effecting good communication. A French amateur across the Channel, hearing his signal, calls him. According to our regulations, unless he is specially licensed to do so, our friend must not reply! A communication with a friend in Belfast is quite in order, but he will commit an offence against the regulations if he exchanges signals with Dublin, for Dublin is not within the area "Northern Ireland!" If, on a particularly good night he should succeed in raising an amateur in the United States (not exceeding, it should be noted, his licensed power of 10 watts) he is liable to have his licence withdrawn for breaking regulations.

We certainly think it is high time the Post Office made some statement on their attitude towards the transmitting experimenter; there is every evidence that the form and regulations have been drawn up by officials who are not really acquainted with the art, and are simply following out Civil Service traditions of red tape and obstruction. So long as it is possible to hear amateur transmitters asking one another, by radio, "what is an artificial aerial?" and so long as the genuine experimenters are refused transmitting licences when they are quite prepared, if necessary, to pass an examination and demonstrate their competence, the profound dissatisfaction in the amateur fraternity regarding the Post Office and its methods will continue.



The Buzzerdyne is compact, even for a wavemeter.

The Buzzerdyne—A New Wavemeter

By PERCY W. HARRIS, Assistant Editor

An instrument combining the advantages of a buzzer wavemeter with the silence and simplicity of a separate oscillator.

EVERY listener who looks upon wireless as something more than a means of receiving music from the nearest broadcasting station desires, sooner or later, to possess himself of a wavemeter. For some reason or other beginners look upon wavemeters as elaborate and complex instruments, the principles of which are difficult to understand. Briefly, however, a wireless wavemeter is nothing more than a simple wireless circuit consisting of an inductance coil and a condenser in series with some kind of device to give either an indication of the current flowing in the circuit, if current should be set up by outside signals, or, what is more usually the case, some form of exciter to set up oscillations in this circuit so that it can radiate them to a near-by receiver. The frequency at which the radio circuit will oscillate is determined by the value of the inductance and condenser, and if we plot out on a chart the wavelength readings for various settings of the condenser for given inductance coils we shall have a standard to which we can always refer. For example, if with a given coil a setting of 15 degrees of the condenser sets up oscillations of a wavelength corresponding with London, then, whenever we want to try out a new receiver and to find quickly which is the correct setting of our new instrument for London, we can set the wavemeter going

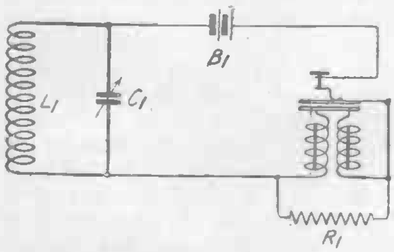


Fig. 1.—A simple buzzer wavemeter circuit.

and tune our receiver to the note from the wavemeter; when the note is loudest we shall be accurately tuned to London wavelength, and on stopping the wavemeter, if London should be operating at this time, we shall hear the station clearly.

Not only can a wavemeter be used for measuring wavelengths, but it is also most useful in comparing inductances, capacities, in determining resonance curves and making many other calculations. The wavemeter is, in fact, the most useful of all wireless measuring instruments.

Classification of Wavemeters

In general, wavemeters may be divided into two classes: buzzer wavemeters and heterodyne wavemeters. The former consist of an oscillating circuit with inductance and capacity, oscillations being set up in the circuit by means of sudden pulses of current due to the interruption of a buzzer circuit. Each interruption of the buzzer will give a short train of waves, and as a buzzer vibrates at a more or less musical frequency, we shall get a reproduction of this note in our telephones. Heterodyne wavemeters, on the other hand, have continuous and not intermittent oscillations set up in a resonant circuit by means of a valve, the plate circuit of which is coupled tightly to the grid circuit so as to maintain continuous oscillations.

Accuracy of Wavemeters

Heterodyne wavemeters are far more accurate in their reading than buzzer wavemeters, owing to the fact that any continuous wave generator, when setting up oscillations which interact with those in a receiver, will cause a heterodyne note in which very slight differences of frequency are easily noticeable. Buzzer wavemeters, on the other hand, are quite broad in their tuning, although, if they are well designed with low loss coils, the tuning is reasonably sharp for all ordinary purposes.

Wavemeter Circuit

Fig. 1 shows a simple buzzer wavemeter circuit, and Fig. 2 a simple heterodyne wavemeter circuit. Of course, there are many varieties of each kind, but the two are representative.

In Fig. 1 current from dry cells, or an accumulator, flows through the inductance, through the windings of the buzzer magnet, across the contact and back to the battery. As soon as this current flows, the armature of the electromagnet is attracted towards the pole pieces, thus breaking the circuit. Just prior to the moment of interruption, current is, of course, flowing through the coil L1, setting up a magnetic field, and, owing to the inductance of this, the current will tend to be maintained. After interruption, the current field collapses, setting up a sudden current which will charge the condenser, which, in turn, will discharge through the inductance, the circuit thus oscillating at its natural frequency. The train of oscillations will rapidly die down, and, of course, as the circuit was interrupted when the armature was drawn down and the current thereupon ceased to flow in the magnet coils, the armature is released and the cycle of operations is repeated. We thus see that we can get a series of trains of waves in the oscillating circuit L1 C1, the frequency of the oscil-

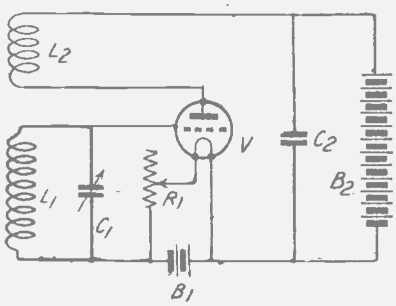


Fig. 2.—A simple heterodyne wavemeter circuit.

lations depending upon the wavelength of this circuit, the interval between the separate trains of waves depending upon the frequency of the buzzer interruption.

In Fig. 2 we have an ordinary reaction circuit, and if we assume that oscillations are occurring in the circuit L1 C1 (any slight irregularity in the flow of current will start them), they will be repeated in the plate circuit and handed back to the grid circuit once more in an intensified form. The grid circuit will now oscillate more strongly, the feed-back will pass still more energy to the grid circuit, and soon the circuit is maintaining continuous oscillations.

Calibration of Wavemeters

Both buzzer and heterodyne wavemeters are obtainable commercially, and also can be simply built by the home constructor. Commercial instruments are sold with "calibration charts," that is to say, charts on which the relation of condenser degrees to wavelength is plotted out as a curve. The home constructor who builds his own wavemeter must naturally calibrate it in some way, and he usually does this by borrowing a calibrated wavemeter and comparing it with his own. It is not absolutely necessary to borrow a calibrated wavemeter in order to make out a chart for our own instrument, for if we tune in a receiver to each of the broadcasting stations in turn, and on each tuning adjustment alter our wavemeter until it gives the loudest note, we can make a fairly accurate chart by plotting out the figures obtained, as the wavelengths of the British Broadcasting Company's stations are known and do not vary greatly from time to time. Calibration in this way is extremely simple if we use a square law condenser, for the calibration chart in most cases will show a straight line practically from beginning to end. I described a short-wave heterodyne wavemeter in *Wireless Weekly* for January 23, 1924, and for this a calibration chart was given. As a square law condenser was used in this particular instrument, a straight line effect was obtained. If ordinary condensers are used, the calibration line will have a curved form, although on its upper portion it will be fairly straight.

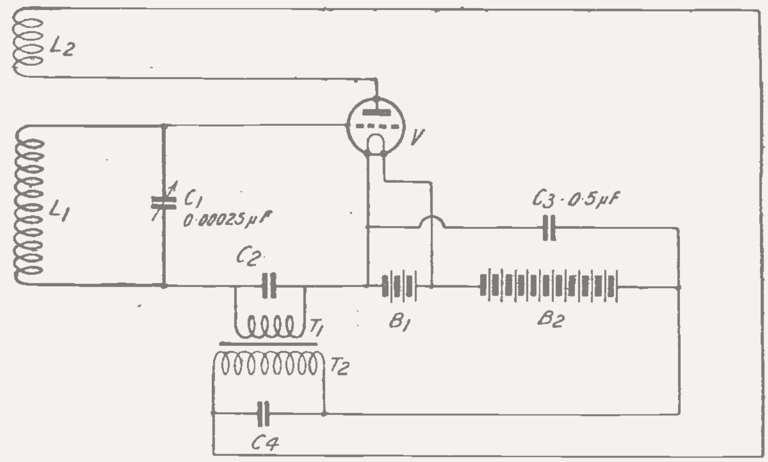


Fig. 3.—An experimental buzzer wavemeter circuit described.

Disadvantages of Wavemeters

There are two main troubles with buzzer wavemeters; the first is that it is almost impossible to obtain a first-class buzzer which will maintain its note and adjustment constant, and secondly, it is very difficult to muffle the buzzer in such a way that we only hear its note as a true wireless note in our receiver. Heterodyne wavemeters, on the other hand, are not audible on ordinary receivers, except when these latter are oscillating—a most undesirable state of affairs. The only exception to this statement is when we are receiving continuous wave signals with which the oscillations of the heterodyne wavemeter can combine to give a musical note. A heterodyne wavemeter will pick up the carrier wave of a broadcasting station, and we shall then get in the 'phones exactly the same effect as if our own receiver were oscillating. Such a wavemeter is of no use in those cases where we are desirous of setting our receiver to a broadcast station adjustment before the carrier wave starts.

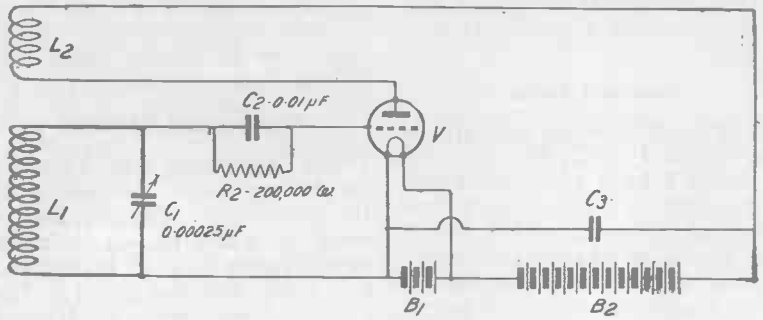


Fig. 4.—The Buzzerdyne circuit. The coils L1 and L2 are those of a plug-in transformer.

Combining the Virtues of Both Instruments

I have been experimenting lately to see whether it is possible practically to combine the advantages of both heterodyne and buzzer wavemeters, at the same time getting rid of the chief disadvantages of each.

The circuit connected to an oscillating valve can be kept very constant and is silent in operation so far as mechanical noises are concerned. If the current in a heterodyne circuit could be broken up or modulated at audio-frequency, so as to give the effect of a buzzer in the 'phones without the use of this mechanical device, we should get what we require.

Fig. 3 shows an interesting arrangement which I have used lately, but which, at the moment, is not sufficiently reliable to be recommended for general use, although it has a number of possibilities.

It consists of a closed oscillating circuit L1 C1 connected to a valve, in the plate circuit of which is the inductance L2 tightly coupled to L1 so as to set up continuous oscillations. Between the lower side of the condenser C1 and the filament is interposed the secondary of an ordinary audio-frequency transformer shunted by a fixed condenser which may have a value of .0003 μF or more. In series with the reaction coil is placed the primary of this transformer, also shunted by a condenser of about the value named. We thus have two effects in the same circuit; high-frequency oscillations are set up in the circuit L1 C1, the shunting condenser across the secondary of the transformer by-passing these quite easily; we also have a low-frequency circuit capable of oscillating owing to the tight coupling between the primary and the secondary of the intervalve transformer, the result being that the high-frequency currents are modulated at audio-frequency by these low-frequency oscillations.

In order to get the best from this arrangement the audio-frequency circuit should be tuned to the note we want, but in practice I have found that the circuit given operates fairly well without any special tuning. The note, however, varies with different transformers, battery voltages, etc., and at present the circuit is only in an experimental form.

The Fig. 4 circuit shows another method of obtaining audio-frequency modulations of the high-frequency current. We

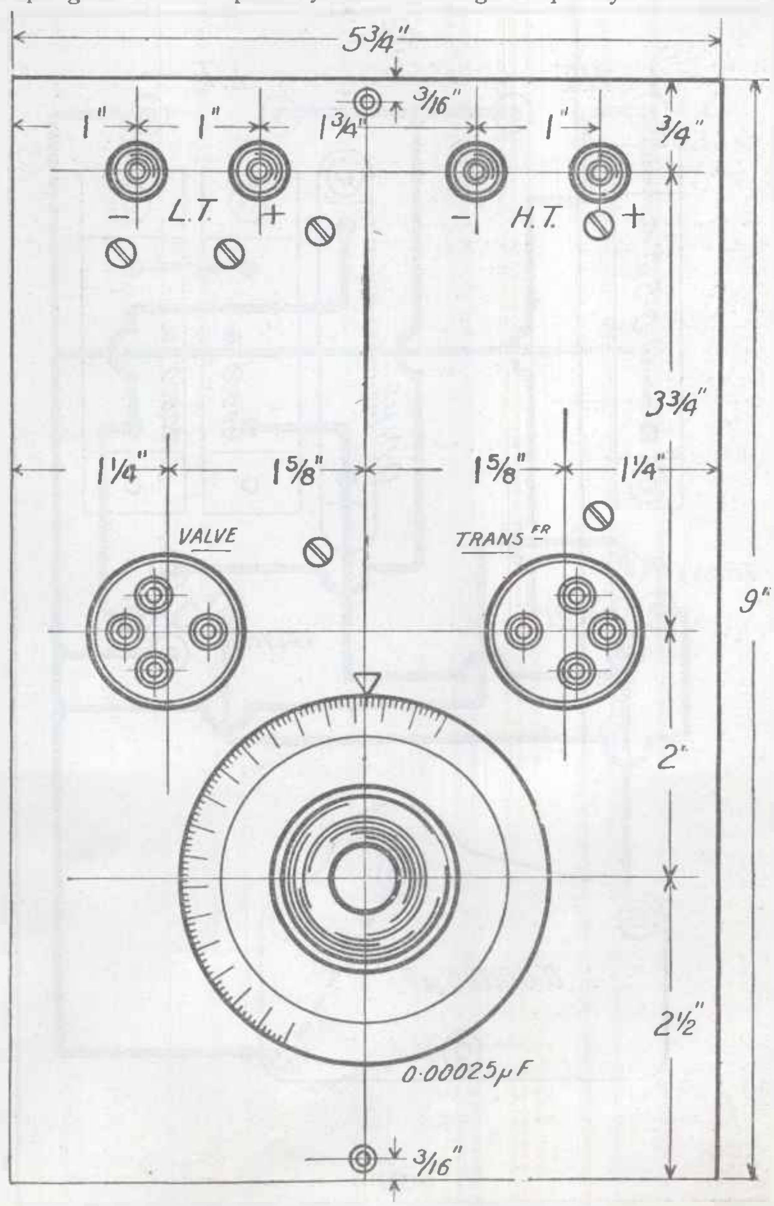


Fig. 5.—Drilling plan of the panel.

here have an oscillating circuit as before, with a grid condenser and leak of values quite different from those used in ordinary receivers. The circuit is not new and was already known when Mr. Scott-Taggart published his book, "Thermionic Tubes in Radio Telegraphy and Telephony" in 1921. In this circuit, when the valve starts to oscillate, a negative charge builds up on the grid until the valve ceases to oscillate. The charge will then leak off the grid through the leak, and the valve will start to oscillate once more. If the values of gridleak and condenser are correctly chosen (in the instrument about to be described I have used 200,000 ohms as the leak, and .01 microfarad as the condenser) a musical note is obtained which is of remarkable constancy and considerable strength.

Practical Form

The wavemeter on this principle, which I shall describe and to which I have given the name "Buzzerdyne," has one or two novelties of construction which will appeal to the experimenter.

First of all, it is possible to cover a very wide range of wavelength without winding special coils, as for the inductances L1 and L2 I have used the primary and secondary of the popular plug-in transformers which, as readers know, can be obtained to cover a wide band of wavelengths. A square law condenser is used, and every part of the apparatus is readily obtainable by any experimenter.

