The Wireless Constructor

6D MONTHLY

EDITED BY
PERCY W. HARRIS, M.I.R.E.

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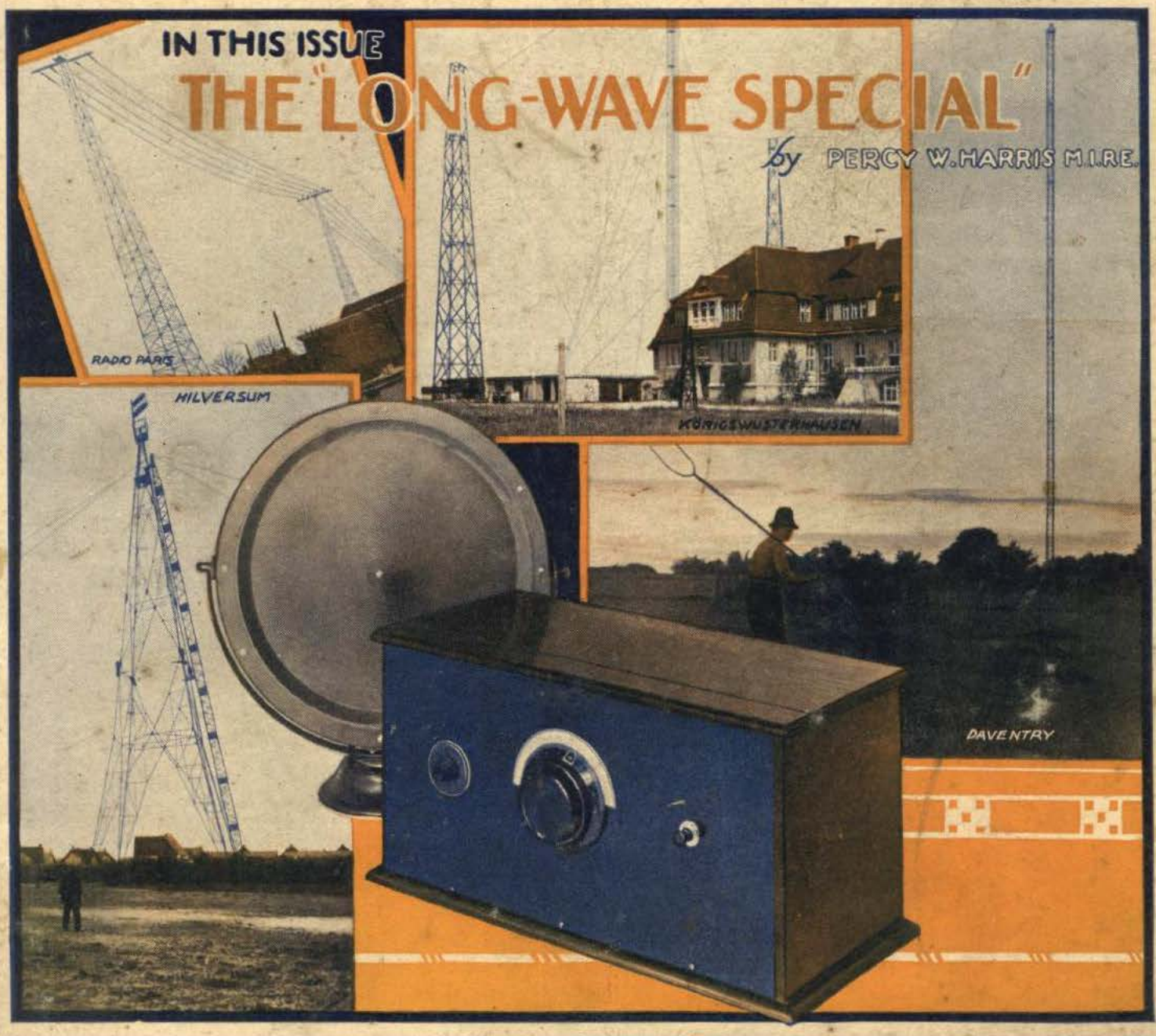

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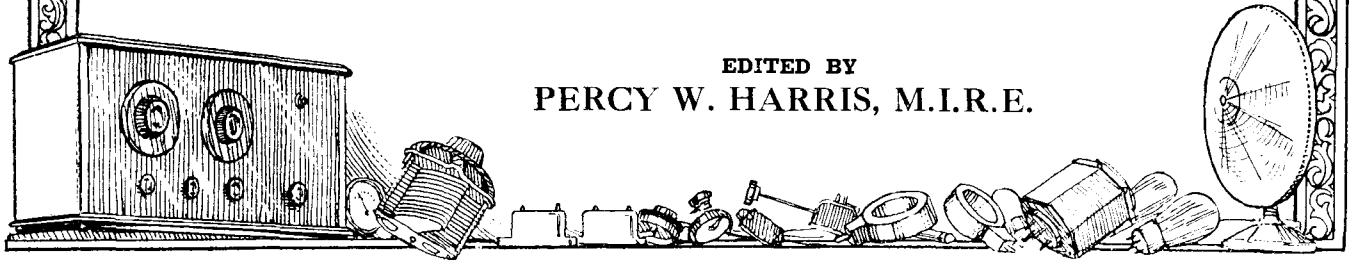

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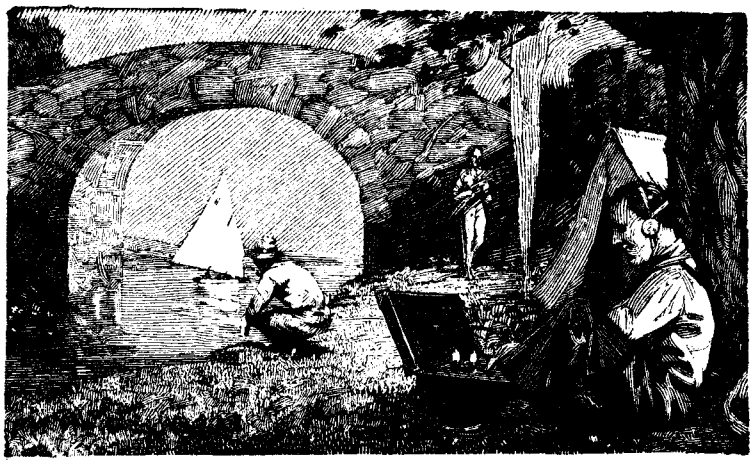
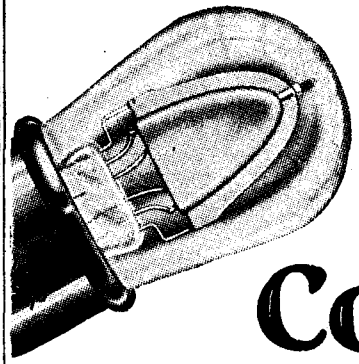


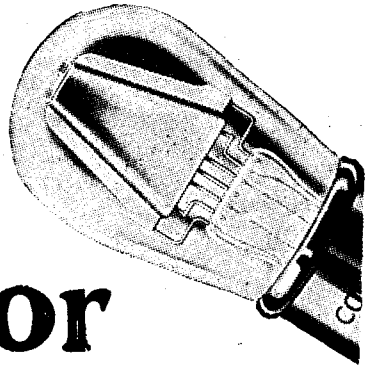
Cossor

—the really strong Valve essential for all Portable Receivers

IF you own a portable Wireless Set you need robust valves. The ordinary valve with its delicate gossamer-like filament is much too fragile to resist hard knocks. An accidental blow and its life is ended. But fortunately for those who enjoy their Radio music in the open air Cossor has invented a filament which is practically unbreakable. The Cossor Kalenised filament is so tough that even after 12 Cossor Valves were hurled 600 feet from an aeroplane every filament was found to be intact. Such a dramatic test had never before been attempted in the history of Radio. It proves once and for all that the Cossor Kalenised filament is the strongest in the world. Remember this when you buy your next valves—whether you want them for a portable Set or not. After all, every man wants long service from his valves—and the Cossor user gets it every time.



Full range for 2 volt 4 volt & 6 volt Accumulators



Cossor

—the melody maker

The WIRELESS CONSTRUCTOR

Edited by
PERCY W. HARRIS,
M.I.R.E.

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THE EDITOR'S CHAT

Percy W. Harris, M.I.R.E., the Editor of the "Wireless Constructor," has something to say about the "Long-Wave Special," and other matters of general interest to all readers.

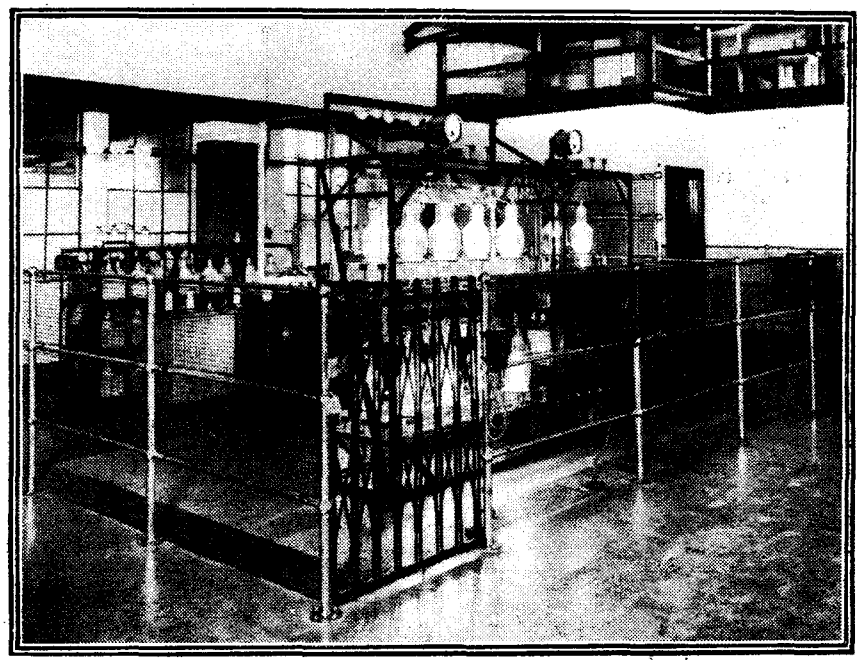
IT is the lot of every Editor to receive a big postbag; indeed, there is something radically wrong with his journal if he does not! By careful perusal of such letters is he able to keep in touch with the opinions and desires of his readers, and thus both readers and magazine benefit.

Such a study of letters from readers of the WIRELESS CONSTRUCTOR has given rise to some of the features in this journal which have the widest appeal. Lately it has been evident that there exists a wide desire for what may be termed a "more specialised" study of the reception of Daventry and the long-wave stations. It would be easy to assume that, as such a multiplicity of stations can be heard on the band between 200 and 600 metres, few people would need—or desire to receive—the longer-wave stations.

The "Long-Wave Special"

Such an assumption, however, would overlook the fact that owing to severe jamming from ship and coast stations reception of the nearest station on the ordinary broadcast band is by no means always the simple task we might believe. Again, while the Londoner may rarely trouble to listen to Daventry, as it is in nine cases out of ten but a repetition of the London station programme, many listeners in the provinces for this very reason prefer it to their local station.

"The Long-Wave Special," which forms the leading feature of the current issue, is a receiver specifically designed for long-wave reception, although, when desired, the ordinary broadcast wave-lengths can be received quite satisfactorily. It has many interesting features which should give it a wide appeal, not the least of which is that although a high-frequency stage is incorporated, single-dial tuning is possible without the difficulties attendant upon the use of gang condensers.



A section of the transmitting apparatus at the Grimsby Beam Station.

One of the most amusing letters I have received for a long time comes from a reader in Dublin who seems to be suffering from what may be termed "Americanitis," or a blind worship of everything in radio that is American.

After pouring scorn on British sets, "To me," he says, "it is very clear that the crystal set and the one-, two-, and three-valve sets will soon be losing all interest to constructing amateurs. Already in America they are dead, and even the four-valve set is fast dying. The future here, as it does there, lies with the frame aerial and six- to eight-valve sets, coupled to battery eliminators run from the house mains."

The WIRELESS CONSTRUCTOR will continue unblushingly to publish

The Editor's Chat—*concluded*

designs for new crystal sets, just whenever improvements in them can be found, and in the same way one-, two-, and three-valve sets as well as multi-valvers will make their appearance from time to time. As a close student of all American radio development I am by no means blind to the fact that multi-valve sets are increasing rapidly in popularity there, but I am equally well aware of the vast difference in conditions on the two sides of the Atlantic. Thank goodness, we have not yet—and I hope we never shall have—twenty or thirty stations working together within a few miles of one another, and therefore we are not forced, as are many Americans, to use frame aerials to obtain sufficient selectivity for comfortable reception of the local station.

Serious Interference

In America interference makes the use of the crystal set impossible; two stages of radio-frequency amplification preceding the detector being in nearly all cases necessary to give sharp enough tuning. Six- and eight-valve sets have come into use in America just because five-valve sets will not give adequate distance and volume on a frame aerial. Such receivers have such an appalling high-tension consumption that they cannot be run satisfactorily from dry-cell high-tension batteries and are almost invariably run from "mains units." As the voltage and periodicity of the American electric-lighting mains are the same everywhere, such mains units can be standardised. In this country we have all kinds of voltages and periodicities, and the problem is much greater.

Fortunately English valves are the best and most efficient in the world, and so far as special valves for resistance-capacity magnification are concerned we are miles ahead of America. Our ·1 amp. valves are decidedly superior to the American quarter-ampere valves, and in addition we have an excellent series of valves specially designed for high-frequency circuits, with a magnification of about 18 to 25, and an impedance of 20,000 to 25,000 ohms. While for resistance-capacity coupling we have valves with a magnification as high as 50, the Americans are still endeavouring to do high-frequency, detection, and low-frequency work (save for super-power valves) with the same general type of valve.

Our Future Policy

British constructional sets are now incorporating the best features from the circuits of all countries, and very high efficiencies are being obtained for the number of valves we use. The aim of the WIRELESS CONSTRUCTOR is to give its readers efficient, inexpensive, and handsome receivers, capable of filling British requirements, and not those of the American public, while keeping them in touch with what is being done on the other side of the Atlantic from time to time.

READERS' RADIANO RESULTS

The Radiano Three in Norwich

SIR,—Having made the three-valve set "Radiano Three" described in the March number of WIRELESS CONSTRUCTOR, I wish to inform you how pleased we are with same.

In the first place, the issue mentioned was the first copy of your journal I had seen, and this was my first attempt at building a set unaided.

The result is most gratifying because, although about 110 miles from Daventry, we are getting splendid volume on loud speaker, the music not only filling the room, but, if required, filling the house. I have added a Lissen anode resistance, thereby enabling me to control both quality of tone and volume.

Without professing any authority to pronounce opinion, it certainly appears to me, a comparative novice, that the "Radiano Three" circuit must be a good one, and the clear instructions and simple chart are well thought out and wonderfully easy to follow.

My sole idea in writing is to express appreciation, as I expect you receive many queries and, perhaps, sometimes complaints.

Wishing you further successes.

Yours faithfully,
E. B. REYNOLDS.

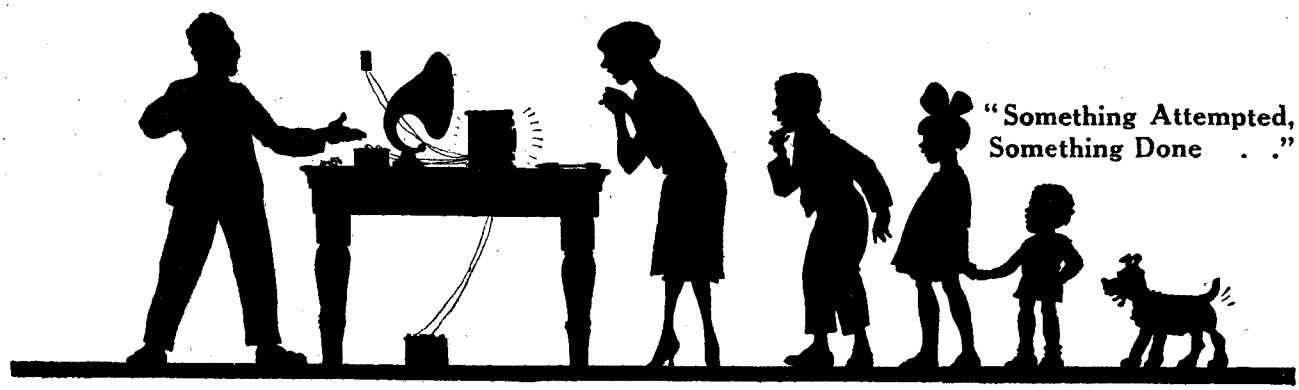
23, Neville St., Norwich.

"A Great Success"

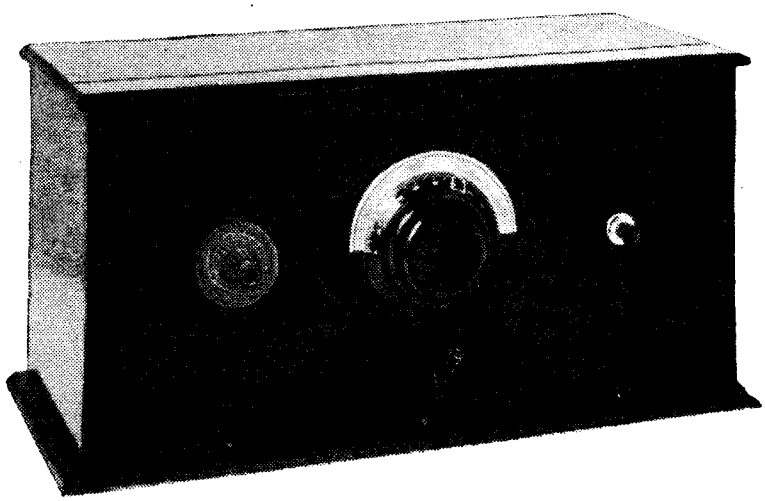
Sir,—I made the "Radiano Three," and it is a great success. Using the parts mentioned by you and P.M. 2-volt valves, with an Amplion £5 5s. speaker, I get splendid volume from Glasgow (60 miles), the same from Daventry, and the Continental stations come in powerfully. Aerial, 40 feet height with 80 feet of wire. Selectivity is excellent and the set is very easily manipulated. The tone is good also. I can tune in Daventry at one o'clock and get Frascati's orchestra on the speaker with more than sufficient volume to fill a fair-sized room. I think this is very good.