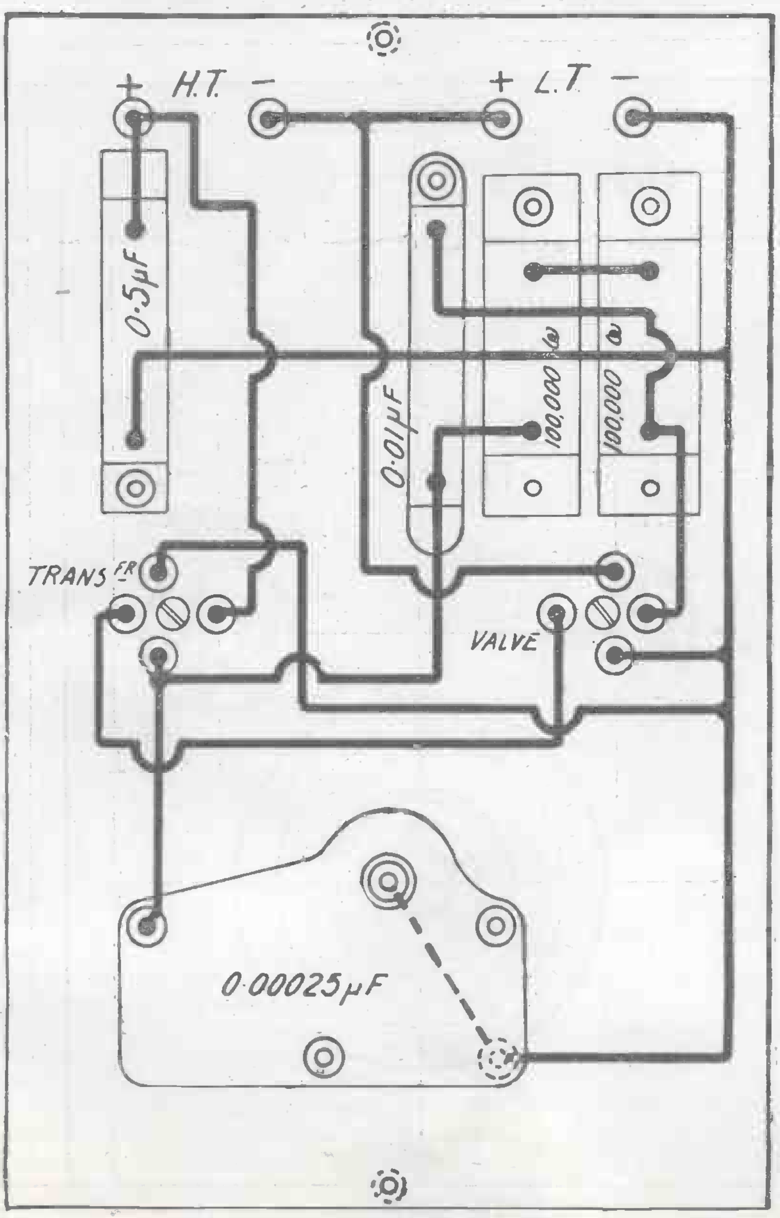


Fig. 6.—Practical wiring diagram.

Components Required

The instrument can be made up on any panel convenient to the constructor. My own instrument is made up on a panel measuring 9 in. × $5\frac{3}{4}$ in. × $\frac{1}{4}$ in., this being the size that has frequently been used in *Modern Wireless* and *Wireless Weekly*. The following are the components needed:—

Panel, of dimensions above given.

Suitable box.

One variable condenser .00025 μF (Sterling square law); a .0003 would do equally well here.

One Mansbridge condenser, .5 or 1 microfarad.

Two 100,000-ohm resistances (any of the standard 100,000-ohm resistances will do here).

One fixed condenser, .01 microfarad. (I have used a Dubilier, but a Mansbridge would do.)

Four terminals.

Two valve sockets.

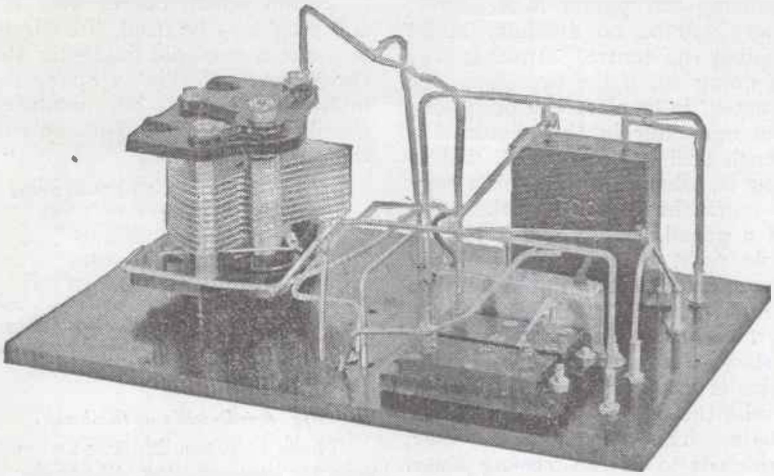
Square section wire for joining up.

Plug-in transformers for the wavelength ranges required. (That shown is a Peto-Scott. I have actually used in this instrument McMichaels', Bowyer-Lowe's, Gent's and Peto-Scott's.)

Suitable Valves

It will be noticed that no filament resistance is used. The reason for this is that in any wavemeter using a valve, a variation of filament resistance will upset the calibration. If a .06 ampere valve is used, then two dry cells connected across the L.T. terminal will suffice. If a bright emitter is used of the 4-volt type, then we need only connect a 4-volt accumulator across the terminals. It will thus be seen that in neither case is the filament resistance necessary here.

The high-tension battery need not be of large voltage. The actual voltage used will depend upon the valves you have; the instrument shown, using any of the well-known .06 ampere valves, oscillates readily with about 20 volts on the plate. Increasing the voltage does not appreciably upset the calibration of broadcast wavelengths, but considerably increases the intensity of the sound heard.



The underside of panel is very simply laid out.

Construction

The construction is so simple that an examination of the photographs and diagrams is all that is necessary. It will be noticed that the two 100,000-ohm resistances are in series to give the 200,000 ohms, and that the Mansbridge condenser is shunted across both H.T. and L.T. batteries.

Calibration

Calibration of the instrument can be carried out by one of the methods already described, and will depend on the size of a plug-in transformer and the value of the variable condenser used.

□ □ □

A Midget Variable Condenser

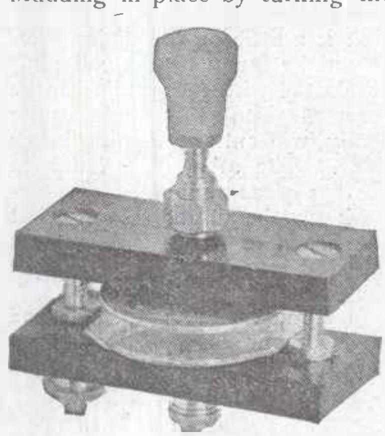
By R. W. HALLOWS, M.A., Staff Editor.

WHEN one is making up a large set containing three or four tuned circuits, one has plenty to do to find room for ordinary variable condensers, and if at any later time it is desired to add vernier condensers in parallel with any of them the problem becomes rather difficult. Here is a handy little condenser very easily made up, which has an overall depth below the panel of $1\frac{1}{4}$ in., a width of $1\frac{1}{4}$ in. and a length of $2\frac{1}{8}$ in. If it is carefully constructed it will have a maximum capacity that is adequate for all ordinary work when wired in parallel with the main condenser, whilst its minimum capacity is so small that it is practically negligible.

The materials required are two pieces of $\frac{1}{4}$-in. ebonite, $2\frac{1}{8}$ in. long by 1 in. wide, one flush fitting coil plug, two 4 B.A. screws $1\frac{1}{4}$ in. in length, seven 4 B.A. nuts, a short piece of 4 B.A. studding, a small piece of thin ruby mica, an insulating knob, such as is used for wander plugs, and two metal discs $1\frac{1}{8}$ in. in diameter. Flush-mounting coil plugs and sockets are obtainable from advertisers in *Wireless Weekly* at eightpence per pair, though only the plug portion is required for making this condenser. It may be noticed that the metal discs are just the diameter of pennies, and these coins would be most handy for the purpose if it were not against the law of the land to deface them. One can, however, always obtain foreign copper coins of about the same size, and these will answer excellently.

The first process is to grind one surface of each coin quite smooth and flat, care being taken to choose coins which have not been bent in any way. The rubbing down can be done surprisingly quickly with the help of a sheet of medium emery cloth. This is laid flat on the table and the coin is moved to and fro on it with the fingers. The final polish is given with a sheet of very fine emery cloth. We next have to drill and tap a 4 B.A. hole in the centre of each disc. If the constructor is the fortunate possessor of a lathe he will have no difficulty in finding the centres, but the job can be done quite well without the help of a lathe. Lay one of the discs on the table and pass a footrule over its surface until the point at which it is widest is found. Scribe a line here and then measure carefully to see that you actually have found the widest part, which will give you the diameter. Having made sure of this, bisect the scribed line and the point marked will be the centre. Mark the centre with a punch and drill with a No. 34 drill, afterwards tapping carefully. Treat both discs in the same way.

Into the hole in one disc insert a piece of 4 B.A. studding, $\frac{3}{4}$ in. long. Screw this in until it projects very slightly beyond the rubbed down surface. Lock the studding in place by turning the



A photograph of the condenser made up as described.

nut hard down against the unground surface of the disc, and rivet over the projecting point of the studding with a small round-ended hammer. Then rub down the surface again so that the riveted portion of the studding does not project beyond it. The disc in which the $\frac{3}{4}$-in. length of studding is fastened will form the fixed plate of the condenser. Into the other disc, which will form the moving plate, a piece of studding, $1\frac{3}{8}$ in. in length, is fixed in the same way. Take care to see that both pieces of studding are perfectly straight. We complete the fixed plate by shellacing to its polished surface a piece of thin ruby mica, which should be allowed to project over its edge for about 1/16 in. all round. Use very thin shellac for the purpose, and when the mica has been

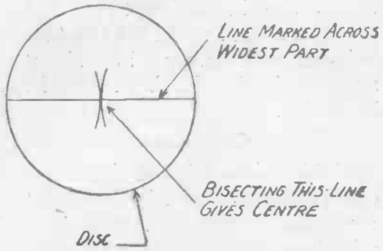


Fig. 1.—Indicating method of finding the centre.

applied, let it dry for several hours under pressure.

Fig. 3 shows the lay-out of the ebonite top and bottom pieces. These should be drilled together, great care being taken to see that the holes are vertical. All three holes should be made 4 B.A. clearance (No. 26 drill) in the first instance. We now put a No. 1 drill through the middle hole in the top piece and countersink it a little on the under side. It will be found that a coil plug lubricated with turpentine can be screwed into this hole quite firmly, without any tapping being done. The other two holes in the top piece should be countersunk on the upper side so that the heads of the 4 B.A. screws inserted into them lie flush with the ebonite.

We must now adapt the coil plug for our purpose by making it into a threaded bush. This is

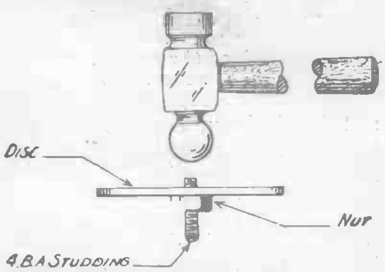


Fig. 2.—How the riveting is done.

a job which requires a little care, though it is by no means so difficult as might appear at first sight. Place the plug in a vice with the prongs downwards and find the centre of its base. This can be done with considerable accuracy by anyone who has anything like a true eye. Make a punch mark here. If a self-centring-bell punch is available, there will be no difficulty about finding the centre. Another way of doing so, if the eye cannot be trusted, is to place the prongs of the coil plug in the chuck of a bench drill or breast drill, and to spin it, when it will be fairly easy to mark the centre with the point of a pencil. Now drill a No. 34 hole right through the body of the plug and tap this carefully. The bush so made should be screwed into the top piece from below. A short piece of bare wire is soldered to it in order to make the contact for the moving plate. The spindle of the disc, which is to be the moving plate, is now screwed through the bush, and a knob is placed upon its end, being locked in position with a nut. We next turn to the other end piece upon which the fixed plate will be mounted. We remove the nut from the piece of 4 B.A. studding fixed to the

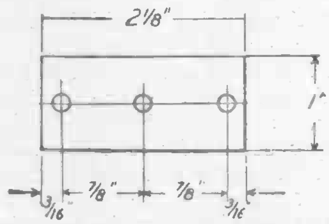


Fig. 3.—The layout of the top and bottom ebonite pieces.

second disc, pass the studding through the middle hole of the lower plate, and then fix firmly with a nut.

We are now ready to assemble the condenser in the way shown in Fig. 5. The long screws are inserted into the top plate and secured by nuts below it. Another nut is run on to each, and the ends are inserted through the holes in the bottom plate. The moving disc is turned right down and the bottom plate is adjusted by means of the nuts above and below it until the surfaces of the two discs are parallel with one another. The wire soldered to the screwed bush is fixed to one of the long screws either by soldering it or by placing it under the nut below the top plate. The end of this screw, and that of the piece of 4 B.A. studding which is secured to the fixed disc, form the contacts of the condenser. The necessary connections may be soldered to them, or each may be provided with a milled nut from a 4 B.A. terminal. The large nut which comes with the coil plug may be used, if desired, to make a one-hole fixing for the condenser. If this is done, the instrument can be mounted simply by making a $\frac{1}{4}$-in. hole in the panel of the set.

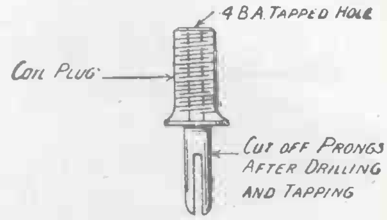


Fig. 4.—Details of the back.

These little condensers are very handy indeed for "vernier" work, since the capacity can be adjusted to a nicety, owing to the fine pitch of the 4 B.A. screw which turns down the moving plate. Even with ordinary care a condenser can be made which will suffice, not only for vernier adjustments, but also for providing the necessary capacity in the Cowper variation of the tuned anode circuit. The writer uses two of these small condensers for the

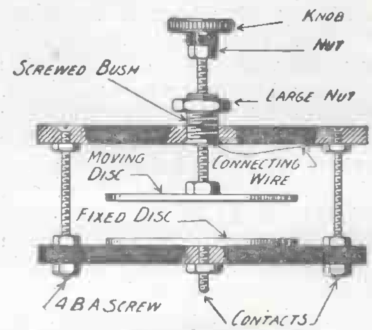


Fig. 5.—The assembly of the condenser.

purpose and finds them very satisfactory. The mica cover on the fixed plate serves a double purpose. It increases the maximum capacity when the plates are close together, since mica has a dielectric co-efficient about eight times greater than that of air. It also acts as an efficient insulator, making it impossible for a short circuit to take place through the touching of the plates. This is especially important in the Cowper circuit, where the small variable condenser is placed across the combined high- and low-tension batteries.

R. W. H.

And the next, please ?

We come now to one of the most vital of the components of our receiving set, the

The word rheostat (said he, showing his intimate knowledge of the classics) is derived from two Greek verbs, one meaning "I flow" and the other "I place." The full significance of the word thus becomes at once apparent, even to the meanest intelligence. How happy science always is in fitting appropriate names to its bits and pieces! The purpose of this neat little instrument is to enable you to close down quickly whenever the more boring type of lecturer gets to work at the broadcasting station. "I propose," says he, "to tell you something of my researches into the great problem of the stalagmite. . . ." Not knowing the difference between a stalagmite and a cheese mite, and not desiring further information upon the subject, one merely seizes the knob of the rheostat, and, with a deft flick of the wrist, silences the speaker. It is, of course, also used for regulating the potential of the filament, but this is merely what we may call a secondary duty; its main function is to act as a bore-extinguisher.

All about it

As I am feeling in a highly original mood whilst I write this, I cannot refrain from remarking brightly that there are rheostats *and* rheostats. Other people have said that before? Possibly, possibly; but I am sure they did not say it half as well as I do or with nearly so much feeling. Having on many occasions been driven to the verge of insanity by *and* rheostats, I can claim to be quite an authority on the subject. My collection was at one time unique, containing, as it did, rheostats that would not turn on the current, rheostats that turned it on in jumps and jerks; rheostats with resistances that did not resist, rheostats with loose arms, rheostats whose knobs went round whilst the arms stayed still, and, in fact, every form of wireless frightfulness that can be compressed into the narrow compass of the filament resistance. I no longer possess these since I have found them most useful for unmaking friends. There are times when one realises that one has too many friends.

The Little Visitors

They come in, they take up your time, they smoke your cigarettes, they scatter the ash upon the carpet (and *you* catch it from the missis next morning), they drink your whisky, they use your spare wireless components as if they were their own; they are, in a word, little better than a swarm of locusts, for they descend upon you and clean you out. It is as well every now and then to go through your list of friends, and to decide which of them are superfluous. You can then rid yourself of them easily by presenting each of the unwanted ones with *and* rheostats of various types, having previously assured the recipients that they are the very last word in efficiency. Thanks to my unique collection of *and* rheostats, I have been able to weed out some of the worst of friends who clung more closely than a brother.

Making the Rheostat

If you are one of those peculiar people who like to give themselves a lot of trouble—and there are such—you may, of course, make the rheostat for yourself. The ingredients required are a chunk of ebonite, a knob, a strip of brass, a length of No. 30 S.W.G. Eureka, a lot of patience, and a good vocabulary. Provided with these, you will be able to turn out quite a decent selection of *and* rheostats if you really knuckle down to your work. Never make more of these than you have undesirable friends, for they take up a great deal of space even in the scrap-box. When you have quite satisfied yourself that the making of rheostats is a simple job, and if you are quite sure that you cannot borrow a real one from any unsuspecting friend, the best tip is to reduce the weekly housekeeping cheque by five shillings and to go out and buy one with the profit on the transaction. Don't be put off with inferior goods. Mention my name and tell the fellow behind the counter that you don't want one like the last one he worked off on me.

Other Components

We come next to the

which, in case you fail to recognise them, are the terminals. The greatest care should be taken not to order terminals from an American firm, or dreadful results may ensue. Over there they call them binding posts, and the word terminal has quite a different signification. I know a man who once ordered a dozen terminals from a Chicago firm, and received an invoice running into millions of dollars for twelve complete railway stations. As I have never yet found use for a railway station in the wireless set, I cannot advise you to follow in this foolish fellow's footsteps. There are terminals *and* . . . . I beg your pardon, I do not think that I will use that again. What I mean is that some terminals are far better than others. The essential idea of a terminal is that it should enable you to make or unmake connections quickly. Professor Goop has produced appalling figures showing the quarts of midnight oil burned by inventors in their attempts to design convenient terminals which enable you to make connections so quickly and so easily that you hardly realise that you are doing it. I suppose that I am conservative, but I must say that my own preference is for something that just screws down after you have got the wire in place. I don't like those things like miniature rat-traps which grab the wire in a close embrace before you have had time to realise that in a moment of muddy-mindedness you have been so unfortunate as to connect H.T. plus to L.T. minus. In wireless all kinds of things can happen in a fraction of a second, which I, personally, cannot afford, though, being a journalist, my income is, of course, a princely one.