Yours faithfully,
JAMES MAXWELL.

Thornhill, Dumfriesshire.



"Something Attempted, Something Done . ."



The "LONG-WAVE SPECIAL"

A NEW SINGLE CONTROL H.F. SET

by Percy W. Harris M.I.R.E.

An easily-built receiver designed for the reception of the many excellent long-wave transmissions now available to British listeners.

THE "Long-Wave Special" has been developed in response to many requests from WIRELESS CONSTRUCTOR readers for an inexpensive, simply controlled, and efficient set, capable of giving three or four alternative programmes in really good quality on the loud speaker. It will be, I venture to say, of more than ordinary interest to the home constructor, for it embodies several ideas which, I think, have not been previously incorporated in any such receiver.

Most, if not all, sets designed for home construction have been primarily designed for the 200- to 600-metre wave-band, and by the use of interchangeable coils and transformers have enabled Daventry, Radio-Paris, and other long-wave stations to be received if desired. In many cases the necessity of incorporating some arrangement to enable Daventry to be received has prevented the designer from making the set quite so efficient as it might be if designed for the shorter band alone. Those of us who are situated sufficiently far from the seaboard to be free from coast stations and ship jamming are rather prone to overlook the fact that thousands of listeners are really dependent upon Daventry for uninterrupted reception, and to them the long wave-band is a necessity rather than a rarely used alternative.

Special Receiver

While considering this aspect of affairs the thought suddenly struck me—would there be any advantage in designing a receiver specially for the *long* waves, with means for tuning on the shorter band if necessary? The more I considered this point the more attractive it seemed, and after a few experiments I realised that there were great possibilities in a direction so far practically unexplored.

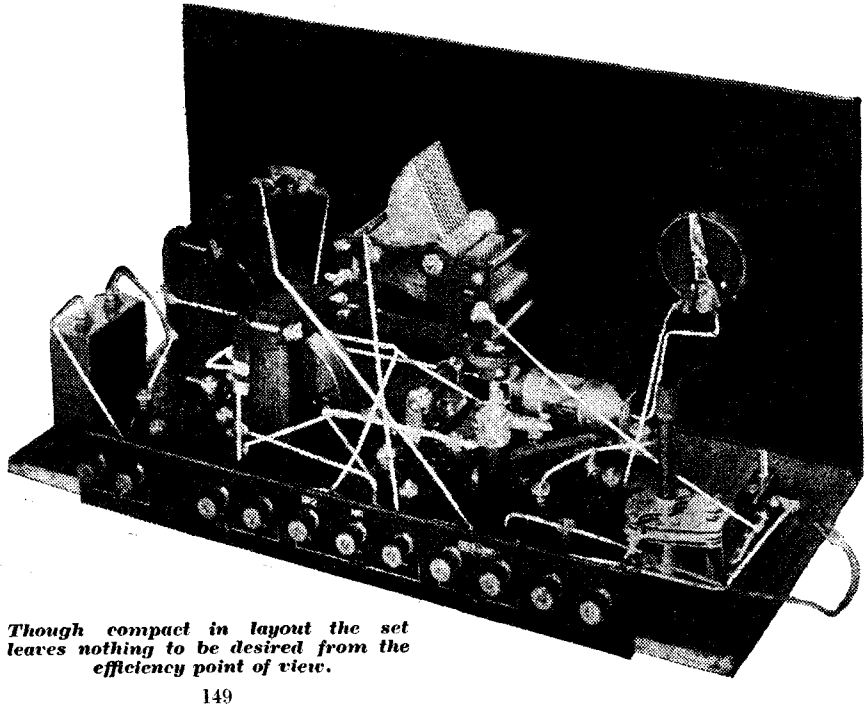
Take, for example, the question of simplicity. True, a detector with two stages of note-magnification and using reaction will give loud-speaker results on Daventry, Radio-Paris, Hilversum, and others (the "Radiano Three" is a good case in point); but, as many experimenters know, if the detector can be preceded by a stage of H.F. magnification less reaction needs to be used, and the quality of reproduction will accordingly be appreciably improved.

Here we come to the first advantage in the "Long-Wave Special." On the Daventry wave-band, resistance-capacity-coupling for H.F. is not only possible but really practicable, and with the new high-magnification valves we can achieve something really worth while.

Many Circuits Tested

R.C. H.F. coupling means considerable simplification, and reduction of cost. Accordingly, a three-valve set suggested itself with such a stage of H.F., a detector, and one transformer-coupled L.F. The H.F. stage, being untuned, dispensed with the usual H.F. tuning condenser, so that a single tuning condenser could be used, with only one coil, or at the most two if reaction were required.

I am sure most readers would be very surprised if I were to give a list of the many arrangements which were tried and discarded before the final design was decided upon. Nearly all the



Though compact in layout the set leaves nothing to be desired from the efficiency point of view.

The "Long-Wave Special"—*continued*

difficult work centred around the reaction control, and in the end an arrangement was found which permitted the use of only one coil, and yet was sufficiently flexible to allow of many different makes of valves working satisfactorily, both in the H.F. stage and as detector.

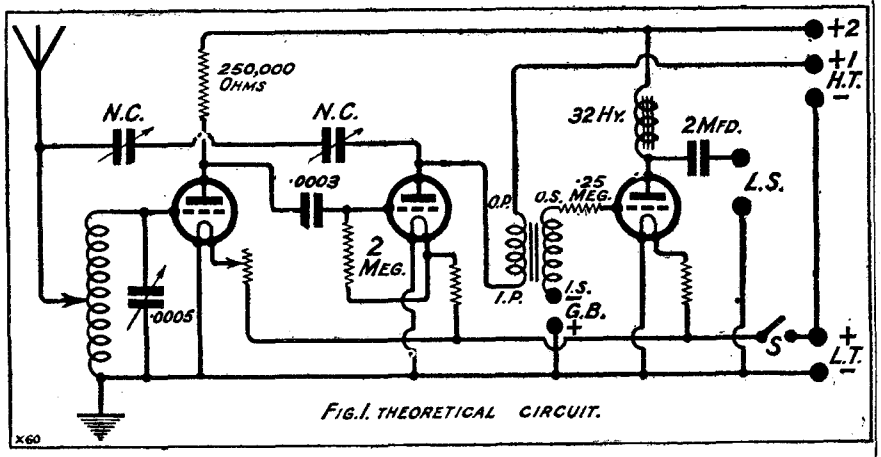


FIG. 1. THEORETICAL CIRCUIT.

Single-Dial Control

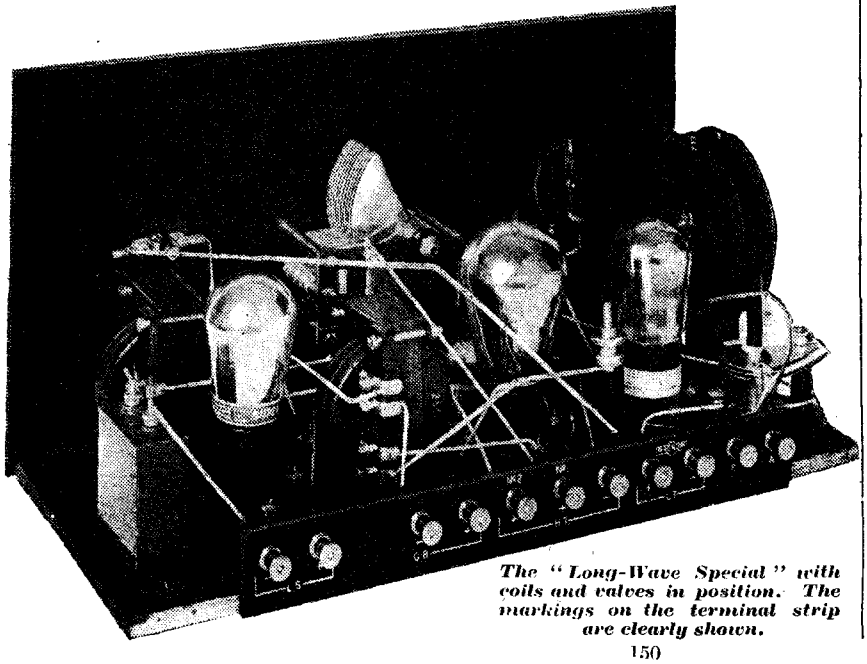
The set as it now stands has a single-dial control and will give loud-speaker reproduction of excellent quality, without reaction being pushed to the limit, on Hilversum, Daventry, and Radio-Paris in broad daylight, with perfectly controllable reaction and excellent selectivity. At night, Koenigswusterhausen and sometimes Moscow can be added. On the ordinary broadcast band really excellent reproduction on the nearest station is obtainable. The set is not intended to receive more than this on the shorter band, as it is specifically designed for high efficiency on the longer wave-band only.