Acquiring Terminals

My advice to those who wish to provide themselves with terminals is that they should betake themselves to a nearby wireless shop, where the salesman should be treated as a man and a brother. Open your heart to him; ask him to befriend you. Tell him that though your first order is small you are about to become one of his biggest customers. Then request him to supply you with six really good terminals, and choose the simplest that he produces for your inspection. Place these in your waistcoat pocket and go home. On your return you can get the missus to help you to extract five of them from the lining of the waistcoat into which they have strayed through a hole whose presence you had not suspected. The remaining one has, of course, disappeared altogether, and this you write off as loss. You must, however, remember that if it had not been for the erring and straying of the terminals you would never have discovered the hole in your waistcoat pocket, which might have cost you a small fortune had you been in the habit of using this pocket as a receptacle for coins.

The Great Ebonite Question

The next component required is a piece of

EBONITE ↗

measuring 6 inches by 9 inches. There is, of course, ebonite *and* . . . . Aha! I think I had you that time. You thought I was going to say ebonite *and* ebonite. Well, I was not. What I was (and am) going to write is ebonite *and* mud. Mud is still obtainable in a great number of wireless shops. It can be distinguished by its beautiful glossy surface, and by the fact that quite a small piece weighs pounds and pounds and pounds. You see, ebonite is sold by weight, and there are all kinds of cheap things which may be mixed in to help to tip the scales a bit. Mud contains a variety of substances which are most useful, no doubt, in their own way, but are hardly worth 4s. 6d. per pound. This material is also very much appreciated by the elusive electron, which is like you and me (or me anyhow) in that it is never so happy as when it is avoiding work. Mud provides all kinds of little short cuts for the electron, which is thus preserved from the indignity of having to pass through various gadgets where it would be compelled to work. There is an old proverb that says it is a bad thing to throw mud, but I have always found that it pays well to throw it, and throw very hard at the fellow who tries to push it on to you. Next week we will see the full circuit of the Goop-Wayfarer No. 761 as a two-valver.

WIRELESS WAYFARER.

How to use the "Wireless Weekly" Key Chart of Continental Broadcasting

The key chart on pages 518 and 519 of last week's issue forms not only a rapid means of ascertaining what broadcasting stations are working at any particular hour, but also acts as a guide to which station it is advisable to listen to first. The time line is divided into quarter-hour intervals. The spaces between vertical lines indicate the time occupied by the particular transmissions. Different stations are indicated by different heights, as shown by the names on the left. Thus at 5.0 p.m. (bottom line) Brussels and Geneva are working, and finish together at 6.0 p.m. At 5.30 p.m. Eiffel Tower and Berlin will commence, Eiffel Tower finishing first, Berlin closing down at 7.0 p.m.

WAVELENGTHS.

Eiffel Tower, FL	2,600m
Munich	486m
Voxhaus	430m / 500m
Lyons, YN	470m
Frankfurt	467m
Radio-Paris, SFR	1,780m
Breslau	415m
Nauen, POZ	2,800m
Ha ren, BAV	1,100m
Leipzic	452m
Stuttgart	437m
Radio-Belgique, SBR ...	262m
Geneva, HBI	1,100m
Ecole, Sup. des P. et T., PTT	385m
Lauzanne, HB2	800m
Madrid	408m
Konigswusterhausen, LP ...	2,800m
Ned. Radio Industries, PCGG	1,050m
Ned. Seintoestellen Fabr, NSF	1,050m
Heussen Laboratory, PCUU	1,050m
Smith and Hooghoudt, PA5	1,050m
Ned. Vereenigen van Rad. Tel., PCGG	1,050m
Middleraad, PCMM	1,050m
Petit Parisien	340m
Le Matin, SFR	1,780m

SERVICE DEPT. NOTICE.

Will readers kindly note that under the present congested conditions it is not possible to undertake the testing of sets during the owner's visit except in very unusual circumstances.
Readers are requested to label their sets with their own names and addresses, and to leave them with us for the normal period of about seven days, required for their testing in rotation.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

An Inverted ST100 Circuit

IN the ST100 circuit the order of operation is :—

1. The incoming oscillations are amplified.
2. The amplified oscillations are rectified by a crystal detector, the low-frequency currents being fed back into the grid circuit of the high-frequency amplifying valve.
3. The first valve proceeds to amplify the low-frequency currents.
4. The second valve acts simply as a low-frequency amplifier.

This order of the processes is intentional, but an alternative circuit similar to that in the accompanying figure may be arranged so as to get a variation of the order of the processes.

The new order is :—

1. The first valve acts as a high-frequency amplifier.
2. The amplified oscillations are applied to a crystal detector and the low-frequency currents applied to the grid circuit of the second valve.
3. The second valve acts as the first stage in the low-frequency amplification process.
4. The first valve acts as the second stage of low-frequency amplification, the amplified low-frequency currents appearing in the anode circuit of this valve.

From this it will be seen that the first valve now acts as the second stage of low-frequency amplification, and the second valve acts as the first stage, whereas in the ST100 the first valve acts as the first stage and the second valve as the second stage.

When using Small Valves

In general, to obtain the maximum output from small valves it is desirable to keep the potential variations on the grid within reasonable limit. In the case of the ST100 we have applied to the grid high-frequency potentials and also low-frequency potentials. These will add together at times and will result in a large portion of the anode current characteristic curve being covered.

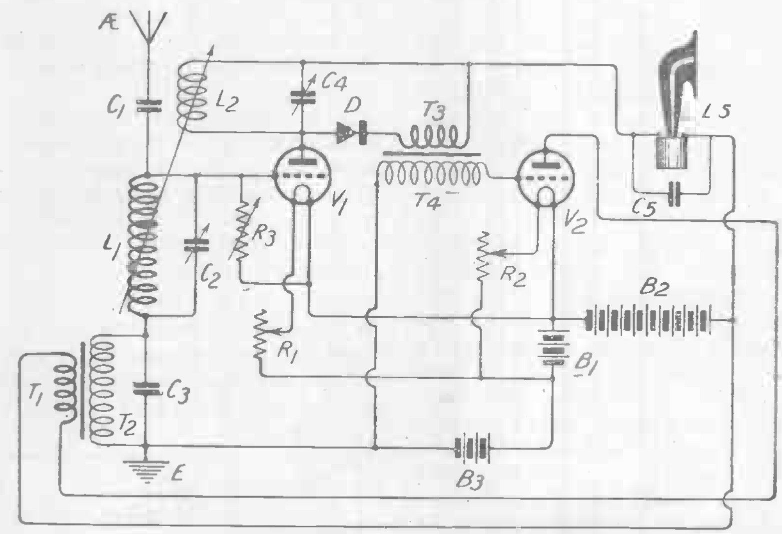


Fig. 1.—A form of circuit which compares favourably with the well-known ST100.

If the valve is unsuitable for the purpose, or the filament and anode voltages are not high enough, the combined potentials on the grid will be sufficiently great to cause distortion through the representative point travelling round the bends.

The Action of the Circuit

In the circuit given here it will be seen that the low-frequency currents applied to the grid of the first valve are larger than ever, having undergone amplification by the second valve. These low-frequency potentials, combining with the high-frequency potentials due to the incoming signals, will result in the grid potential variations covering a wide range, and unless an adequately sized valve is employed in the first stage, distortion may result, with the alternative of keeping the signals weaker and getting purer results.

Assuming that adequately sized valves are used there should be no real difference in signal strength between this circuit and the ST100, but on the whole I think that the latter circuit will find great favour. At the same time I have known cases where the present circuit has given better results. Grid bias, it will be noticed, is given to both grids by means of the battery B_3.

OUR NEXT ISSUE

How to Build a Three-Valve Receiver with Resistance-Coupled L.F. Amplification.

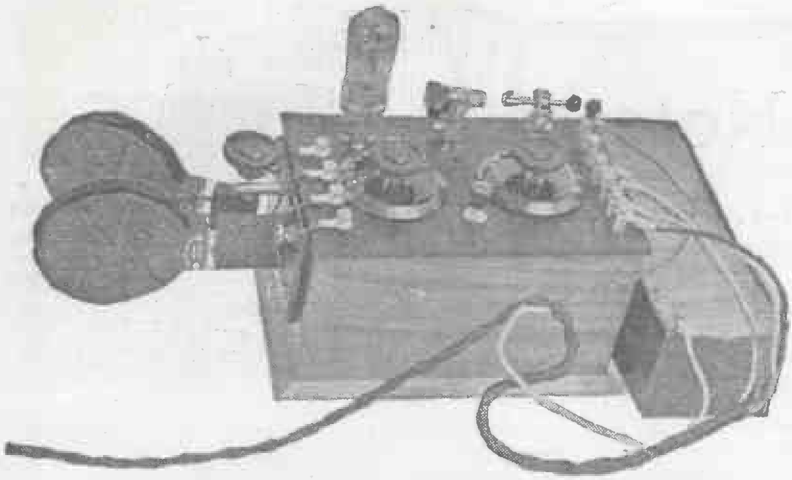


Fig. 1.—A simple and efficient receiver using one valve and a crystal detector.

AN H.F. CRYSTAL RECEIVER WITH REACTION

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

THOUGH the straight circuit arrangement of a high-frequency valve and crystal detector has been incorporated in other receivers described in these pages, the method whereby the combination is arrived at in the present case is unusual, in that, unlike most receivers previously described, reaction is obtained.

On account of the sensitiveness of the circuit and its economy in the number of valves employed, this receiver will be found very useful to those who do not desire to go to the expense of a two- or three-valve set, or who, on account of local conditions preventing the erection of an outside aerial, are dissatisfied with the results obtained upon an indoor arrangement with a crystal set.

Tested on an indoor aerial in S.E. London the receiver, as illustrated, gave excellent results on London, Birmingham, Bournemouth and Chelmsford; a record which justifies the work entailed in the construction of such a set.

A glance at the circuit diagram will show that the arrangement is perfectly straightforward, the only difference from the more usual practice being that the anode coil is coupled to the aerial coil in order to obtain a reaction effect.

The simplicity of the receiver will be seen from the first photograph, which shows the set ready for use, the terminal arrangements being, on the top left and, reading downwards, aerial, earth and two reaction terminals; on the right, reading from the top, the two telephone terminals, H.T. positive, H.T. negative, L.T. positive, L.T. negative.

A photograph of the underside of the panel will demonstrate as no words can, the simple wiring the constructor is called upon to perform.

The make-up of the receiver is compact, yet leaving sufficient room for the easy access to components with the soldering iron; a point which the beginner in constructional work will find particularly valuable.

The Circuit

The circuit arrangement of the receiver is, as shown in the circuit diagram, made up with one valve and a crystal detector,

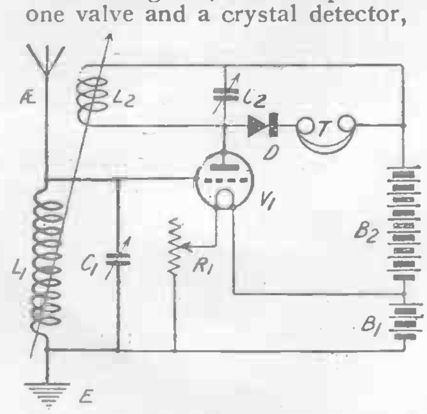


Fig. 2.—The theoretical circuit arrangement.

no dual amplification being employed. The coils L1 and L2 are ordinary plug-in coils, which may be any of the well-known makes. The coil L1 is shunted by a variable condenser of 0.0005 μF, whilst the coil L2 is shunted by a similar condenser, but of 0.0003 μF value. D is the crystal detector and V1 the valve which acts as a high-frequency amplifier.

The coils L1 and L2 are mounted in an ordinary two-coil holder, and by varying the amount of coupling between these two coils reaction can be obtained if desired.

Components and Materials

Those readers whose intention it is to construct this receiver will find below a complete list of components, together with the names of their manufacturers.

This latter information is given not as a condition which must be complied with, but merely to be of assistance to those who may desire the information. In actual fact, any components may be used, subject to the correct values being employed, though it is recommended that component parts of good manufacture be chosen. Cheap condensers of unknown make, for instance, are more often than not well below their stated value, and one of these used in a receiver of this, or any other kind, will not give the wavelength range the receiver is said to cover by the author, with resultant disappointment to the constructor.

One ebonite panel, measuring 9 in. by $5\frac{3}{4}$ in. by $\frac{1}{4}$ in.

One Lissenstat minor.

One crystal detector (that illustrated is a "Kupee" model).

One variable condenser of 0.0005 μF capacity (Bowyer Lowe Co.).

One similar condenser of 0.0003 μF capacity.

One valve holder or alternatively four sockets.

One two-coil holder (Radio Instruments).

Ten brass terminals.

One set of coils for the wavelengths required (see table).

Quantity of connecting wire.

One pair 2,000 or 4,000 ohms telephones.

One containing box measuring 9 in. by $5\frac{3}{4}$ in. by $5\frac{1}{2}$ in. deep.

In the following article is described a useful receiver which will appeal to flat dwellers and users of indoor aerials.

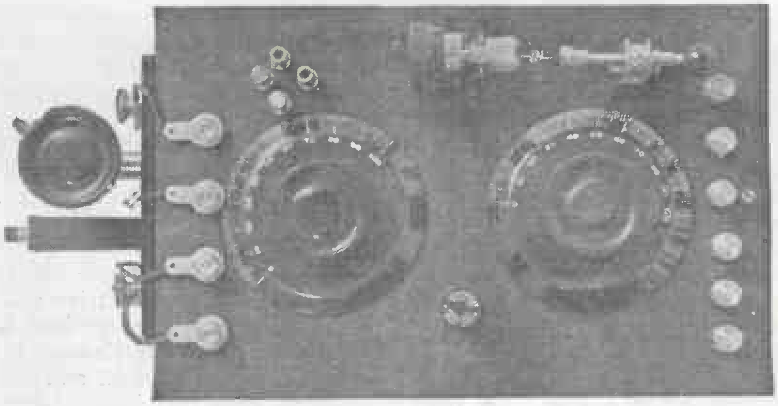


Fig. 4.—A plan view of the panel.

The Panel

This is made from the ebonite sheet referred to in the list of components, and is drilled in accordance with the instructions given in the illustration of the panel layout. After the various drill holes have been made for both components and terminals the usual precaution of removing the surface skin should be taken.

It may interest readers to know that there are now on the market certain makes of ebonite which the suppliers guarantee to be free from surface leakage, and which have also the additional attraction of being finished with a glazed surface. These ebonites, though perhaps given a little to showing scratches, add considerably to the appearance of the receiver, and, further, dispense with the tedious necessity of treating the panel with a vigorous rubbing of emery paper before that element of safety is reached with the non-guaranteed material.

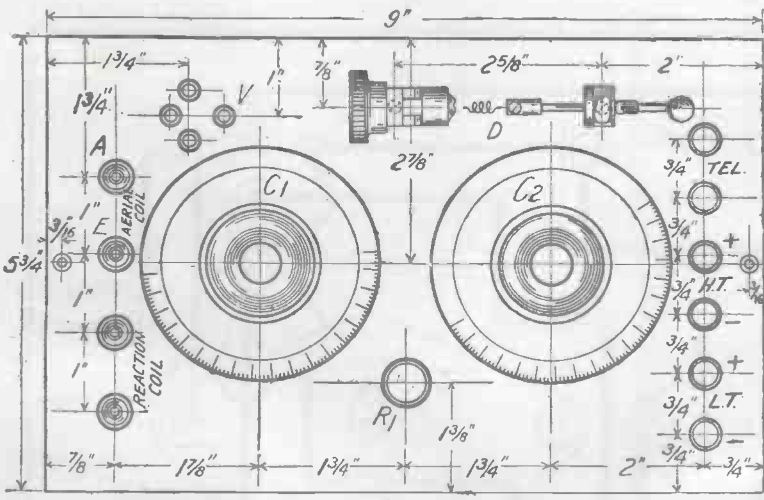


Fig. 3.—The layout of the panel, indicating positions of components and purposes served by the terminals. Blue print No. 60a.

Mounting the Components

The positions of the various component parts and terminals may be gathered from both the photograph showing the underside of the panel and the layout showing drilling dimensions.

The two-coil holder, it will be seen, is mounted on the side of the box, the connections from this to the panel being made on the outside. It may suggest itself to readers that these connections may be carried through the side of the box, and in cases where this is done the holes through which the connections are to be taken should be well spaced and should also be bushed with ebonite, as any leakage from these connections to the wood of the box will have a very detrimental effect upon the efficiency of the high-frequency valve.

Wiring the Receiver

The connecting-up of the components is carried out in compliance with the practical wiring diagram illustrated, and is best done with stiff wire used without insulating sleeving. The reason for this is that the capacity afforded by systoflex may play a very important part in affecting the efficiency of the high-frequency valve. For the best results all leads should be well spaced and kept as short as circumstances will permit, all connections being made by solder instead of between nuts.

The connections to the two-coil holder should be kept reasonably long before finally completing the construction of this receiver, for it may be found necessary to change these about before finding the correct way round of those leads which go to the fixed coil.

Operating the Receiver

With the receiver completed insert suitable coils from the list given with the smaller coil in the moving coil socket; connect the L.T. terminals to an accumulator suitable for the valves chosen, first turning the filament resistance to the off position. Place a valve in the socket provided and turn on the filament resistance very slowly; if the valve lights with a brilliance consistent with the position of the filament resistance then the current should be turned off and the H.T. battery connected, using about 50-60 volts.

If in this test the valve does not light, or if the resistance does not give control, then the wiring is wrong, and should be checked with the wiring diagram.

Assuming everything to be correct so far, and the H.T. battery connected, turn the two coils in the coil-holder at right angles, turn on the filament current and adjust the crystal for the most sensitive spot. At this stage the tuning of the set is effected by turning the two condensers simultaneously until the best results are obtained; if no signals are heard at all the two connections to the bottom left-hand terminals marked "reaction" in the panel layout should be reversed and the operation of tuning again gone through, still keeping the two coils at right angles to each other.

Obtaining Reaction

With signals tuned to their loudest volume the moving coil may now be brought, very slowly, nearer to the fixed coil, at the same time slightly retuning with the two condensers. With the best results obtained in this way, the moving coil may again be brought nearer to the fixed, again retuning with the condensers, taking care meanwhile that the set does not oscillate; in the event of oscillation the best remedy is to move the moving coil a little away from the fixed coil and make condenser-tuning once more.

In connection with the adjustment of reaction, it must be borne in mind that any alteration in the positions of the two coils in relation to one another will affect the tuning of the set and must be remedied by further adjustments of the two condensers; these same remarks also apply to the adjustment of the crystal detector, tuning again being made upon the condensers.

Valves

In testing this receiver valves of various makes were tried with equal success. The receiver is fitted with a suitable filament resistance for both bright and dull emitters, thus permitting, where required, the use of dry cells with a low filament consumption valve, making, therefore, a truly economical receiver. So far as H.T. voltage is concerned, this must, of course, vary with the type of valve chosen, but in most cases the usual 60-volt tapped battery will be found to fulfil all requirements.

Reception of B.B.C. Stations

For the reception of the B.B.C. stations the following table of coil sizes will be found useful, though in the case of indoor aerials the actual sizes, for the best results may vary somewhat, there being too many unknown quantities to give a correct prediction.

OUTSIDE AERIAL

Wavelength	Aerial Coil Socket	Anode Coil Socket
300-400m.	35 or 50	50 or 75
400-500m.	50 or 75	75
1,600m.	150	200 or 250

INDOOR AERIAL

Wavelength	Aerial Coil Socket	Anode Coil Socket
300-400 m.	50 or 75	50 or 75
400-500 m.	75	75
1,600 m.	150 or 200	200 or 250

Continental Broadcasting

In cases where this little set is connected to a good outside aerial and conditions are favourable the reception of Radio-Paris is quite possible using the same coils as in the case of Chelmsford.

The tuning of this station will, of course, be somewhat critical in the adjustment of reaction, but with patience little difficulty will be experienced. For the reception of the Eiffel Tower Time Signals, coil No. 250 should be used in the aerial or moving socket with No. 300 in the fixed socket. For the reception of these same signals upon an indoor aerial, the aerial coil will be one size larger than in the case of outdoor aerials, say No. 300.

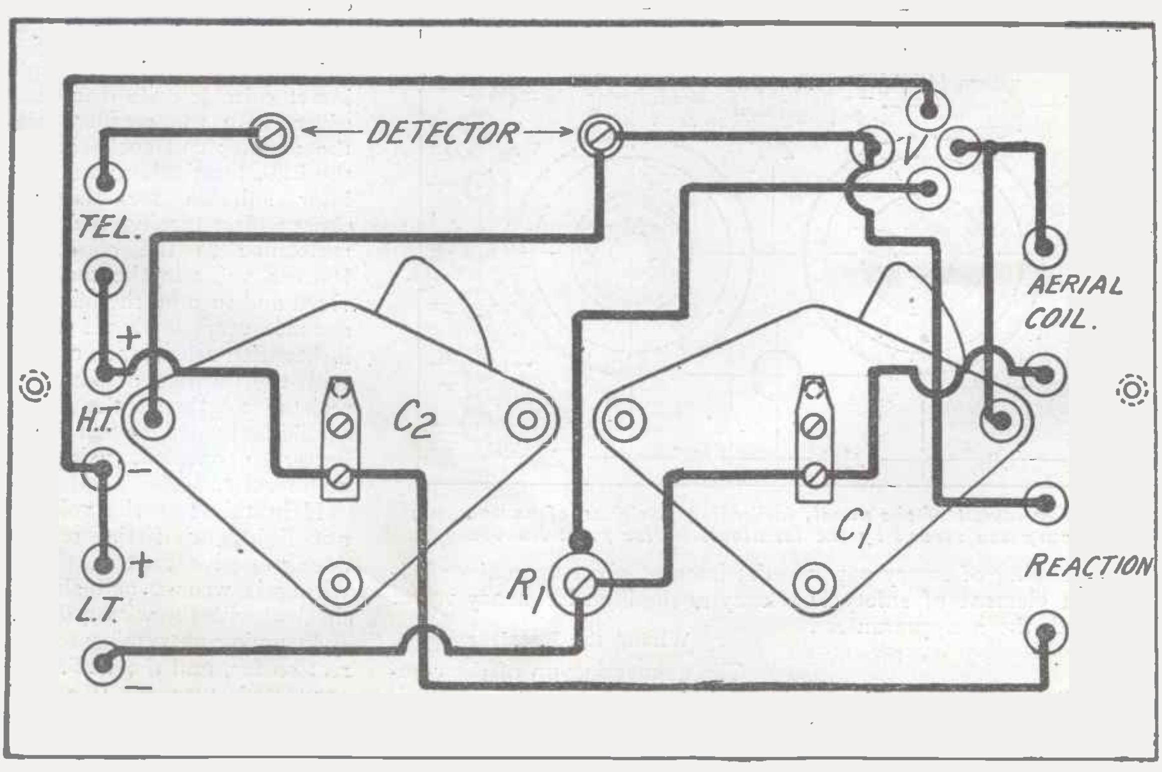


Fig. 5.—Practical back-of-panel wiring diagram. Blueprint No. 60b.

Test Report

On completion and undergoing test, the receiver as illustrated gave good loud signals from 2LO upon an indoor aerial situated in S.E. London; Chelmsford was loud and as easily tuned as the local station. Birmingham and Bournemouth were also received at good telephone strength, the tuning of these stations being a little more critical.

When connected to an outdoor aerial in S.W. London, fair signals from Radio-Paris were also received, tuning being sharp and the adjustment of reaction particularly fine and sensitive.

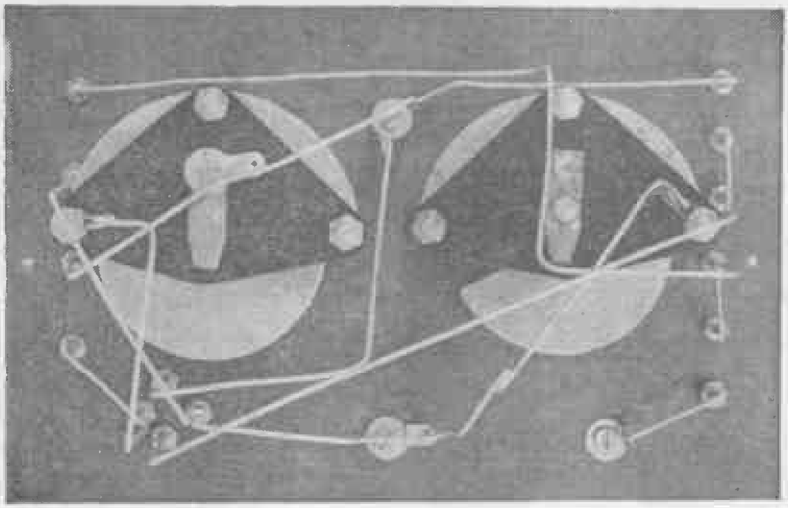


Fig. 6.—A plan view of the underside of the panel showing the wiring

In the hands of another member of the Radio Press staff this receiver also received Madrid.

With the ordinary connections, as when using both H.F. valve and crystal, quite good signals may be received from the local station by merely turning out the filament of the H.F. valve, using the crystal alone, though, of course, signals are very much weaker.

Using the set in this manner, the operation of varying the positions of the coils in relation to one another should be tried, and final tuning made with the two condensers.

By disconnecting the aerial and earth from their respective terminals, and connecting the aerial to the top terminal of the two reaction terminals and the earth to the lower one, the set becomes an ordinary crystal receiver. When using the set in this fashion the coil in the moving socket should be removed and the filament resistance turned to the off position.

The coils for this arrangement should be found by experiment. Tuning with these connections is made by means of the condenser C2, the aerial coil being used in the fixed coil socket.

□ □ □

Some Readers' Letters

APPRECIATION

SIR,—I have read with great interest your readers' accounts of the ST100 circuit and the "Omni Circuit" receiver, but so far I have not seen any concerning this circuit with the addition of the extra H.F. valve in use, as given by you in a recent number. I am hoping the following will prove of interest to your readers and your good selves. I have wired this circuit on the Omni receiver built from your instructions. The set is installed about three miles south of Reigate, and has I think ideal conditions for working. The aerial is 40 ft. high (actual) and a little over 100 ft. long, situated in an open meadow. The receiver is standard with the exception of an extra valve wired permanently as an L.F. amplifier, and can be switched on to any circuit as required. The three condensers are Lissen .001 with a small vernier condenser mounted on the cabinet, and there is potentiometer control on the first two valves, or all valves at will. This circuit will in day-time and *every* day bring in Bournemouth and Cardiff, Radio-Paris, at full L.S. strength, *i.e.*, 100 yds. away in the open (an amplion is used), Eiffel Tower, Hilvarsum and similar Dutch stations on 1050/70 metres come in at good strength, about 40 yds. range. At night all the main B.B.C. stations can be brought in from full to good L.S. strength, except Aberdeen and Manchester, which are always good 'phone or faint L.S. strength. We have frequently danced to music from Glasgow. Continental stations are too numerous to mention with regard to your valuable space. I can generally rely on hearing at fair L.S. strength Berlin, Vienna and another Austrian station about 510 metres, as well as Radio Iberica, Madrid. There are of course many evenings and sometimes days when atmospherics make things impossible from a musical point of view and reduce it to a scientific wonder. I have not mentioned London and 5XX. The result is somewhat like Wayfarer's friend's experience in a recent issue. On a frame aerial with 40-in. sides wound with seven turns of 22 d.c.c. London and Bournemouth and Petit Parisien (when playing) may be brought in at good L.S. strength, free of atmospherics. The frame is always used on bad nights. May I take this opportunity of congratulating you on your Service Department in Devereux Court, Strand? The other day I took the opportunity of calling with regard to a difficulty with the frame aerial, and was very much gratified with the way I was received and the "sympathetic" advice and interest given by your staff.

Wishing you and your sister journal continued success,—Yours truly,

R. H. S. BEVINGTON.

London, E.C.

THE PROOF OF THE PUDDING

SIR,—In No. 3 of the Radio Press Book Series I saw how to make broadcast receiver No. 3, but instead of using a 2½-in. diameter former, I used a 4-in. former, with the result that in twenty minutes I was hearing music very clearly from London relayed by 5XX, this station being about 20 miles from Leigh-on-Sea.—Yours faithfully,

H. S. MACLEAN.

Leigh-on-Sea.

A Handy Compound Condenser

A VERY useful instrument for the experimenter's bench is a variable condenser whose maximum capacity can be increased or decreased at will. For average use in the aerial circuit a condenser of about .001 μF is required; in the closed circuit about half this capacity is desirable, whilst something smaller again is best in tuned-anode or tuned transformer high-frequency circuits.

The device to be described consists of two condensers, one variable and one fixed each with a capacity of .0005 μF mounted together. By means of a two-arm selector switch and five stud contacts quite a number of different combinations can be obtained. The wiring diagram is seen in Fig. 1. When the switch arms rest upon studs 1 and 2 the two condensers are in series; hence the maximum capacity will be $\frac{C_1}{2}$ or .00025 μF. Studs 2 and 3 place the two condensers in parallel and provide a maximum capacity of C_1+C_2 or .001 μF. When the arms are upon studs 3 and 4 both condensers are cut out. Contact with studs 4 and 5 cuts out the fixed condenser, but leaves the variable condenser in circuit; hence the maximum capacity is .0005 μF. Actually the capacities obtained will not be quite the same as those that should be theoretically possible with the device, owing to the parasitic capacities which are bound to occur in the wire and in the switch; but it does provide in one and the same small cabinet small, medium and large capacities suitable for use as A.T.C., C.C.C. or anode-tuning condenser, and it is therefore useful as a bench instrument.

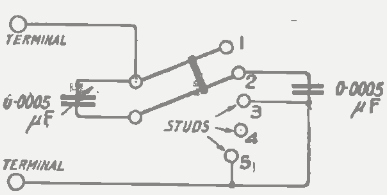


Fig. 1.—The connections.

Details of the switch are given in Figs. 2 and 3. An ebonite knob should be obtained which has a boss of rather large diameter. In this are cut two shallow grooves to take the laminated arms. The arms are made from two of three thicknesses of springy sheet metal. It will be noticed that one of them is long and the other short. The short arm is connected electrically to the spindle by means of a small strip of brass. The other makes contact at one end with the studs and at the other with a brass segment fixed by means of countersunk screws to the top of the panel. As the length of the arms will depend upon the space available upon the ebonite top of the cabinet (which again will depend upon the size of condensers used) actual dimensions are not given in the drawings.

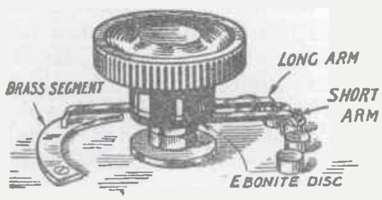


Fig. 2.—Details of the switch.

If the constructor lays the parts available out on a sheet of paper he will be able to see in a few moments how to arrange them most compactly, and he will know how much room is available for his switch. He is then recommended to lay out the drilling diagram full size upon a sheet of paper, which can afterwards be pasted on to the ebonite and used as a jig for the centre punch.

The arms are secured by means of a disc of ¼-inch ebonite with a 2B.A. clearance hole in it, which is clamped against the boss of the knob by means of a 2B.A. nut, and so holds them firmly together. An alternative method is to fix the arms directly to the boss by means of a couple of 6B.A. screws passing through each into the ebonite. To make the disc it is not necessary to have a lathe. A square piece of ebonite can be cut out first of all and drilled. It is then trimmed down roughly with a hacksaw to something like roundness. Afterwards it is clamped against the boss in a vice and filed into shape. Even this process may be omitted if desired, for there is no reason why the ebonite should not be left square. The 2B.A. spindle is passed through a bush in the panel and fitted in the ordinary way with spring washers and lock nuts.

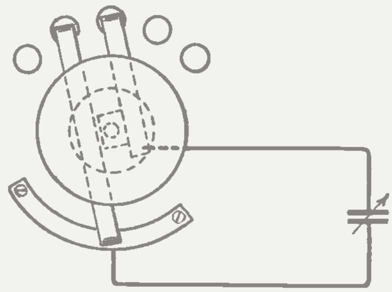


Fig. 3.—Showing how the two arms of the switch are connected.

To make the action of the switch smooth dead studs should be placed between those which are actually required for the contacts. The live studs should be indicated by figures from 1 to 5, which may be put on to the panel with white enamel, or, better still, made with a figure punch.

The best way of making the brass contact segment is as follows—Mount the switch arms and the studs, then place a piece of stamp-edging on the panel so that the far end of the long arm passes over it during its travel. Hold a pencil against the end of this arm, and turn the knob from position 1 to position 4. The pencil will thus trace out the required curve, and if other curves are drawn ⅛ inch on either side of it a pattern will become automatically available for cutting out the segment from a piece of sheet brass. One contact of the variable condenser is made to the spindle of the switch, the other to the brass segment. The fixed condenser is connected to studs 2 and 3. Of the two terminals of the apparatus one is connected to the brass segment, whilst the other is wired to both studs 3 and 5.

R. W. H.

R.S.G.B.

The Autumn Presidential Address will be delivered at the Institute of Electrical Engineers on September 24th, at 6.0 p.m. The Transmitter and Relay Section will commence their new session on September 12th, at 6.30 p.m., when Mr. Marcuse will lecture upon his experiences in America and Canada. The meeting will be held at the Institute of Electrical Engineers.

The French Broadcasting Service

By Capt. L. F. PLUGGE, B.Sc., F.R.A.E.S., F.R.Met.S.

This well-known authority on Continental broadcasting describes the work and service of the French broadcasting stations.

THE Eiffel Tower was one of the first stations to broadcast, as it sent out daily time signals and weather reports in Morse on spark for general use. For some considerable time market prices on telephony have also been transmitted. A concert in the afternoon has also been sent out, but this was regarded by them merely as a test transmission. They were constantly experimenting; if transmission broke down they did not bother to warn people. At that time this station was run by the military authorities, and was merely a military experimental station. In fact, at one time, when they received a letter of complaint from a listener, they replied that the concerts were not meant to be listened to, but were merely for their own purposes, and therefore the public should be satisfied with whatever it got. However, within the last three or four months this station has been taken over by the Post Office, and the usual sentence which used to be given out, "Ici Poste Militaire de la Tour Eiffel," has been replaced by "Ici Poste Radiotelephonique de la Tour Eiffel." An endeavour has been made to please the public, and for that purpose a society has been formed, "Les Amis de la Tour Eiffel." The members contribute a small amount of money, which is spent in improving the gear of this station. A concert is now also given on Sunday and Wednesday evenings in addition to the usual afternoon musical transmission.