Fig. 1 shows the circuit. The aerial is connected to a tapped coil, the H.F. valve is coupled to the detector by a standard resistance-capacity-coupling method, the anode resistance being from 100,000 to 500,000 ohms (a value of 250,000 ohms is as good as any). The detector valve is coupled by a good L.F. transformer to the output valve, which for best results should be one of the modern super-power valves. For the convenience of those who use these valves, a filter is built into the set so that the direct plate current does not pass through the loud-speaker windings.

A few words need to be devoted to the special form of reaction control and how it was evolved. First of all it was intended to include a reaction coil in the plate circuit of the detector valve and couple it inductively to the aerial, or to use the Reinartz

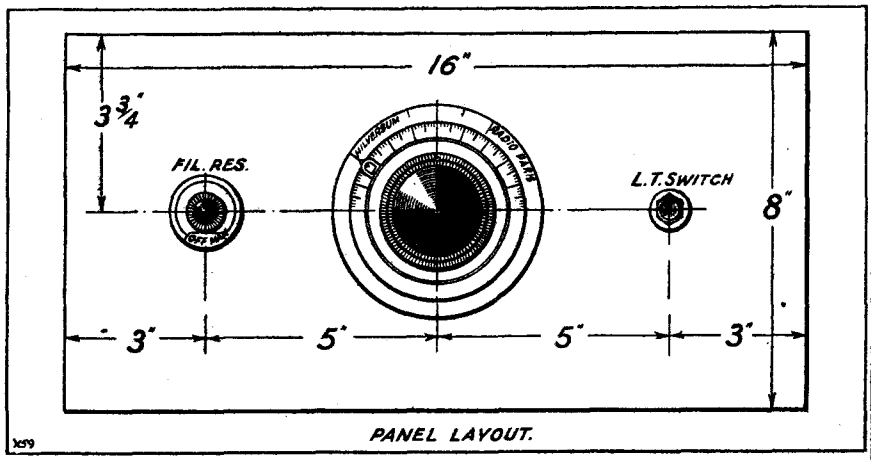
COMPONENTS REQUIRED.

1 standard cabinet to take panel 16 in. × 8 in., in polished mahogany or oak. (Cameo, Caxton, Artcraft, Pickett, etc.)
1 ebonite panel, 16 in. × 8 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in. (Radion, Ebonart, Resiston, etc.)
1 Burndept Etho-vernier Dial, with scale (or other suitable vernier with scale for calibration).
1 variable filament resistance, 30 ohms. (Lissen, Igranic, Precision, etc.)
1 on-and-off switch, (Igranic, Decko, Lissen, etc.)
1 variable condenser, ·0005 mfd. This must be of the flush-fitting type, not the one-hole-fixing variety, if the Burndept dial is to be used as shown. A Cyldon is used in the set. Other condensers of the flush-fitting type can be substituted, such as the Bowyer-Lowe latest pattern, Igranic and others, in which the condenser is held to the panel by two or three screws. If one-hole-fixing condensers are used a special one-hole-fixing Burndept dial can be obtained. If the reader cares to use any of the other vernier dials, either fitted to the condenser as an integral part, or sold separately, he can do so without altering the electrical efficiency of the set.
2 fixed resistors of any of the leading makes.
1 baseboard-mounting coil socket.
3 valve sockets. (Benjamin, Lotus, Precision, Wearite, Magnum, etc.)
1 fixed condenser, ·0003 mfd. (Dubilier, Lissen, etc.)
2 baseboard grid-leak holders. (Dumetohm holder, etc.).
1 grid leak, 2 megohms. Any standard make.
2 grid leaks, $\frac{1}{4}$ megohm. Any standard make.
1 anode resistance with base, 250,000 ohms. (Varley, Mullard, Dubilier, etc.)
1 L.F. choke. (Marconi, Pye, R.I., etc.)
1 L.F. transformer of good make. (See special note.)
1 2-mfd. Mansbridge condenser. (T.C.C., Lissen, Dubilier, etc.)
2 neutralising condensers, one of the "screw up-and-down type," such as McMichael, Gambrell, etc., and one of the interleaving-plate type, such as Bowyer-Lowe, Peto Scott, etc.
1 terminal strip, as shown, with terminals indicated.


The "Long-Wave Special" with coils and valves in position. The markings on the terminal strip are clearly shown.

The "Long-Wave Special"—*continued*

arrangement to obtain a similar effect, but as soon as the experimental work was under way it appeared that, in spite of there being no tuned circuit in the anode of the H.F. valve, the difficulty



PANEL LAYOUT.

was to stop oscillation and not to start it! Not only was the smallest reaction coil most loosely coupled to the aerial far too powerful, but even normal capacity coupling from the plate of the detector valve was too powerful. After a very large number of experiments, including resistance control of reaction, a state of stability was found that proved that not only was the first valve amplifying very considerably, but that the set was far more sensitive than had been hoped for. This particular arrangement, however, proved to be unsatisfactory, as a change of valves completely upset everything, the set being useful for certain valves and no others.

Capacity Value

Luckily, I have on hand specimens of practically all valves now sold, and a series of experiments soon proved that different makes of high-magnification valve vary considerably in their characteristics for high-frequency work. Once capacity reaction had been found to be generally satisfactory it became apparent that some special arrangement would have to be found if different makes of high-magnification valves could be interchanged with equal satisfaction. So small is the capacity needed to give reaction in this receiver that the only practicable method is to use two neutralising condensers *in series*.

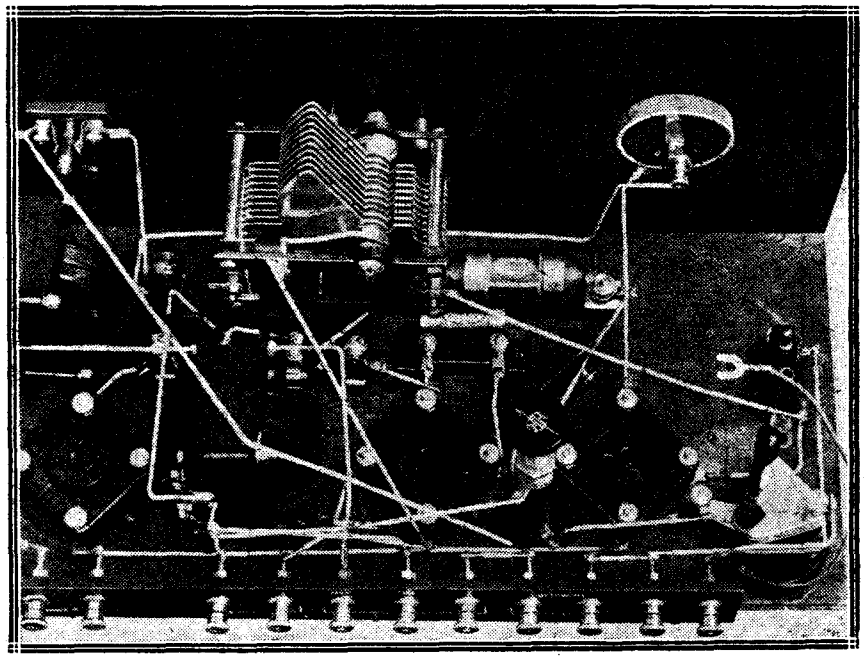
When this is done it is found that some valves such as the Mullard P.M. 5B require one of the two series condensers to be placed at nearly its minimum and the other at about a quarter of its maximum value. Another valve, the Cossor R.C. 6-volt, required one neutralising condenser to be nearly at its maximum and the other at about a third of its value. Other makes of high-magnification valves fall between these limits, although once the correct adjustment has been found, all can be used with good results.

Once preliminary adjustment has been made, reaction is controlled on the neutralising condenser nearest to the aerial, hand-capacity effects being negligible here. This is not the case if adjustment is made on the neutralising condenser next to the plate of the detector valve. With the arrangement shown excellent results are obtainable with a very wide range of valves, even with those of medium impedance and magnification.

So much for theoretical aspects. Let us see now how the set is designed practically. The front panel carries first of all a vernier knob and dial with a calibration scale. On the right of this is placed the on-and-off switch, and on the left the variable filament resistance for the high-frequency valve. I have found the high-frequency valve in this set can be run with a very low filament current, and that with some valves (such as the Cosmos S.P.55B) adjustment of this filament resistance gives a very delicate final reaction control when the maximum volume is required. Behind the panel we have arranged the various components illustrated, the layout of the H.F. side having been given very special attention so as not to lose efficiency.