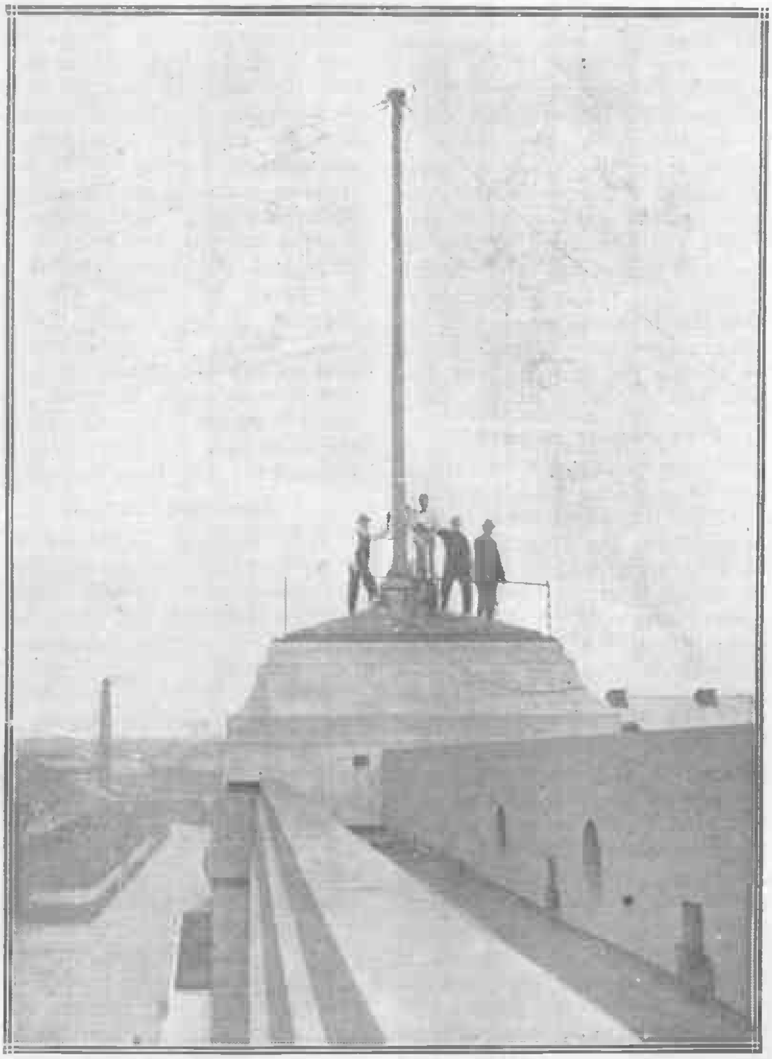
Radiola

This station, second in importance in regard to date of installation, has now become by far the most important broadcasting station in France. It is run by a private company, "Compagnie Française Radioelectrique," which company derives its income from the sale and installation of receiving or transmitting apparatus. The actual broadcasting at the start was only a small side-line of this company's activities. They hold in France a certain number of patents which they incorporate in their instruments, among others resistance coupling between high-frequency valves. Such a coupling may not be sold ready-made in France without licence of the C.F.R. The fact that such a long wavelength was chosen (1,780 metres) for this station may be connected to the fact, well known to amateurs, that this kind of high-frequency coupling becomes inefficient below 1,000 metres wavelength.

Never in any transmission are any names mentioned, save the artists'. The announcer is given an impersonal name, "Radiolo," derived from the original name of the station "Radiola." During children's and women's hour, if the announcer is a woman, she is called "Radiolette," and no announcer is ever referred to in any other name.

Broadcasting Sporting Events

Recently a certain amount of interesting outside sport broadcasting has been relayed by this station, one of the most interesting being the broadcasting of the Rugby match between France and Scotland some time ago.



The old aerial at 5IT being removed from the building of the General Electric Co. at Witton. The aerial in use is, of course, at the Summer Lane Station.

Radio-Paris had placed a man on the field, and beginning about a quarter of an hour before the match, and during it, he spoke constantly into his microphone, describing the contest in its smallest details. I happened to be fortunate enough to be listening to this transmission at my place in London, and was struck by the wonderful possibilities of this kind of transmission. We have been for a long time familiar with boxing matches and other such contests being filmed and the films shown in various theatres, and although contests such as Rugby or boxing appear to be entirely a matter to do with sight, I could not help feeling that the interest was very much greater by hearing the event described as it was occurring than seeing it on the film after it had occurred. A ready explanation which occurred to me was that the wireless method thrills one because of the indecision of the result. In the film it is possible to see great detail of action; still, the result is known from the start, whereas by radio, although nothing is visible, all the smallest interesting events are conveyed to one as they are occurring, and during all this time there is no idea of what the ultimate result will be. You are constantly furnished with the thrills you would have had were you actually on the field.

"Le Parleur Inconnu"

An important point, of course, is to have a man who is capable of talking the whole time, and, as we all know, the French are very quick talkers, and in particular the man whom Radio-Paris has chosen was very good. As a consequence of the principles of Radio-Paris not to give out names of their officials, this man is known all over France as "Le Parleur Inconnu." Several newspapers published photos of him seated on the ground, his microphone on a tripod, his assistant beside him with headphones on, checking the outgoing transmissions, and the only name written under the photo was "Le Parleur Inconnu." It caused such a sensation that the attention of the daily papers was drawn to the impersonal character of Radio-Paris officials, and naturally made an effort to get to know the name of "Le Parleur Inconnu." His name is M. Lehorter, and his name is now frequently mentioned in the Press.

The Grand Prix Motor Race

As another example of this, I was listening to the "Parleur Inconnu" giving out news of the Grand Prix Motor Race, Circuit de la Sarthe. Speaking of the chief engineer, he said: "Mr. —— no, I won't tell you his name. I am sure he would blush even at this distance of 300 kilometres," which was the length of the land line.

At this same race, while he was transmitting incidents in one part of the Grand Stand, in another part there was a loud-speaker picking up from Paris by wireless what he was saying. The loud-speaker was turned in such a direction that it was inconvenient to him, because he could hear his own words being sent back to him. In order to ask the man in charge of the loud-speaker to change its direction he simply spoke into his microphone, saying, "The loud-speaker which is in the stand is disturbing me," and asked the man to move it, and then, "The man had no doubt turned the instrument in another direction, because it no longer disturbs me. Isn't it extraordinary that to say something to a man who is only some hundred yards away from me it is easier to send my voice over 300 kilometres and then all the way back again?"

Our Own Methods

This method contrasts with ours, in which the personality of the announcers of the various stations doubtless has had a beneficial effect on the broadcasting in general. Knowing the announcers by name and following them by references in the Press develop a kind of bond between the listeners and the station, and although the rigid principle of the Radio-Paris has its advantages, the method adopted in this country has its good side also, so long as exaggeration does not occur in either practice.

There is no doubt that British radio listeners will become familiar with this station, as the wavelength of 1,780 metres makes listening possible on most instruments which are designed to receive Chelmsford. The number of British listeners to Radio-Paris is already so great that the number of the item which has just been played is given out in English at all transmissions, as well as in French. A numbered programme will be mailed on request by this station to listeners who are interested.

Radio-Paris is a very regular station, and to those who tune-in to their 1,780 metres at the time indicated for their transmission will invariably get their programme, which is sent under very high power—10/15 kw.—and the modulation is excellent.

There is one disappointment about Radio-Paris, and that is that it ends its transmission so early in the evening. It is very rare that anything is done after 10.45, but usually transmission ends at 10 o'clock. The reason for this is that Eiffel Tower starts sending out time signals and corrections from 10 o'clock Greenwich mean time, and for people living in Paris or the vicinity these time signals sent out on spark and on such high power must necessarily cause unpleasant interference with the long-wave transmissions.

Ecole Superieure des Postes et Telegraphes

Another station is that of the P.T.T. This station does not transmit on such heavy power as Radio-Paris, its equipment being approximately 1 kw. Modulation, if anything, is better, and it has been familiar to a great many British listeners because of its wavelength, which is in the range of B.B.C. stations. It is consequently suitable on sets which are designed for 300/500 metres wavelength.

Possibly due to its low power a great deal of fading is noticeable when listening to this station. Programmes, as a rule, consist of outside broadcasting from various concert halls in Paris, usually Salle Gareau and Salle Pleyel. This station being run by the staff college of the French post offices, has naturally facilities for using the telephone wires, and in this way is able to give outside broadcasting with less trouble. Owing to this outside broadcasting announcing is not always satisfactory from this station. Long intervals are sometimes experienced between items. Transmission, for the same reason, is somewhat irregular in regard to its starting time, which, however, always occurs between 8 and 9, and sometimes goes on until a very late hour. Afternoon transmissions occur quite frequently, but are not at all regular, either in regard to day of the week or the hour of transmission, but occurring, as a rule, between 2 and 5.

The Tzigane Orchestra

A very interesting concert to listen to is the daily mid-day Tzigane Orchestra of Radio-Paris. It is conducted by Monsieur Mario Caze, who, in addition to being a brilliant violinist and conductor, is also a very prolific composer. It is quite usual to find half of the items comprising the concert of his own composition. This concert is especially soothing to listen to, as the music chosen is all of a light kind, of great variety, and at the same time of delightful character.

Very little news is given at this mid-day transmission, but those interested in the latest events are advised to listen in at 5.40 p.m., approximately, when a short, but interesting, news bulletin is given out. I remember on one occasion an interesting news item about Mr. Ramsay MacDonald in his dealings with the French Ambassador in London. It was to the effect that a letter had been handed to Mr. Ramsay MacDonald by Comte de St. Aulaire, French Ambassador in London, in the afternoon. At seven o'clock the London News Bulletin only gave out that a letter was on its way.

Le Petit Parisien

Another station that has been heard a great deal in England is the Petit Parisien. *Le Petit Parisien* is one of the leading French papers, and naturally seizes the opportunity of wireless to provide a small amount of advertisement. They built a small station and have been sending on Sundays and Thursdays a fairly good programme, but in no way comparable in quality and variety to the programme of Radio-Paris.

Their wavelength is fairly low; and here again items are given out both in English and French, together with any announcements connected with the station's activities.

Listeners' Co-operation Invited

French stations are very pleased if people write to them, and the announcers have often given out that any letter from England, with an international stamp enclosed, which may be bought at any Post Office in the U.K. for 3d., would receive a reply. We all appreciate that it is difficult for stations to know what is going on unless their listeners co-operate to some extent.

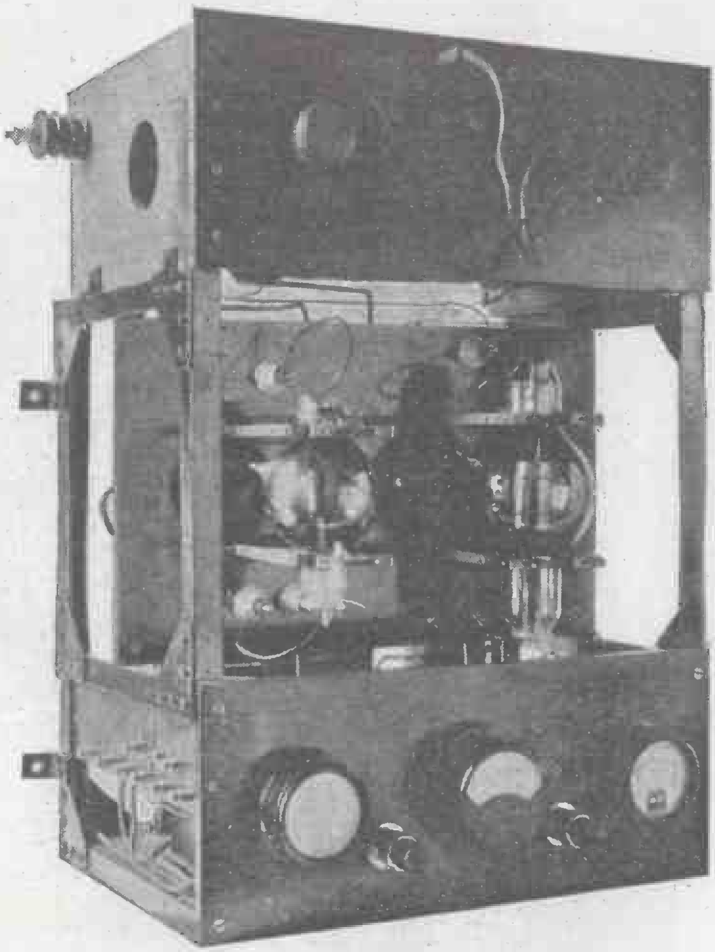
Realising the possibilities of wireless in general as a means of diffusing information, the French Government have tried to foster its use, and have endeavoured to eliminate, as far as possible, hampering rules and regulations. For instance, there is no license fee for installing a wireless apparatus; the only thing that is required is a declaration to the effect that a receiving station has been set up. There is no limitation to the length or height of aerial or the make or origin of the instrument, etc. Comparing this to the restrictions in this country, it is strange to note that wireless telephony, in spite of these facilities, has not made such rapid strides as it has over here. Doubtless, the method adopted in this country has had a greater stimulus, as apparently people have attached greater importance to something they have had to pay for, and at the same time, of course, this method has provided a means of getting in funds for better concerts and better service.

The receiving apparatus of the s.s. "Cyrus Field," which left the Thames this month for duty as a cable repair ship. The vessel is carrying 170 miles of cable.

An Amateur in the Arctic

By *FREDERICK JAMES.*

WHEN the Canadian Government ship "Arctic" left her berth in the River St. Lawrence at Quebec, on July 7, *en route* to the Arctic Archipelago, she is to be in touch with the outside world from that date until she returns next October, assuming, of course, that no serious accident prevents her. This stout little vessel, built in 1900, has been tripping up to the Arctic Seas these twenty years. This year the "Arctic" has her two regular radio equipments, consisting of a standard 600-metre 2-kw. spark equipment and a continuous wave transmitter working on 2,100 metres, with which communication is maintained with the long-wave ship station at Louisburg, Nova Scotia, and in addition a short-wave I.C.W. transmitter, which will transmit on wavelengths between 100 and 150 metres. The installation of this short-wave equipment is for the purpose of carrying on tests with Canadian and United States amateurs, with a view to ascertaining the efficiency of short-wave signals from the far north during the all-daylight period in the land of the Midnight Sun.



The 2,100-metre long-wave transmitter on board the "Arctic."

The Canadian Government ship "

The operator on the "Arctic" is Mr. W. Choate, of Toronto, Ontario, owner and operator of the amateur station 3CO.

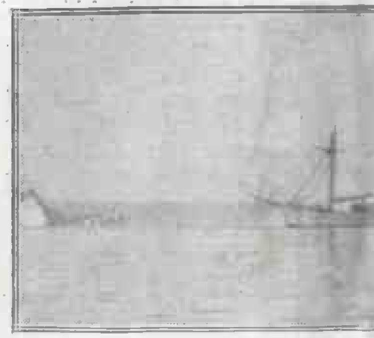
The call-sign of the "Arctic" is VDM and her wavelength 120 metres. The hours of transmissions given in Eastern Standard Time are:—

Daily, except Wednesday, 11 p.m. to midnight.

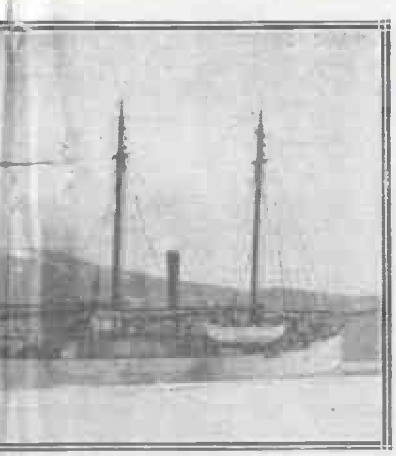
Saturday only, 11 p.m. to 3 a.m.

NOTE.—G.M.T. is five hours ahead of Eastern Standard Time.

The Radio Branch of the Canadian Government, Department of Marine, has authorised all amateur stations to use the wavelength of 120 metres during



The vessel passing an i



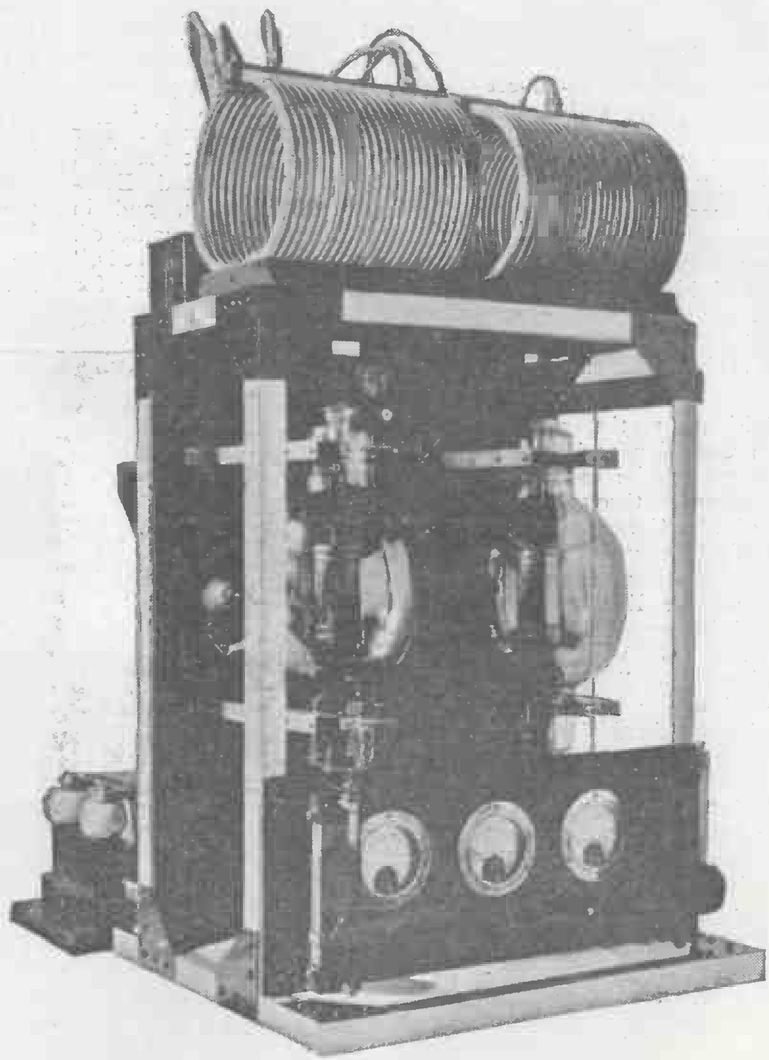
Arctic" off the coast of Greenland.