Constructional Work

First of all mount the variable condenser, variable filament resistance, and on-and-off switch on the front panel, and, without yet attaching this to the baseboard, lay out your baseboard component parts as closely



Care should be taken when wiring up to see that the pin of the coil holder on the baseboard is connected to the earth terminal, while the socket is joined to the grid terminal of the valve holder.

The "Long-Wave Special"—*continued*

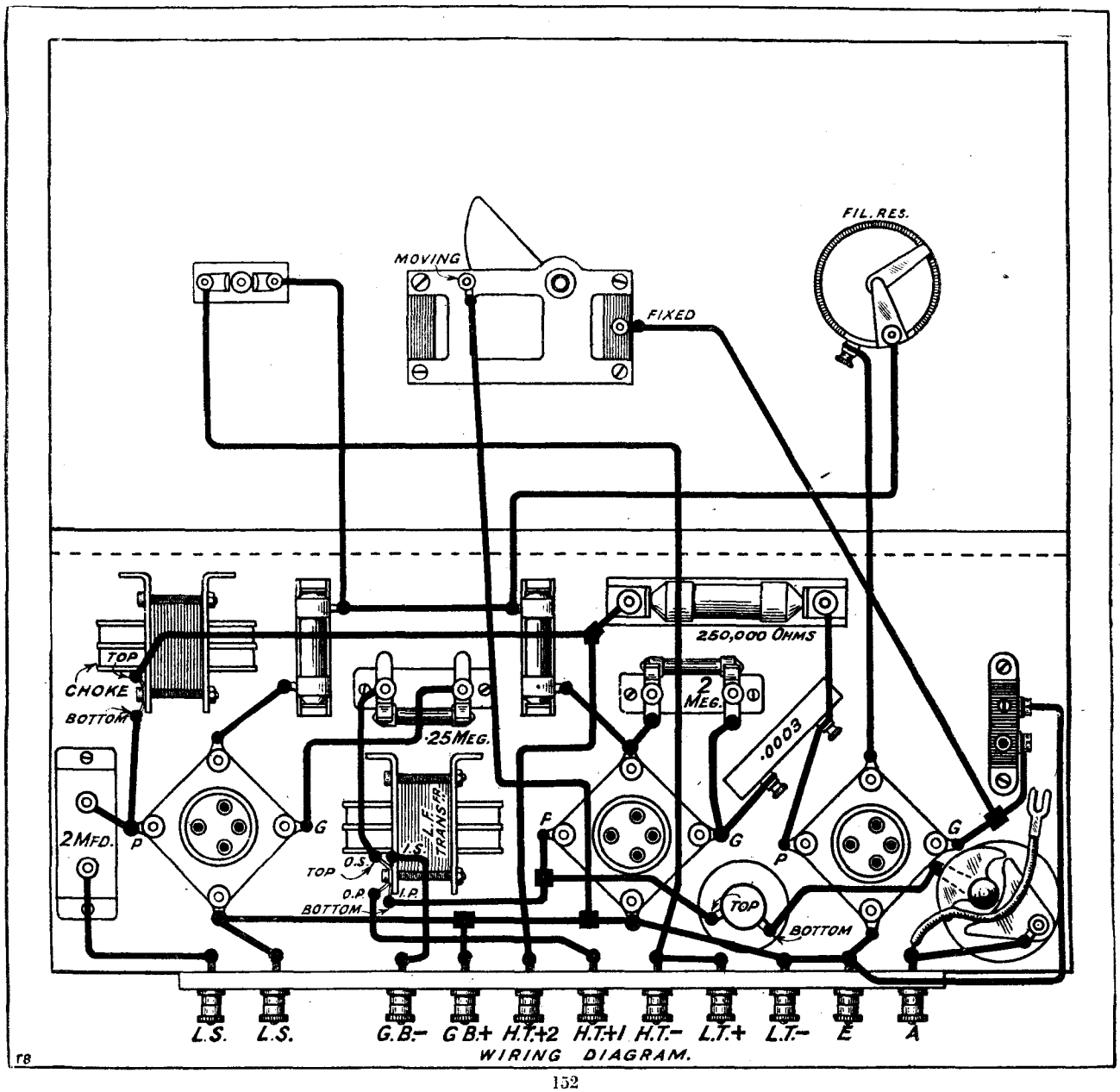
as possible to the positions shown in the photographs and practical wiring diagram. Having stood the baseboard parts in position (do not yet screw them down) bring up the front panel into position and see whether the variable condenser and the on-and-off switch clear the L.F. transformer and the choke respectively. If not, a slight readjustment of the positions of these two parts should be made. The important point in layout is to maintain the relative positions of the neutralising condensers, anode resistance, and ·0003 mfd. fixed condenser as closely as possible to the layout shown.

Before attaching the front panel you can carry out practically all of the wiring on the baseboard in comfort, and when you have wired up these parts as completely as possible (not forgetting occasionally to place the valves in their sockets and the coil in position to make sure you are not fouling anything) attach the front panel and complete your wiring.

A close-up photograph of the wiring of the H.F. side of the set is given, in addition to the usual photographs, so as to help you in this regard.

Choice of Coils

The plug-in coil is preferably of the 250 X variety, with two tappings. Lissen, Gambrell, and one or two other makers are now producing such coils suitable for this receiver. Notice that a flexible lead terminating in a spade is connected to the aerial terminal. This is the connection to one or other of the tappings to the X coil. If high selectivity is not required you can use a centre-tapped coil just as effectively, and, indeed, you will get a slight increase in signal strength by using such a coil, at the expense of selectivity.



The "Long-Wave Special"—*continued*

Normally you will use a 250 X type coil with a flexible lead connected to the larger of the two tappings. If you use a Gambrell centre-tapped coil an E and an E1 will between them cover the long wave-band satisfactorily. An E will give you Daventry and Radio-Paris, and will not come quite low enough for Hilversum, for which an E1 coil will be necessary. It is, however, generally preferable to use one of the long-wave X-type of coils, as the one coil will cover the whole long wave-band and give you very good selectivity with comparatively little loss of signal strength.

Choice of Valves

Provided you use for the first circuit one of the resistance-capacity-coupling types of valves, an H.F.-detector type of valve for the detector, and a small power valve or a super-power note-magnifying valve (if you are getting very loud signals and you want undistorted reproduction), you can use any of the leading makes with satisfaction. There will, however, be considerable differences of adjustment with the two neutralising condensers in series when changing from one make of valve to another.

Once you have found the right setting for these condensers only one will need to be varied, and that for reaction control only. By the way, do not be tempted to alter the layout and put the reaction condenser on the front of the panel. If you do so the whole working of the set will be upset.

The Operating Adjustments

When all wiring has been completed join up your batteries, using a grid bias suitable for the L.F. valve chosen, and connect your loud speaker. Connect up aerial and earth, and join the flexible lead to the larger of the two tappings on the X coil. Set the screw-down neutralising condenser (that nearest the plate of the detector valve) at the minimum position and the interleaving-plate type also at its minimum.

Adjust the variable condenser till the plates are set at maximum capacity position, and use about 100/120 volts on H.T.+2, and about 60 to 90 on H.T.+1. Set the variable resistance near the full "on" position and switch the set on. It is improbable that you will hear any signals with the condenser plates at maximum, as here it does not tune to any broadcasting station. The next procedure must be very carefully carried out.