In the following article the Author explains how the Canadian amateur 3CO, now on his way to the Arctic, will maintain communication with the civilised world.

the foregoing hours for the purpose of communicating with VDM.

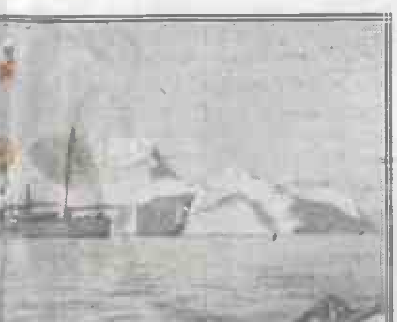
The test transmitter comprises two Admiralty T4A valves, operating on 8,000 volts on the plates with an output rating of approximately 500 watts per valve, using a standard Meissner circuit. No filter system is being used and the characteristic 480 cycle note will enable amateurs to place VDM immediately they hear the note, even if they do not get the call-sign.

The "Arctic" is going into the Arctic Archipelago — the islands of which, measuring over 500 square miles, have an area of over 520,800 square miles—to relieve outposts of the Royal Canadian Mounted Police and other Canadian Government officials who have spent one or two years in the Arctic circle, to establish new police posts, customs houses, post offices, and to complete numerous surveys and comparisons of previous observations.



The 120-metre transmitter for short-wave work.

There is a desire on the part of the Government of Canada to establish and maintain the majesty of the law, even in its most remote outposts. Establish a police post at the North Pole or anywhere else, and law and order will prevail. The Canadian Government also has some commercial interests in the Arctic that need protection. There are reindeer and musk ox by the millions, that may some day play a part in the world's food supply. Trading companies under



ceberg in the Arctic Seas.

different flags are opening, and they need both protection and watching.

The expedition this year is in charge of Mr. F. D. Henderson, of the Northwest Territories Branch of the Canadian Department of the Interior. He will go as far north as Ellesmere Island, 823 miles from the North Pole, the farthest point reached last year by the Craig expedition in the "Arctic." The master of the "Arctic," Captain J. E. Bernier, is now making his 258th voyage.

Earthing Arrangements

The working of the radio set in a ship fitted with sail is not as satisfactory as in a steamship on this account. In addition, the "Arctic" being built of wood, the operator will be casting an anxious eye over the side as soon as they run into Arctic floe ice, and his chief concern will be the welfare of the 200 square feet of copper plate which constitutes his main earth connection.

In addition to the regular tests with Canadian and American amateurs, special tests have been arranged, through the courtesy of Mr. George Wendt, of the Westinghouse Electric and Manufacturing Company, with the station KDKA every Monday night on their short-wave set. KDKA will use its experimental call sign 8XS when working with VDM. The results obtained from the short - wave set while the "Arctic" was proceeding down the Gulf of St. Lawrence have been very satisfactory, American amateurs as far west as Oklahama having been worked.

In addition to the telegraph apparatus aboard the "Arctic," the Westinghouse Electric Company have provided her with special short-wave receiving equipment for receiving concerts transmitted by KDKA's short wave. Recent tests indicate that Captain Bernier and his crew will be able to enjoy the short-wave concerts long after the regular broadcast transmissions on the higher wavelengths have faded away.

Police Wireless

The Northwest Mounted Police Posts in the far north at Craig Harbour and Pond's Inlet were equipped with radio receiving apparatus last year, but until the "Arctic" returns this winter, no data is available as to what concerts, if any, they were able to receive up there last winter.

The battery problem is a serious one in the case of these sets, in that supplies are only taken in once a year. The receiving sets at the Posts are equipped with Northern Electric peanut valves and use special batteries prepared by the Ever-Ready Battery Company for filament lighting. In addition, they are provided with 300-ampere - hour Edison - Lalande primary batteries with ample refills to see them through. For L.T. batteries they are provided with both Burgess and Ever-Ready Standard units, and in addition an adequate supply of, what are termed, "inert cells," which are made up specially for the Department by Siemens Brothers, London.

It will be interesting to hear how these different batteries have withstood the severe climatic conditions prevailing in those latitudes.

The Police Station is also supplied with the portable long-wave receivers, specially built by the Radio Branch, Department of Marine and Fisheries, Ottawa, for surveyors. Strong long-wave signals are received up north from the high - power stations in the United States and Europe on this receiver, and with the numerous Press transmissions in effect, the Police Posts frequently receive news items which otherwise they would only hear at intervals of several weeks. Last year, for instance, the report of the death of President Harding was received by the "Arctic" within a few moments of its occurrence.

Typical inhabitants of Greenland.

How every Crystal User may become a Valve Expert

By E. REDPATH, Assistant Editor

Further constructional details of the single-valve receiver described in last week's issue and some alternative methods of obtaining reaction effects.

Connecting Up

With all the components fitted in place, carefully clean with a piece of emery cloth the ends of all terminal shanks, condenser lugs, etc., and affix to each a small bead of solder, employing a thoroughly hot iron and a minimum amount of fluxite. Then, using No. 16 S.W.G. tinned copper wire, either round or square section, as preferred, wire up carefully in accordance with the wiring diagram (Fig. 6), taking care that each soldered joint is properly made. By keeping the soldering bit clean and up to its proper temperature, the work will be facilitated and the lengthy application of the bit to metal parts attached to ebonite can be avoided.

Testing and Operating

If possible, make the preliminary tests upon the aerial when broadcasting is not in progress. Plug in a 50-turn coil in the aerial circuit and a No. 50 or 75-turn coil in the reaction socket, and, with the aerial tuning condenser *in parallel,* and the reaction coil at about 45 degrees to the aerial coil, search for Morse signals from shipping or coast stations. When signals are heard, slowly tighten the reaction coupling, which should result in a steady increase in signal strength until oscillation point is reached, when spark signals become extremely loud, but lose their characteristic note. Should the action not occur as described, look over all connections again, external battery connections as well as those beneath the ebonite panel, and, if all are in order, reverse the connections to either reaction coil or aerial coil.

After a very little practice with the set, it will be found possible to tune in the desired station and adjust the reaction coupling so as to obtain the loudest clear speech or music quite easily and quickly and without causing the set to oscillate. Should oscillation inadvertently be permitted to occur, the reaction coil should immediately be moved further away from the aerial coil, and, provided the same thing is not allowed to occur again, no great harm will have been done. It is forcing the set right up to oscil-

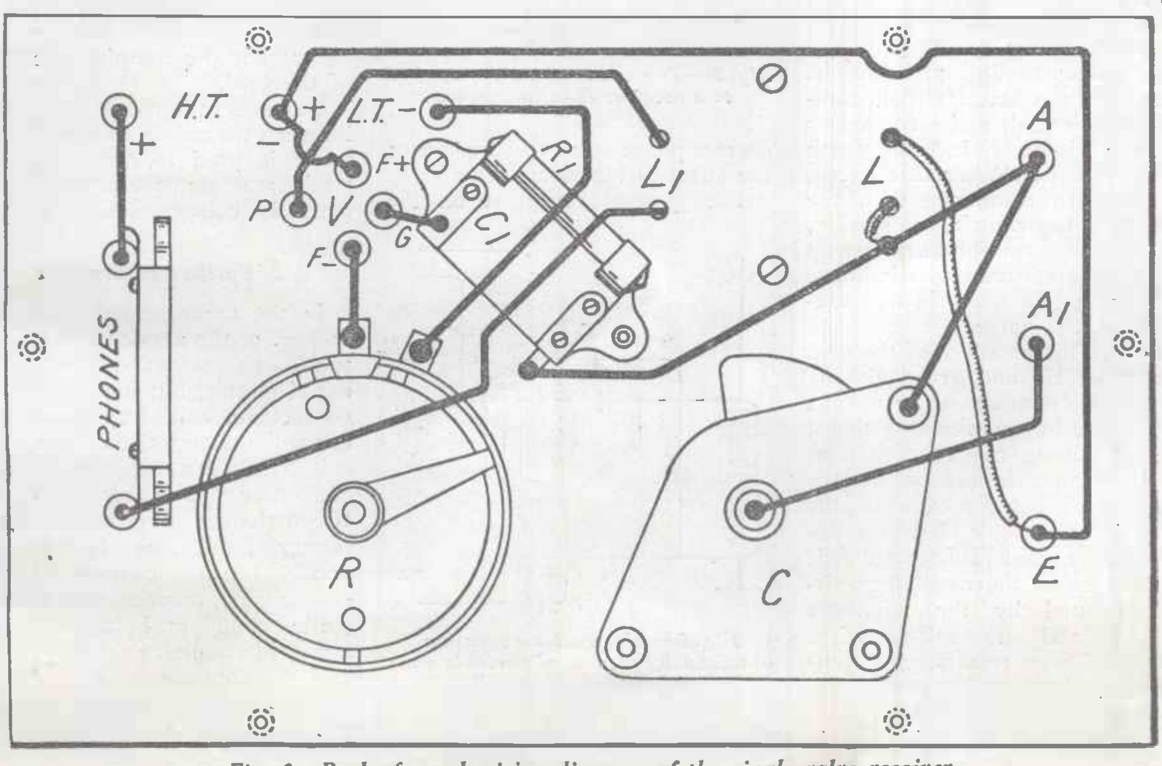


Fig. 6.—Back-of-panel wiring diagram of the single-valve receiver.

lation point, making very fine adjustments in tuning so as to avoid the loud note of the carrier wave, and *leaving the set in that condition*, which causes the most serious interference.

Other Single Valve Circuits

In connection with the use of a valve as a detector, mention must be made of alternative methods of obtaining reaction effects.

The method already described, in which an inductance coil in the anode circuit is coupled back to an inductance coil in the aerial circuit, is known as the electromagnetic method, but in addition to this, reaction effects can be obtained electrostatically.

This involves the use of a coupling capacity, which may be either the natural condenser formed by the electrodes of the valve and known as the self-capacity of the valve, or an external variable condenser connected so as to afford an electrostatic coupling between the anode and grid circuits.

Two arrangements which depend entirely upon the self-capacity of the valve are illustrated in the theoretical diagrams, Figs. 7 and 8, whilst the use of an external variable condenser, connected so as to supplement the existing self-capacity of the valve, is shown in Fig. 9.

Referring to Fig. 7, it will be seen that the aerial circuit comprises the aerial, series condenser C, a variometer L, and earth connection E. When this circuit is tuned to resonance with the distant transmitting station, oscillatory potentials are set up across the variometer windings, and applied to the grid and filament of the valve.

Due to the presence of the grid condenser C1 and grid leak R1, cumulative rectification occurs, as described in previous articles, and by tuning the anode circuit to the same frequency as the aerial circuit by means of the second variometer L1, oscillations of considerable amplitude are set up in the oscillatory circuit formed by the windings of L1 and its self-capacity. For the best results, the self-capacity of the variometer should be kept as low as possible.

High frequency variations in potential are thus set up across the variometer windings, and, one end being connected directly to the anode of the valve, the grid

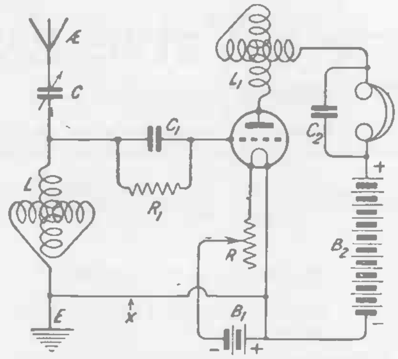


Fig. 7.—The tuned-anode method of obtaining reaction effect.

potential is varied electrostatically, due to the coupling existing between the anode and grid, in

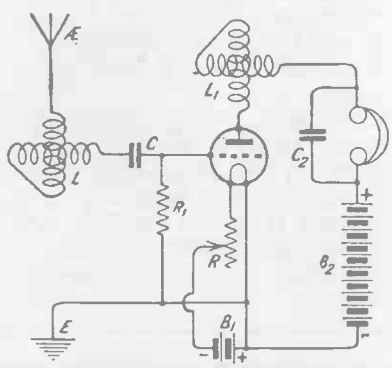


Fig. 8.—The same principle applied to a receiver for short waves.

correct phase so as to supplement the effect of incoming signals.

For general reception on the

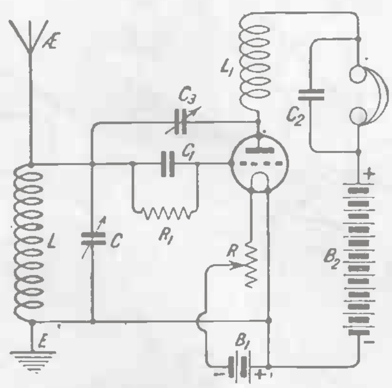


Fig. 9.—Electrostatic reaction obtained by means of variable condenser and choke coil.

British broadcasting wavelengths, this method gives excellent results, one particular advantage being that the reaction effect can be varied by altering the tuning of the anode variometer, without varying the tuning of the aerial circuit.

It will probably be found that, when the anode circuit is brought exactly into tune with the aerial circuit, self-oscillation commences. If desired, this difficulty can usually be overcome either by connecting a variable high resistance (50,000 to 100,000 ohms) across the anode variometer or by introducing a resistance of about 80 to 100 ohms at the point marked X in Fig. 7. It is usually helpful in such circuits to shunt the H.T. battery with a fixed condenser.

Short-Wave Reception

For the reception of very short waves, say, from 80 to about 150 metres, the arrangement illustrated in the circuit diagram, Fig. 8, may be used. This arrangement makes use of the self-capacity of the valve in two ways.

Firstly, oscillatory currents due to incoming signals pass to earth through the capacity between the grid and filament of the valve, the purpose of the resistance R1 connected between grid and filament, and which may have a value as low as 10,000 ohms, being merely to prevent the complete isolation of the grid.

Secondly, the capacity existing between the anode and grid of the valve is used to obtain electrostatic reaction, the anode variometer L1 being suitably adjusted.

A Further Alternative

In the arrangement illustrated in Fig. 9, the anode circuit is not tuned to resonance with the aerial circuit, but includes an air core choke coil, L1, which may conveniently consist of a plug-in coil, whilst an external variable condenser C3 is connected between the aerial end of the aerial tuning inductance L and the anode, thus supplementing in a controllable manner the electrostatic coupling between anode and grid circuits.

NEXT WEEK.—*The Theory and Construction of a Single-Valve Reflex Receiver.*

A Low-Capacity Coil

VERY effective and simple coils may be wound, without the trouble of making the complicated former incidental to the construction of honeycomb coils, by the following method. A circle of 3 in. diameter is drawn on a piece of hard wood and the circumference divided into 12 parts by fixing the compasses at $1\frac{1}{2}$ in. and marking round the circumference and then bisecting one of the resultant arcs and marking again, as shown in Fig. 1.

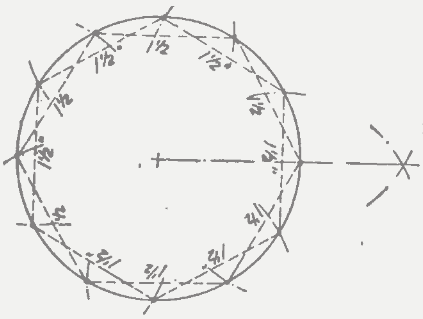


Fig. 1.—Showing how the positions for the nails are found.

Twelve 2-in. wire nails are then driven into the twelve points thus obtained, and the former is complete. The nails and former should then be very lightly smeared with vaseline to prevent the coil adhering when varnished, and the end of a bobbin of wire secured by twisting to nail No. 1. The wire is then passed in succession round nails 3, 6, 8, 11, 1, 4, 6, and so on, *i.e.*, alternately missing one nail and then two. Fig. 2 will make the method of winding quite clear.

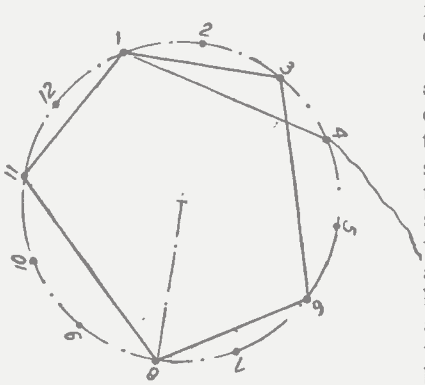


Fig. 2.—With nails in position the wire is wound in the manner shown.

The total number of turns may be calculated by multiplying the number of turns passing *outside* nail No. 1 by 2.5, or inversely to wind a coil of 80 turns the number of turns passing outside nail No. 1 will be $\frac{80}{2.5} = 32$. The number of turns required for a given wavelength can be estimated by adding 25 per cent. to the number of turns given for ordinary honeycomb coils in the various lists and graphs published. After winding, the coil should be coated with shellac or celluloid varnish, and baked if shellac is used. The nails are then removed, and the coil is ready for mounting in the manner most suitable for the coilholder used. The appearance of the windings is shown in Fig. 3. Owing to the very liberal air spaces and resultant low capacity of this coil it will be found extremely useful in the tuned anode part of a multi-valve set. Careful adjustment of the number of turns on the coil, allowing as little variable capacity as possible, will result in a very gratifying increase in signal strength.

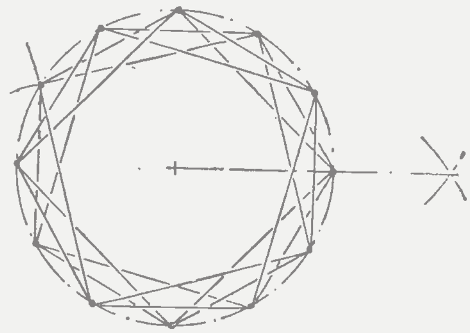


Fig. 3.—The appearance of the wound coil should be somewhat similar to this illustration.

A Double-Purpose Panel Switch

THE useful switch shown in the accompanying diagram (Fig. 1) may be used for adjusting a variable condenser,

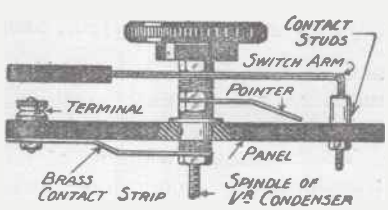


Fig. 1.—The double-purpose switch.

also as a tuning adjustment for a tapped inductance. The two functions are at the same time quite independent of each other.

The construction is clearly shown in the diagram, but care must be taken to assemble the nuts and spring washers as shown, by reason of the fact that the pointer is actuated by the spindle carrying the moving vanes of the variable condenser, and the switch arm is actuated by the extension handle. The adjustment of the nuts in relation to the spring washers should be of just sufficient tension to allow the switch arm to be moved round without disturbing the pointer adjustment and *vice versa*.

In Fig. 2 the theoretical connections are shown. It will be seen that the switch arm, and also the pointer, are connected at one point, namely, the spindle of the variable condenser. Connection is made from this point to a terminal, as shown in both the diagrams, by means of a springy brass strip. The fixed vanes of the condenser are then connected at the beginning of the winding of the tapped inductance and the tappings are taken off to the studs, as shown, the number of studs being in accordance with the tappings desired.

H. B.

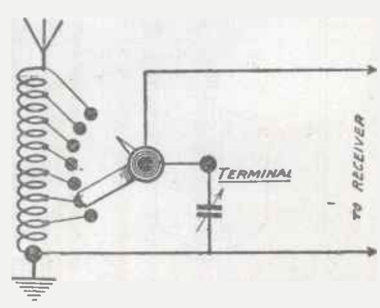


Fig. 2—The connections are made in accordance with this illustration.

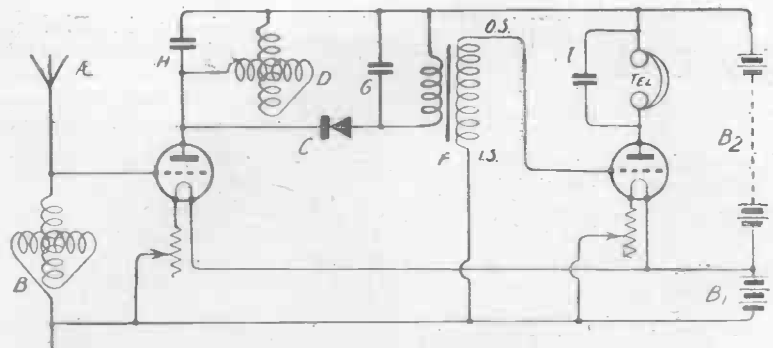


Fig. 1.—The Theoretical Circuit Arrangement.

Practical Back-of-Panel Wiring Charts

An H.F. Crystal and Note Magnifier Circuit.

By OSWALD J. RANKIN

THIS receiver consists of a high-frequency amplifying valve followed by a crystal detector and a note magnifier.

Aerial tuning is carried out by means of the variometer B. Another variometer D is connected in the plate circuit of the first valve, and is shunted by the fixed condenser H of 0.0003 μF capacity. These variometers cover the broadcast wavelengths, and if it is desired to tune to higher wavelengths, each variometer should be replaced by a coil socket and a 0.0005 μF variable condenser connected in parallel with the contacts of the coil socket. Plug-in coils of the desired sizes may be inserted in the sockets, tuning being effected by means of the variable condensers.

Across the anode variometer are connected the crystal detector C and the primary winding of the intervalve transformer F. The fixed condenser G, which has a capacity of 0.001 μF, is placed across the primary winding, as shown in the wiring chart, and is secured to the panel by means of small screws, which, however, do not project on the other side of the panel. The condensers H and I are fixed in a similar manner, their exact positions being unimportant.

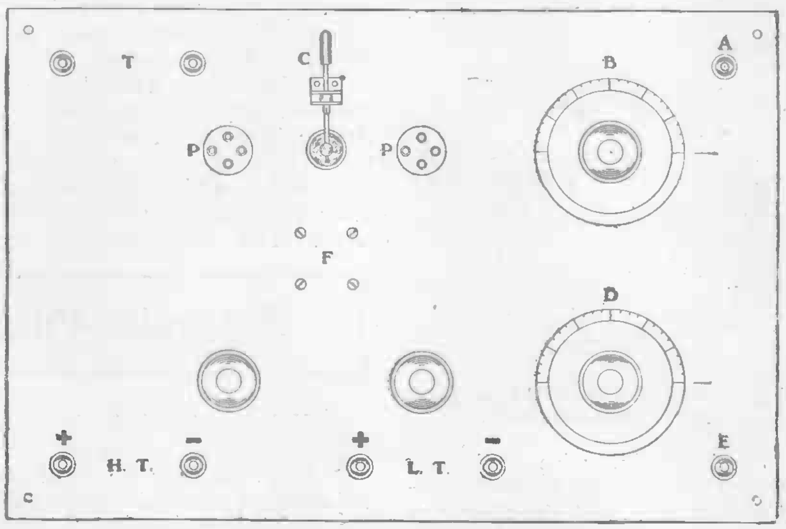


Fig. 2.—Panel Layout, Showing Position of Components.

The secondary winding of the transformer is connected across the grid and negative filament of the low-frequency amplifying valve. It will be noted that the terminal OS is connected to the grid of the valve, and this is found best as a general rule. If desired, however, IS may be taken to grid, and OS to filament, and note taken of the results obtained thus, and compared with the former method. The arrangement giving the better results, should, of course, be made permanent.

The telephones are connected in the anode circuit of the note-magnifying valve, and are shunted by a fixed condenser I of 0.002 μF capacity.

The circuit is quite straightforward, and when the set is completed no difficulty should be experienced in operating it. Having adjusted the crystal and obtained maximum signal strength by tuning the variometers B and D, the crystal should be re-adjusted, when a final touch to the variometers B and D completes the tuning.

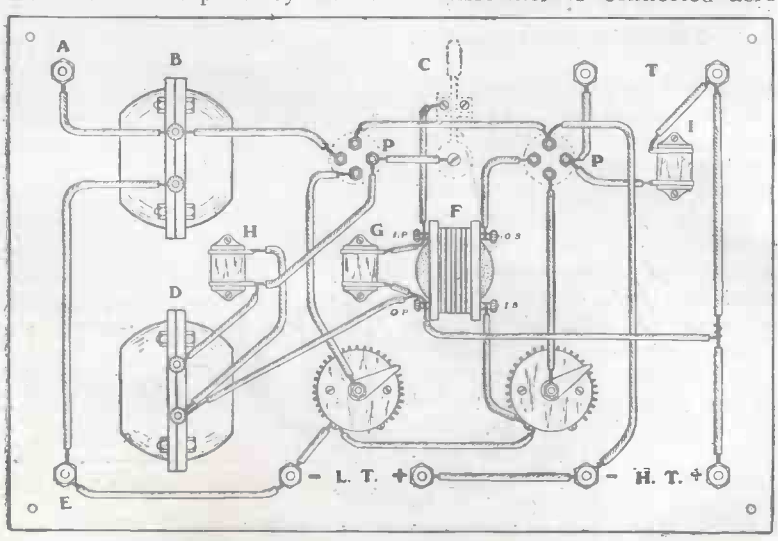
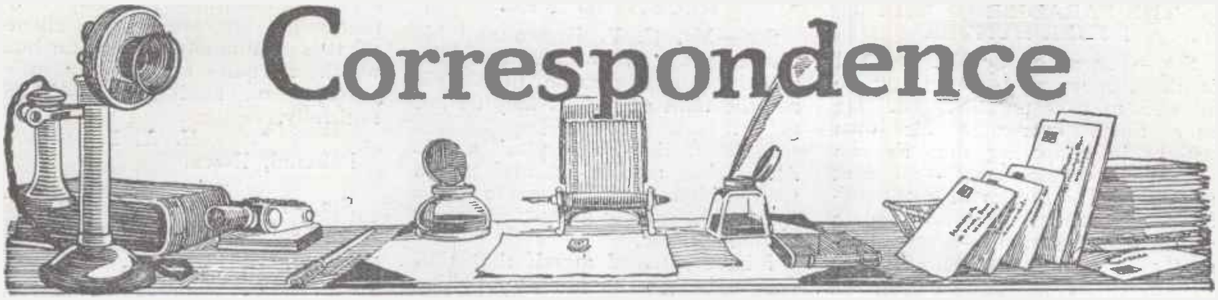


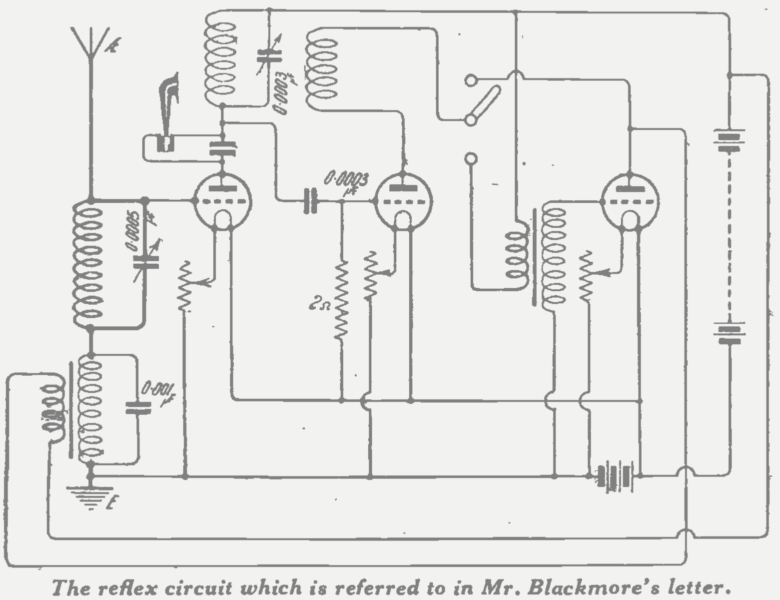
Fig. 3.—Practical Back of Panel Wiring Diagram.



ST76

Sir,—I read with interest Mr. Scott Taggart's "Valve Notes" in May 7 issue regarding the stabilisation of the ST76 circuit. I had previously tried the old form of the circuit, and had met with the difficulties he describes. After reading the article regarding the Simpson connection, I immediately set to work and re-made my set, embodying this connection.

I experienced a distinct improvement, but I cannot say that I was really satisfied with the result. Whilst working out the causes and possible cures of the defects (Yes, I'm afraid my transformers were rather cheap!), I thought of the circuit given below, which I set to work to construct.



The reflex circuit which is referred to in Mr. Blackmore's letter.

The circuit is in all probability as old as the hills, but I have never seen it published anywhere; as a matter of fact, this rather deterred me from starting to build it, since if the idea was any good, I thought that it would have been given publicity long before. There must also be numerous technical reasons against the circuit, but I was not technical enough to see them.

On trying the set, however, I was surprised not only to get results, but to get very good results also, perfectly equal to a four-valve "straight," this whilst using the two doubtful transformers referred to above. The main difference between this circuit and ST76 is in the fact that the H.F. valve acts in its dual capacity as the second L.F. valve, and not as the first L.F. valve, as is usual in dual circuits.

I have a switch between the detector and first L.F. valves, so that the set becomes the ST75 on switching off the first L.F.; the ST75 is a circuit I have had very good results from, and it seems easier in this case to switch on ST75 than if the full circuit were ST76.

I hope that this may be of interest to you, and I should like at the same time to express my thanks for the many excellent circuits and ideas I have found in both *Wireless Weekly* and *Modern Wireless*.—I remain, yours faithfully,

R. H. Blackmore.

Hyde, Cheshire.

[This idea is perfectly sound and is probably better than the ST76, as it avoids the awkward position of the transformer next to the first anode. In general, however, it is not desirable to combine too strong L.F. circuits with weak H.F. in the same valve. We greatly welcome letters of this nature.—Ed.]

AN AMERICAN SHORT-WAVE RECEIVER

Sir,—We notice in an article on "An American Short-wave Receiver," by Mr. Gerald R. Garratt, appearing in the *Wireless Weekly* of August 13, that reference is made to the fact that damping resistances for use in the circuits described are not obtainable in this country.

We would point out that the Igranic Electric Co. are manufacturing a stable variable resistance which has proved excellent for this purpose, and, in fact, in many reflex circuits where damping resistances are introduced.—Yours faithfully,

Igranic Electric Co., Ltd.,
A. H. Curtis, General Manager.
Bedford.

THE GOOP-WAYFARER CIRCUIT

Sir,—The Goop-Wayfarer Circuit has had constructional articles and a test report, but no *Wireless Weekly* circuit is complete without a description of a reader's results. I constructed the set in accordance with your instructions, making a few alterations to suit my own ideas, as is the custom of amateur constructors. I have added five valves of the ordinary frequency and various other gadgets which need not be specified. I have had the most extraordinary success from the very beginning. I have not as yet got any of the broadcasting stations, but I have logged 97 amateurs. They were all howling, but that was really fortunate, as I was easily able to distinguish them by the note of their howl without having to wait for their call sign.

The selectivity of the set is marvellous; each degree on any of the condensers brings in a fresh station with a different note.

This is the first set I have constructed, and I think you will agree that the results I have obtained are astonishing. I showed the set to a friend who seemed much struck by it, but he said I ought to have a transmitting licence.

Owing to the doubt about the licence, I will not sign my name, but remain, Yours faithfully,

Gooperator.

Swansea.

THE PARADISE OF THE ETHER HUNTER

SIR,—The article by Mr. Barnard in the August 13 issue cannot be allowed to pass unchallenged. He very much over-rates his own powers in supposing that he can "spoil our contentment"—mine, at any rate. He speaks of a "handful" of stations; there are to date eight main stations—seven low-power ones and Chelmsford, with an immediate prospect of another main station and relays at the rate of one per month—a fair handful indeed. Would he, even with an American set, soon get *ennui* through the ease with which he could run through all these on one evening.

Does he *really* hold it up as an advantage to have as many stations in a decent-sized city as we have throughout the country. Heaven forbid that we should ever be forced to put up with such a state of affairs. That alone is sufficient reward for paying for the privilege of listening (⅓d. per day!). Personally I am glad to pay towards the upkeep of an organisation which is able to give the whole country simultaneous broadcasting of any event of special interest and gives first-class programmes without resorting to the broadcasting of advertisements to obtain revenue.

We are also saved from the necessity of studying long lists in the radio press of :—

Broadcasting Stations opened *and* Broadcasting Stations *closed down*.

I take the liberty of expressing entire disagreement with the views contained in the article.—Yours faithfully,

E. M. W.

Timperley, Cheshire.

SIR,—I read with some surprise the article by Mr. George Barnard. Evidently the author is under the impression that the wireless fans in this country look with envy on the American listeners, which, I think, is not the case. The author forgets also that the station hunter here can, in addition to B.B.C. stations, also receive PTT, SFR, FL and many others.

I am quite confident also that our programmes here beat the American programmes easily, and what more does a listener want than a good programme every night from every B.B.C. station? Further, I do not think any decent-minded listener begrudges paying the paltry sum of 10s. every year. I should feel sorry for Great Britain if such a state of chaos came about here as that existing in America.

Wishing your paper every success, —Yours faithfully,

C. LAW.

Chadderton, Nr. Oldham.

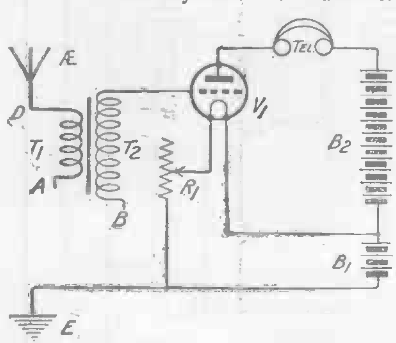
RECEIVING 5XX.

SIR,—Mr. C. P. Brown and his "vast majority of London listeners" should realise that it is not the fault of 5XX if they do not get it.

I hear that a crystal set in Algiers has received it, and that a really high aerial here (10 miles from 5XX) enables a crystal to work a loud-speaker.

I have satisfied myself that 5XX comes in here on almost anything that provides enough impedance, *e.g.* :—

Experiment.	Apparatus.	Result.
1.	Crystal alone in aerial	Faint.
2.	No. 6 Peto Coil across this crystal	Quite good.
3.	Nos. 6 and 7	Still louder.
4.	These two and a 200 turn coil of 1 ft. diameter all in series across crystal ..	Not so loud.
5.	A copper cat whisker on steel, neither of which were ever near a crystal ..	Detects quite well
6.	Anode resistance only in aerial	Faint.
7.	Earth wire direct on grid of valve ..	Faint.
8.	Earth wire direct on grid condenser ..	A little louder.
9.	Aerial alone direct on grid	Quite distinct.
10.	Aerial alone on grid condenser	Quite good.
11.	The same plus earth on L.T. –	Still better.
12.	Same as 9 plus earth on L.T. –	Similar.
13.	L.F. Circuit as shown in diagram	Faint.
14.	A No. 7 Peto Coil across A D and no earth anywhere ..	Quite audible.