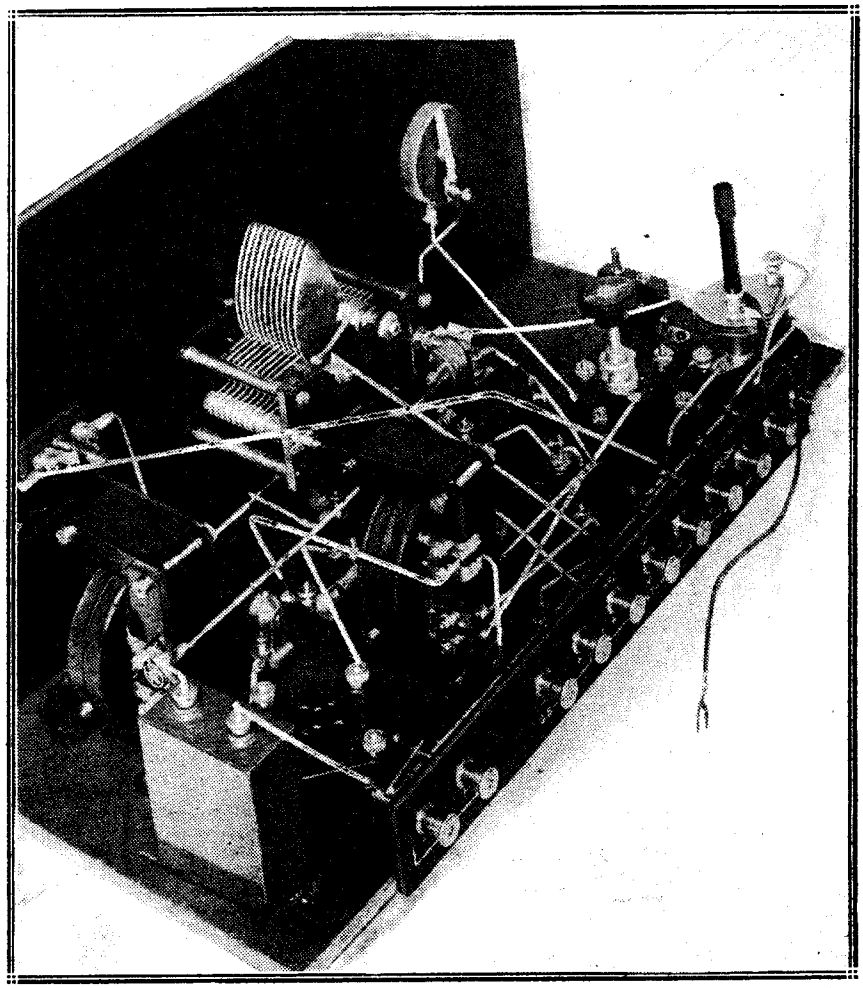
Now set the interleaving-plate neutralising condenser so that the plates are about a third or a half interleaved, and then carefully turn the up-and-down neutralising condenser towards its maximum position until the set oscillates. This will be indicated by a slight "plop" in the loud speaker.

Leaving this condenser where it is, vary the interleaving-plate condenser, and you should find that you can bring the set in and out of oscillation by turning it towards maximum or minimum respectively. If you find you can do this, try various positions of the tuning condenser to make sure that the set can be made to oscillate freely over the whole range. Preferably make these preliminary adjustments out of broadcasting hours, to avoid interference with other listeners.

The different makes of R.C. valves will be found to vary considerably in regard to the amount of capacity required in the screw-down type of neutralising condenser. The P.M.5B, for example, will require this set nearly to its minimum, whereas the Cossor 6-volt R.C. will require it near the maximum. Somewhere or other within the range of this condenser you will be able to find a correct point for any of the R.C. valves.

Filament Control

The variable filament resistance on the H.F. valve will serve as an additional fine reaction control, but a still more important function is to enable you to run the filament of the H.F. valve at as low a temperature as will give efficient results.



The two neutralising condensers are clearly discernible in this photograph taken from the L.F. end of the set.

THE "LONG-WAVE" SPECIAL

concluded

With most valves this filament can be run at a very much lower temperature than would normally be the case, and its life will therefore be appreciably prolonged. Some valves, such as the Cosmos S.P.55B, are sensitive to the filament current changes, and in such cases there will be an appreciable reaction control on this filament resistance. Others, such as the S.T.61A, will work practically as well over the whole range of the 30-ohm filament resistance.

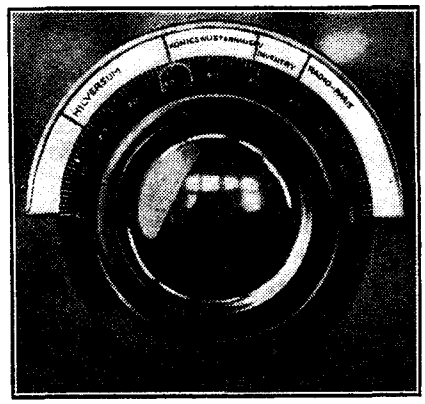
Operation

To operate the receiver adjust the reaction condenser so that the set is below oscillation point over the whole range, and then simply turn the single dial until you hear the station required. You will probably pick up Hilversum, Konigswusterhausen, Daventry, and Radio-Paris without any alteration of reaction control and directly on the loud speaker. Once the station required is found, lift the lid of the cabinet and make the slight readjustment of the interleaving-plate condenser to get maximum volume. To use the set on the short wave-band you can use either the normal centre-tapped coil or a 60 X coil. The real efficiency of this set, however, is on the long wave-band, and normally you will not be able to bring the set up to oscillation-point on the shorter band by varying the reaction condenser, although this will give an appreciable amplifying effect. However, by using a centre-tapped coil, such as a 40 or 30, a much greater reaction effect is obtained, and probably you will be able to bring the set up to oscillation-point over most of the band. In any case, the set is sufficiently sensitive to bring in your nearest station at really good loud-speaker volume, and you will notice that, on the shorter as well as on the longer waves, the quality of reproduction is considerably above normal. Indeed, several people, when listening to this receiver, have gathered the impression that it is a well-designed resistance-capacity-coupled set.

Test Report

On tests extending over a very appreciable period this set has been found to bring in Hilversum, Daventry, and Radio-Paris at loud-speaker strength in broad daylight on every occasion when it has been tried. As I write, Hilversum is giving an excellent programme with this set through an Amplion Radiolux at 2.15 p.m. For some reason or other Konigswusterhausen does not come over very well in daylight, but after dark excellent loud-speaker reproduction has been obtained from it. At times other stations have been heard, but those named are regular, and are a real source of entertainment to the listener. The quality of reproduction from Hilversum, in particular, is exceedingly good in these days, and better than that usually obtainable from Radio-Paris.

Thus, for anyone who wants loud-speaker reproduction in daylight from three countries on three valves, the "Long-Wave Special" fills his requirements, at the same time providing a set able to give excellent quality



The type of dial used in the original receiver enables the names of the stations to be inscribed on a special "station card."

from the nearest station on the ordinary wave-band.

A very interesting application of the set is to simultaneous reception, in two different parts of the house, of two distinct programmes. As I write this 2 L O is operating two loud-speakers in the house, while I am listening on telephones to a different programme from Daventry, using six feet of wire in the laboratory as an indoor aerial.

A "CLIP-IN" CONDENSER ATTACHMENT

ONE requires so frequently to shunt anode resistances with condensers, whether they are used on the high-frequency side of the set or on the low, that it saves a great deal of time to add to one's existing resistance holders the condenser clip attachment seen in the fig. It is then the simplest matter in the world to slip a condenser into the clips in order to test the effect of a shunt capacity.

To make the attachment calls for no great skill. A pair of condenser clips are bent, as shown, their tangs being at right angles.

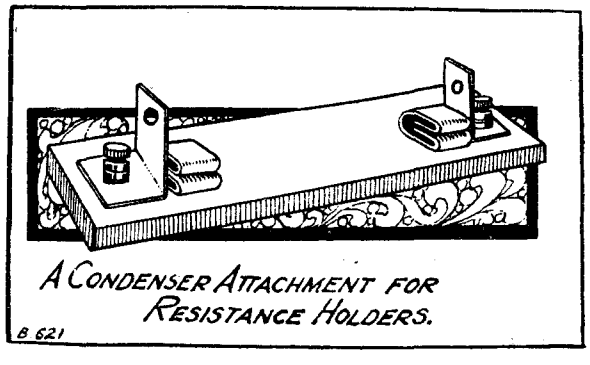
The condenser clips having been dealt with in this way, detach the spring resistance clips from their base and remove from them their lacquered surface by means of emery paper. Then tin the places to which the condenser clips are to be attached, as well as the tangs of the condenser clips.

A Perfect Fit

Having thoroughly cleaned the surfaces, apply a little flux and then run on a small amount of solder.

The coating of solder should be thin and smooth, not thick and "blobby." When the tinning is done take one clip and one resistance contact and place the two together in the position that you wish them to occupy. Apply a little flux to the tinned surface of one of them. Hold them together in a pair of pliers and place them in the flame of a spirit lamp, a gas ring, or a blow lamp until the solder runs. Then withdraw them and allow them to cool before releasing your hold with the pliers. As soon as they are cool the two will be found firmly joined together. The holders of Dubilier resistance clips are conveniently just so placed that when clips are fixed as suggested they are a perfect fit for the condensers.

Care must be taken when bending the condenser clips that the metal at the bottom of the bend is not cracked. Soft brass is preferable to very hard metal.



A CONDENSER ATTACHMENT FOR RESISTANCE HOLDERS.

B 621

I RATHER fancy I am entitled to the Banana-skin Sliding Championship of the World, but until I receive confirmation of my claim to it from the authorities I shall delay ordering a larger size in hats or putting on frills of any kind. It happened whilst I was taking the air the other day. Strolling down the High Street, meditating the while upon the metagrobolisis of dielectric thingmejigs, I passed the establishment of Mr. Grubbs, our largest dealer in fruit and veg., just at the moment when his youngest urchin flung upon the pavement a banana skin for which he had apparently no further use. It reached the flagstones a fraction of a second before my right foot, which descended gracefully but firmly upon it. The next instant I was whizzing down the High Street with a velocity that would have left light-waves standing still.

"Why, Professor Goop!" I cried.

As measured by me upon the following day the total distance covered was 162 yards 2 feet and 9·4123 inches. Though this, so far as I can make out, beats the previous record by at least ·0001 inch, I should have travelled a great deal further had it not been that, like the bullet in the proverb, I found my billet.

My Journey is Broken

Just before I began my epoch-making skid, I had observed, some distance in front of me, the back view of a figure which somehow seemed familiar. I was just trying to puzzle out which of my acquaintances it could be who was likely to parade the High Street wearing one patent leather boot and one gym. shoe, when Mr. Grubbs's infant set the Wayfarer, so to speak, wayfaring. The figure seemed positively to leap at me, though in reality I was, of course, leaping at it. Anyhow, the result was in the end the same. We met with that sickening thud of which the best lady novelists are so fond.

An Old Friend

Mathematicians tell us that when a fast-moving body is stopped by impact with an obstacle heat is generated. Though I have at ordinary times little respect for mathematicians I must admit that this statement of theirs appears to be true. As I gradually regained consciousness the cause of my sudden deceleration was telling the world all about it in one of the most impassioned oratorical passages that I have ever listened to. I regret that I am unable to reproduce it here, for the very good reason that the WIRELESS CONSTRUCTOR is not printed upon asbestos pages, and that the supply of asterisks, daggers, dashes, and other such things at the disposal of the printers is far too limited. There seemed to be something vaguely familiar about the voice. Having lain until all hopes of anyone arriving with brandy had disappeared, I slowly sat up and regarded the human shock-absorber who had unintentionally done such a noble deed that day.

I looked again. I rubbed my eyes. There was no doubt about it.

"Why, Professor Goop!" I cried.

"— — . . . . — — * * * * † † † †," chanted the professor. "Why, it's Wayfarer! Really, my friend, I don't know what is coming over people nowadays. Do you know, somebody has just pushed me right over."

"I absolutely agree," I said. "Nothing can be more deplorable than the manners of the rising generation. I also have been positively hurled down the High Street."

We picked each other up, performed a mutual dusting down (I took good care to borrow the professor's handkerchief before doing my share), and continued upon our way together.

"But what," I asked at length, "are you doing here?"

"Why, just walking up to my house," said the professor.

"But, my good old friend," I cried, "you're miles and miles and miles away from home. This is Mudbury Wallow."

"Mudbury what?" screamed the professor.

"Wallow," I told him.

"Then, hang it all," he said, "I must have got into the wrong train again. Anyhow, it seems a pleasant sort of place, so I will stay here."

"But where?" I inquired.

"There seem to be plenty of houses," said the professor; "that is quite a nice one over there, and it seems to have a good aerial. I will have that."

Without further ado he opened Miss Worple's garden gate and advanced towards her front door. He turned the handle and walked in. The next moment he had flung himself into the most comfortable chair in her drawing room, and was removing the boot and the gym shoe, explaining to the scandalised Miss Worple that pavements always made his feet ache.

Miss Worple Surprised

Under the horror-stricken eyes of the good lady, whom surprise had deprived of her wonted powers of speech, he appropriated the tea cosy, placed both his feet inside it, sank on to the chesterfield, and announced that he proposed to take a little nap to

Before Miss Worple could say anything he was snoring loudly.

restore his shattered nerves. Before you could say knife—in fact, before Miss Worple could say anything at all—he was snoring loudly.

"W-w-w-who," quavered Miss Worple, "w-w-who is this terrible t-t-t-tramp?"

In Lighter Vein—*concluded*

"Hush, dear lady!" I breathed. "Little do you know that you are entertaining an angel unawares."

"Angel!" snorted Miss Worple. "Looks a jolly sight more like the other thing! Anyhow, what *is* it?"

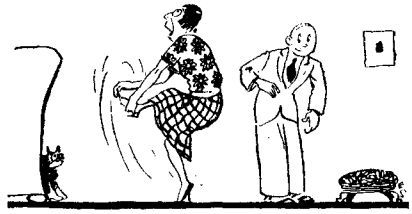
"The august, though admittedly somewhat dishevelled figure that is at the present moment honouring your sofa, is no less——"

"Cut it out!" snapped Miss Worple. "Tell me what the dickens your friend, Tired Tim, thinks he's doing?"

"Snoozing," I said helpfully.

A Famous Inventor

Miss Worple stamped hard with her right foot—not upon the floor as she had intended, but upon her left. Whilst she was hopping round the room I explained that her guest was no other than *the* Professor Goop.



Miss Worple stamped hard with her right foot—upon her left!

Miss Worple suddenly stopped hopping.

"Do you mean," she breathed, "the inventor of the Super-Putridyne and the Hypoiodine?"

"Yes, yes!" I hissed. "And not only of these things; he is the man who made long-distance reception what it is by being the first to suggest that hand-capacity effects might be eliminated by using the feet for operating the tuning controls; who showed the futility of those writers who in one line advocate the elimination of damping and in the next advise enthusiasts to water their earths; who was the first to raise his voice in protest about the interference with FFB caused by Newcastle and Birmingham; who designed the smooth file for those whose teeth are set on edge by the disgusting noise produced by the ordinary tool; who gave to the world the Goop Rubber Staple for fixing bare leads; who demonstrated that kilocycles, if given a proper chance, could produce just as many heterodynes as metres, and who invented the Li (with its compounds the Bigali and the Damli) as the unit of efficiency in the long-distance receiving set."

Miss Worple listened spellbound. I was just going on to tell her more when the sleeping professor emitted a snore of such shattering amplitude that the overloading of his eardrums caused him to wake with a start.

Miss Worple is Ejected

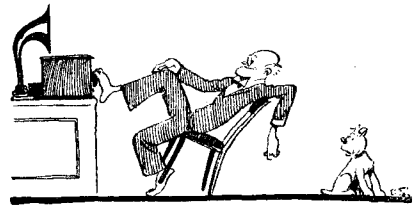
"A nasty atmospheric, that," he remarked, sitting up with a smile. "Wayfarer, what is this lady doing in my drawing-room? Tell her to go away at once."

I hastily effected an introduction, explaining to the professor that it was Miss Worple's house.

"Nonsense!" cried Professor Goop. "Such a house would be quite wasted upon a woman. She has my permission to depart. Surely, madam, you have an aunt or something of the sort to whose abode you can go? You appear to be at least twenty-one; go to some quiet place and meditate upon your responsibilities now that you are about to have a vote."

Rising from the sofa, he gently shooed Miss Worple out of the room into the hall and out through the front door, which he locked, barred, bolted, and chained.

"And now, my dear friend," said he, "we can get down to work once more Let us immediately tackle the question of variable condensers. Now, it is perfectly clear that dust can get in between the vanes and cause trouble. Why should we not prevent its entry once and for all by filling up the spaces between the vanes with cotton wool? We can do better than that; we can make the cotton wool itself a collector upon its surface of the very dust that does so much harm. All that we have to do is to wet it,, and if we use as our moistening medium water mixed with



Hand-capacity effects might be eliminated by using the feet for operating the controls.

a proportion of sulphuric acid we shall be able to destroy the dust as soon as it settles."

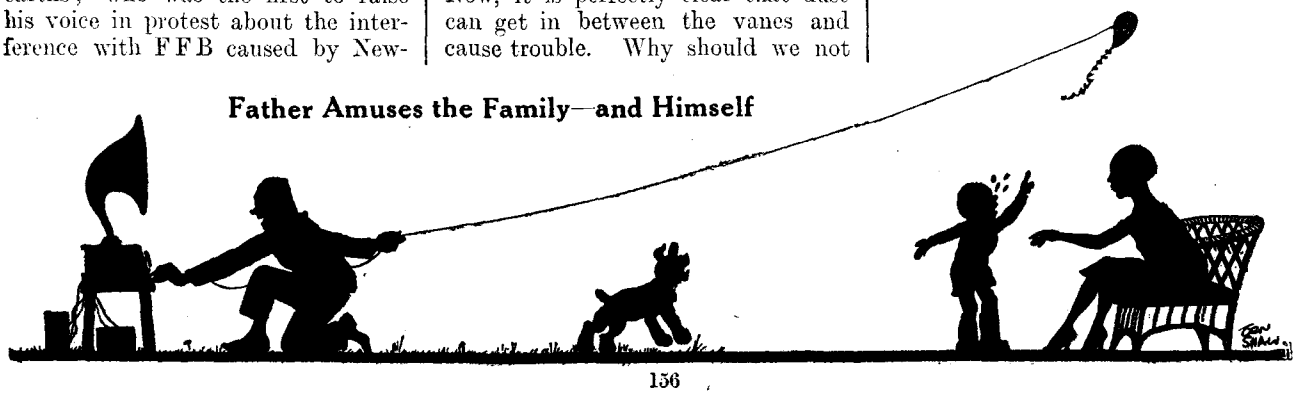
The professor was now becoming thoroughly worked up on the subject of condensers. He told me that he could never see why the moving plates should be turned into mesh or out of mesh with the fixed.