The No. 13 experiment tried by Mr. Philpots for the reception of 5XX.

These results are valuable if only because they point to the undesirability of testing a circuit on a near station.

Again, with a circuit properly tuned to 5XX, the 5XX carrier wave enables one to receive transmissions faintly from other stations working on their *own* wavelength. This was proved beyond doubt with 2LO as the other station. But when Dame Clara Butt was S.B. to all stations I distinctly heard in the intervals what seemed to be a turn of the music-hall type given by a woman.

In conclusion, 5XX's quality seems excellent. The only thing that might improve it is to silence what is presumably a generator hum which is quite obtrusive in quiet passages on loud signals.—Yours faithfully,

E. A. PHILPOTS.

Felstead, Essex.

SIR,—In reply to Mr. C. P. Brown's letter in *Wireless Weekly*, August 6, *re* 5XX.

Here in Bournemouth, 150 miles from Chelmsford, 5XX comes in quite well on a crystal set in broad daylight, every word being understandable, the aerial being on the roof but only 4 ft. above it.

With 1 H.F. detector and 1 L.F. 5XX is as loud as 6BM, *i.e.*, good L.S. strength. It may interest you to know that 5XX in no wise interferes with SFR in this district, no loose-coupler or wave-trap being used.

Thanking you for two such fine papers as *Wireless Weekly* and *Modern Wireless*, both of which I have taken from No. 1 and still cherish.—Yours faithfully,

Bournemouth. M. SAINSBURY.

SIR,—Referring to the letters published in *Wireless Weekly* relating to readers' experiences on the reception of 5XX, I should like to relate my experiences with this station using a one-valve set (Flewelling Circuit).

With this set (on an aerial 40 ft. high, 90 ft. long, and carefully insulated) at Streatham, I found that 5XX was no stronger than 2LO.

When making arrangements for my holiday, which I intended to spend at Bognor, I decided to take my set with me in the hope that on wet nights I might at least be able to receive 5XX, and perhaps Radiola.

I had to erect an aerial, consisting of 50 ft. of electron wire, supported one end on a small tree (the only thing available) 10 ft. high and running through a small window 7 ft. high directly to the set. The earth wire consisted of about 4 ft. 6 in. of the same wire fastened at one end to an iron peg which was driven into the ground for 12 in.

Using a 150-turn coil for the primary with a .001 variable condenser in parallel, and a 300-turn coil for reaction, I was absolutely astounded with the results.

5XX came in much too strong for telephones to be used, so had to detune.

The following evening I borrowed a small Sterling loudspeaker from a local dealer. After careful tuning, using the telephones, I connected up the loudspeaker. The volume of signal was sufficient to comfortably fill a fairly large sitting room. I disconnected the aerial and connected the earth wire to the aerial terminal. By placing one's ear into the horn music could be clearly heard at about crystal strength at four or five miles from 2LO.

On the same evening dance music from Radiola could be heard 6 to 7 ft. away from the loud-speaker, and using four pairs of telephones reception was all that could be desired.

Reverting to the signals from 5XX, atmospherics were most conspicuous by their absence, whilst Morse could be faintly heard.

The reaction coil was always at right-angles to the aerial coil, and using a Cossor P.1 valve I had the greatest difficulty in preventing the set from bursting into oscillations.

Wishing your two journals further success,—Yours faithfully,

A. K. KIRK.

S.W.16.

"STRANGE MODESTY"

SIR,—One of my first acts on returning from holiday on August 14 was to open *Wireless Weekly*, and I was naturally very interested in your Editorial, entitled "Strange Modesty." If you had been present at the meeting of the General Committee I do not think you would have found it necessary to devote your valuable editorial space to my broadcast talk, as it is obvious that you have quite misunderstood my attitude.

In the first place, why was the General Committee ever brought into existence? Because there was dissatisfaction amongst the affiliated societies with regard to the inactivity of the old Wireless Society of London. Why disguise the fact? The Council of the R.S.G.B. is aware of it; the affiliated societies are aware of it. But we, the wireless amateurs in general, are now trying to push things on, and while it is no good crying over spilt milk, it is all to the good to show the contrast between the old and the new states of affairs.

If in my broadcast talk I said anything contrary to the real present position I should be only too glad to hear from any delegates who were actually present at the meeting of the General Committee. You say that in many quarters the meeting was a grievous disappointment to the delegates. I have heard no such opinions expressed, but if such an opinion does exist, then I should be most glad to hear it in detail.

Nearly every line of your article calls for reply either from myself or from the R.S.G.B. For my part, however, I will content myself by saying that, in fairness to the R.S.G.B. and to all affiliated societies, I should be very glad if you would make it known that I was *not* making *admissions* in my broadcast talk. I was merely expressing my own views, not as a member of the R.S.G.B., but as a member of an affiliated society.

I know it is easy to criticise; I have been known to be guilty of criticism myself. (See my letter in the *Wireless World*, September 26, 1923. My ultimate aim remains the same to-day as it was at that time, although my intermediate views have necessarily been modified.) But in spite of all criticism, I am convinced that the salvation of the amateur movement in this country lies, for the immediate present, in the whole-hearted support of the General Committee by all concerned. That the Radio Society of Great Britain should give me the opportunity of expressing my views is, I think, a very promising sign. Whether the R.S.G.B. approves of what I say or not is neither here nor there at the moment, but I think that the prestige of the Society is proof against my "admissions."—I remain, dear Sir, yours faithfully,

J. F. STANLEY.
Hon. Sec., General Committee of Affiliated Societies.

RADIO-PARIS AND 5XX

SIR,—I was very interested in the article, "Radio-Paris and Chelmsford Interference," in *Wireless Weekly* of August 13. Mr. Kendall expresses the feelings of many, including myself, when he says that the high-power station at Chelmsford is not quite such an unmixed blessing as we had hoped, for even at this distance there is a decided interference with SFR. Whilst we are glad to get 2LO without any interference from our local station, 2ZY, we very much regret not being able to listen to the excellent concerts from "Radiola" with the clearness as we did before the coming of 5XX.

Wave-traps are very good so far as they go, but would it be possible to induce the B.B.C. to lower the wavelength of 5XX to, say, 1,400 or even 1,500 metres? If this could be done, there would be little or no interference.—Yours faithfully,

(REV.) H. BRIERLY.

Heywood.

"JOTTINGS BY THE WAY"

SIR,—It is a far cry from South Africa to London, yet from a wireless point of view it is merely a matter of moments.

Now we have commenced broadcasting in earnest, possibly a few remarks about our progress would interest our friends in the Homeland. We haven't forgotten dear old "Blighty," though we elect to stay in sunny South Africa.

From the veriest schoolboy to the white-haired old pioneer, each and all have got it—the "wireless" fever. It is worse than enteric, because once you catch it you can't throw it off.

One of our local papers quotes a humorous story about a youngster of fourteen going into a "wireless store" and asking the price of a "four-valve set." He expatiates most profoundly thereon. Valves, amplifiers, variometers, reactance, etc.—he waltzes through the whole gamut, then calmly asks if there are any cat's-whiskers in stock, and being supplied with one, scampers off to try and get 2LO, or America relayed, in preference.

On a "home-made" crystal set I get JB (Johannesburg) perfectly. We are distant 25-28 miles. Of course in the winter time the conditions are ideal, but woe betide those who are not properly "earthed" in the summer.

Our atmospheric or electrical storms are so sudden. Practically without warning they appear. A thunderous report overhead is usually the first warning.

A gentleman listening-in from Rhodesia reported getting JB on a crystal set, though reception was very faint.

Broadcasting is a great boon to the dwellers in the wide spaces of the "achterveldt" (backveldt). The town is brought to the country in very truth.

As the pioneer in wireless in my district, I'm busy interesting my neighbours. "Wireless for all" is my slogan. I'm holding meetings and giving demonstrations to the uninitiated.

I have no doubt JB will be a huge success, as it is being run by the Associated Scientific and Technical Societies of South Africa. We pay JB £2 per year, plus 5s. to the Government—licence fees.

There is a controversy over the question of broadcasting advertisements. The company reckon they are committed at present to big contracts, so I'm afraid advertising has come to stay in South Africa per the media of wireless.

Hoping you consider my effort worthy of publication in your paper, and wishing you every success,—Yours faithfully,

S. W. WRIGHT.

Benoni, Transvaal, S.A.

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

"Fynetune" Micro Adjuster

Messrs. Sparks Radio Supplies have submitted an improved model of their fine-adjustment mechanism for tuning-devices which have bevel scales in front of the panel, a geared friction-ring engaging with the rim of the bevel scale so that rotation of the small control knob gives a slow motion to the latter. As already reported, this device is mounted on the panel-top by a small bolt.

In this new pattern, a substantial moulded rubber ring is used on the friction-wheel, giving securer operation and longer life.

Flush Panel-Mounting Fittings

Messrs. Sparks Radio Supplies have sent us samples of their flush-mounting fittings, which do not require the use of tapped holes in the panel, that bugbear of many constructors.

The valve-socket fittings form short brass tubes, with a flange at one end, which rests on the panel-surface, and with a back-nut screwing on the rear end to hold the socket securely in a plain hole in the panel, and (if desired) to clamp the connecting-wire. Four of these set at the appropriate distances in the panel will carry the valve in a very neat and compact manner, the over-all height required above the panel being substantially reduced as compared with the conventional moulded valve-socket fitting. If good ebonite is used for the panel both insulation and capacity features may also be improved by adopting this form of valve-socket.

The coil-plug fittings have for the socket an enlarged version of the valve-socket fitting; and for the plug a split brass pillar with flange and lock-nut behind of uniform dimensions. This should be particularly useful for introducing plug-in loading-coils for reaching 1,600 metres with ordinary broadcast sets, as the fitting occupies but little space on the panel, the connections are readily made behind the panel, and the height of the coil above the panel is also reduced.

New Pattern R.I. Low-Frequency Transformer

We have received from Messrs. Radio Instruments a sample of the new pattern R.I. intervalve transformer, for audio - frequencies.

While resembling superficially the older pattern, and showing the same good workmanship, insulation, and finish, this new pattern has a different type of winding, both primary and secondary coils being divided into six sections, and the former being now wound outside the latter. A larger gauge of wire is also used. The turns ratio is given as 4 : 1.

The makers claim a more uniform degree of amplification over a large range of audio-frequencies as a result of this improved design, and the resulting diminished distributed capacity; this is borne out by the National Physical Laboratory tests, which show a very uniform characteristic down to 1,500 or 2,000 cycles audio-frequency, and a drop to about 50 per cent. at 500 cycles, without any noticeable resonance peaks. Careful comparative tests in actual reception, both of speech and music, and single notes of different frequencies, showed confirmation of this feature: except for a slight rise in (so-called) "pitch," i.e., preferential amplification of the higher ranges to the loss of some lower frequency energy, the tone was exceptionally good, and compared well with the average L.F. transformer performance. The degree of amplification was quite satisfactory.

A Compact Two-Coil Holder

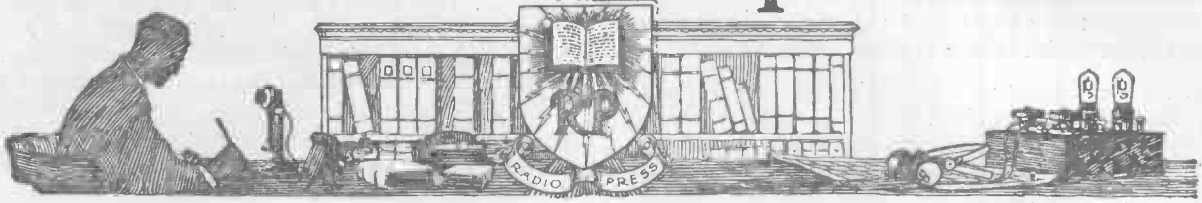
A two-coil holder with micrometer adjustment, which occupies very much less space on the panel than the majority of such devices, and which has actually the single-hole-mounting feature so popular with amateur constructors, is that submitted by J. Telford.

In this instrument the coil-holders are both mounted on a substantial spindle, which is fixed in the panel by a heavy back-nut. The fixed coil stands then clear of the panel, but parallel to it; the moving coil is free to rotate around the spindle at a distance of about an inch in front of the former and parallel with it, being controlled by an insulated handle and an adjustable friction-spring at the further end. The latter can be tightened up sufficiently to hold the larger sizes of coils in any position. When the moving coil is rotated to a position at 180 degrees from the fixed coil, the coupling is, of course, minimised.

The fine adjustment of coupling is given by a rocking motion of the moving coil in the direction of the length of the main spindle, controlled by a micrometer screw with a large ebonite knob arranged conveniently at the inner end of the main handle. This enables the moving coil to be slowly swung out to an angle of approximately 45 degrees with the panel, or in until the coils actually touch, giving the desirable fine control of coupling in any position.

The instrument is well and substantially made and nicely finished. The usual small terminal-screws are provided on the coil plugs for flex connections. For use on the front of the panel in sets where space is limited this neat device offers obvious advantages.

Information Department



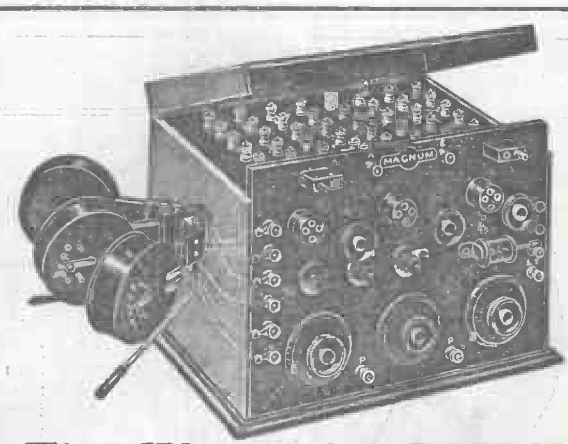
SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

R. A. (WATERFORD) has been informed that it is not safe to use the testing instrument known as a Megger for measuring the resistance of anode resistances, and inquires as to alternatives, since he is carrying out some experiments which require the use of resistances calibrated with fair accuracy.

It is certainly not advisable to use a Megger upon the resistances, since even the most dependable makes are only tested on a load of 200 volts, and the Megger, of course, applies a considerably higher voltage than this to the object under test. Since you do not require very great accuracy, in your calibration, we would suggest that you should use a milliameter, a 100-volt high-tension battery, and a good voltmeter to read the actual pressure applied to the resistance. Ohm's law will then give you the desired information.

S. T. A. (DROITWICH) states that he has seen very conflicting statements as to the average range of high power stations, such as Carnarvon or Leafield, and asks our opinion.

The answer to such a question as this must assume a certain standard of sensitivity in the receiver. For commercial purposes this may be taken as being just so much amplification as is possible without bringing in an excessive amount of atmospheric or other interference, and with such a receiver maintaining a reliable service at greater distances than about 5,000 miles is extremely difficult. These ranges are being rapidly extended, however, and a regular direct service between England and Australia is by no means an impossibility in the near future.



J. R. W. (MANCHESTER) asks whether it makes any difference to the results obtained with a receiving set, whether the variable condenser is arranged with the moving plates to the aerial and the fixed plates to earth, or with the reverse arrangement.

As far as the actual functioning of the receiver is concerned, it is quite immaterial which connection is adopted, but in actual practice it will be found that one of the two possible arrangements has decided advantages. With most types of condensers hand-capacity effects are very much reduced by connecting the moving plates to earth, and the fixed plates to aerial. Similarly, with a tuned anode circuit, the moving plates should be connected upon the high-tension battery side of the circuit, and the fixed ones to the anode.

H. C. (GLASGOW) asks whether resistance-coupled amplifiers have as great a tendency to self-oscillation as those employing tuned intervalve coupling.

Resistance capacity intervalve coupling in high-frequency amplifiers is decidedly more stable than any of the tuned methods, and it has only a slight tendency to self-oscillation. It may frequently be found that an amplifier possessing as many as three stages of resistance-capacity-coupled amplification will be perfectly stable and require added reaction before it will oscillate. When more than three stages are used the inherent tendency to oscillate is generally sufficient to enable a reaction coil to be dispensed with, and a very delicate control of reaction is then obtained by means of the usual potentiometer.

K. C. (HAMPSTEAD) says that he has seen the terms "radiate" and "re-radiate" used in referring to a receiver, in a somewhat confusing manner, and he asks us to explain.

These two terms are often very loosely employed at the present time, since they seem to be regarded as equivalent by some listeners, whereas there is a distinct difference in meaning involved in their correct use. "Re-radiate" means that energy is received by an aerial system, and that some fraction of that energy is re-radiated into space without any serious change being made in its frequency, modulation (in the case of telephony), etc. This, of course, always occurs when any kind of signal is being received, since when the receiving aerial is tuned to the transmitting wavelength, it is thrown into oscillation in sympathy with the signals, and whenever oscillations flow in an aerial system a certain amount of energy must be radiated. No interference is caused by this phenomenon as a rule. "Radiation," on the other hand, means that energy is flowing in the receiving aerial other than that supplied by the received signals, and that energy is radiated which is not simply a faithful copy of the received signals. Such radiation, since it differs from the passing signal, will interfere with other signals when picked up by a neighbouring receiver, and this is the cause of the only too well known squeals and howls.