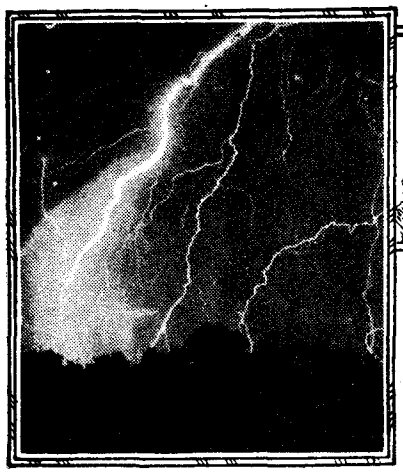
More Simple Method

It would clearly be vastly more simple if a variable condenser were designed which worked in exactly the opposite way. Why should it not be possible to leave the moving plates always in the same position and to make the fixed plates rotate about an axis? This scheme, he explained, would render tuning an infinitely more simple business. We were still hard at it late in the evening when, during a discussion of the area of semi-circular plates, the mention of π made us both feel hungry. But for the professor's invention of a Welsh rarebit made by French leave in a Dutch oven by Englishmen we should probably be hungry still.

WIRELESS WAYFARER.

Father Amuses the Family—and Himself





Summer "DX" Work

Long-distance (DX) reception is not difficult in summer if one goes the right way to work, as this article shows.
From a Special Correspondent.

MOST amateurs believe that reception of distant stations in summer-time is, to put it colloquially, "a washout"! It must, of course, be admitted that in winter-time DX work is productive of more interesting and varied results, but it must not be assumed that in summer-time the reception of distant foreign stations is by any means impossible, or that the results one can obtain are uninteresting.

Many Stations Audible

For instance, the amateur who looks into the situation carefully will realise that there are quite a number of foreign stations which he will not have much difficulty in receiving throughout the summer months.

There are many transmitting on low power which, although they can be heard clearly in the winter, will be difficult, if not impossible, to receive in the summer, but there still remain a great number working on sufficient power to ensure good reception not only in winter-time but in summer-time.

Of course, atmospherics are the great bugbear in summer-time, and their effects on reception from distant points are often adverse. But if the amateur "scouts round" on the wave-lengths between, say, 300 and 500 metres, he will find that atmospherics are not so troublesome as, say, on wave-lengths exceeding 1,000 metres.

Short-Wave Reception

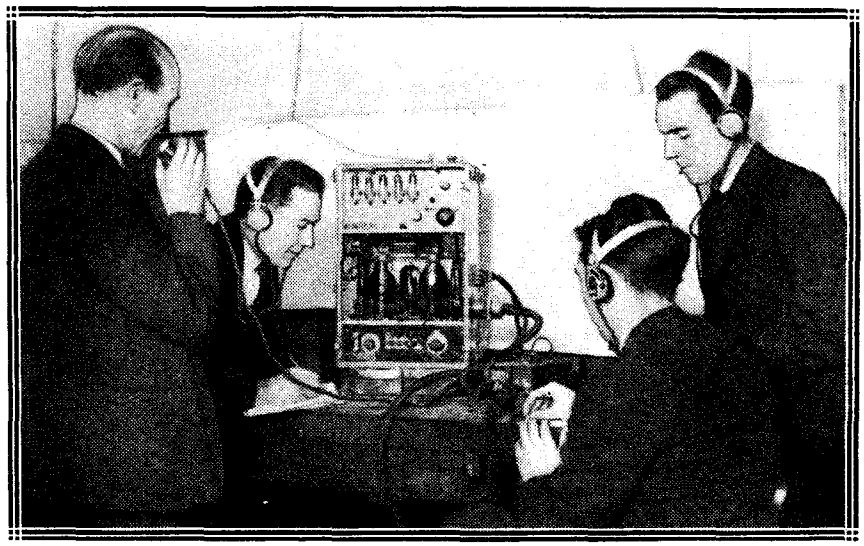
The WIRELESS CONSTRUCTOR this summer has already drawn considerable attention to the advantages of short-wave receivers, and it must be remembered that there are quite a number of very interesting transmissions on the "medium-length" band, from 200 and 300 metres; while from America there are transmissions on even lower wave-lengths which the amateur should have little difficulty in receiving on, for example, the "Short-Wave Radiano."

Let us consider some of the stations below 300 metres. A good many of them, for instance, relay the transmissions of main stations using higher wave-lengths, and therefore, if a programme cannot be picked up from a main station on a higher wave-length owing to atmospheric or other interference, there is a chance of hearing it free from interference of any great degree from one of the shorter-wave stations relaying the main programme.

A good example of this is Langenberg, which very often relays Dortmund (283 metres), and Munster (241·9 metres). And the Stockholm programmes, if they cannot be received from the main station or from Motala, may often be heard from Malmo (260·9 metres). This station, by the way, is coming in as this article is written with considerable volume and clarity. Using the "Black Prince" receiver, which was recently described by Mr. Harris in our contemporary, "Modern Wireless," I find that Malmo is easily the loudest of Continental stations which I can receive—and I say this advisedly—although I can obtain excellent signals from such stations as Berlin, Frankfurt, Stuttgart, Hamburg, Toulouse, Vienna, Rome, and many others.

Long-Distance Relay

A station of like interest is Kiel, which works these days on 254·2 metres. This station often relays the Hamburg programmes, while Gleiwitz, on 250 metres, relays those of Breslau.



Air mechanics receiving their training in radio at the Chelmsford Wireless College.

Another interesting short-wave station is PCJJ, the new Dutch broadcasting station working on 30 metres. This station is more or less famous, for it has been successfully relayed in Australia. I recently listened to PCJJ and found the transmissions clear and steady. Later on in the evening, however, there was a certain amount of distortion, from which short-wave telephony seems to suffer, and later on still a rapid fading, similar to that experienced when

Summer "D X" Work—*concluded*

listening to American ultra short-wave stations.

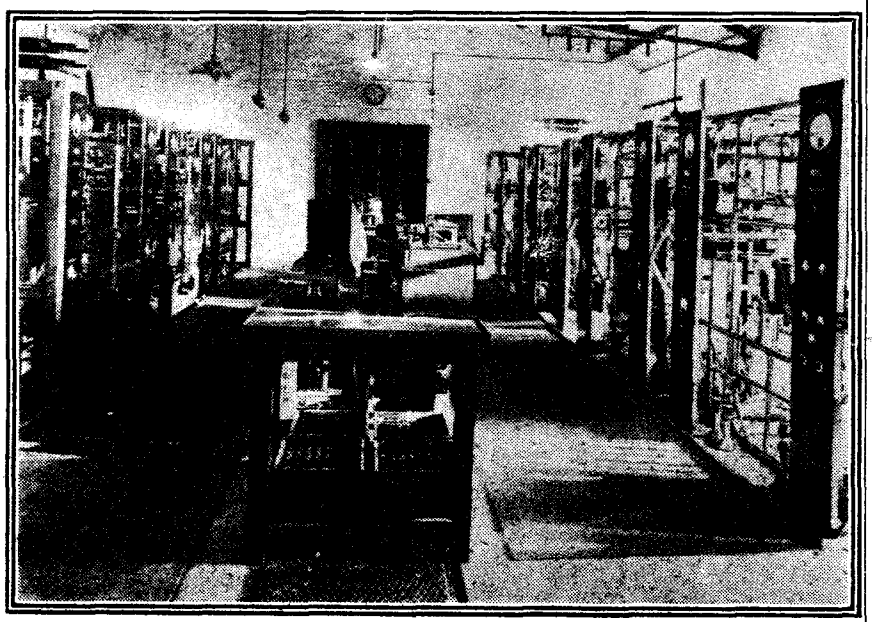
K D K A, Pittsburg, on 63 metres, is coming through fairly well these days, but here again fading is apt to ruin reception completely as the evening advances.

Crowded Wave-Band

Most of these short-wave stations, I find, can be received quite easily on summer evenings, especially the transmissions from Toulouse (P T T) which is now working on a wave-length a fraction below that of Malmo. Then there is the new Polish station at Posen which was opened the other day, and which was working, when last I heard it, on about 270 metres.

Listeners who have been tuning in on the longer wave-lengths have no doubt noticed lately that these longer wave-lengths are becoming very overcrowded. Tests have recently been made to find out how much degree of separation of wave-length between these long-wave stations is necessary in order to eliminate interference. The interference is especially bad, I notice, on wave-lengths between 1,000 and 1,500 metres, and this is not to be wondered at when one realises there are far too many broadcasting stations on the Continent operating on that wave-band. Theoretically it should only accommodate about twelve stations. The trouble is likely to become worse, for there are many high-power long-wave stations now under course of erection. There is one in Italy which is very nearly complete, and which will shortly start operating on 1,600 metres and 2,000 metres, while the big station near Amsterdam is due to come on the air shortly with a wave-length of 1,850 metres, and another one at Stockholm on 1,320 metres is announced to begin broadcasting shortly with the colossal power of 120 kw.

However, the growing practice of some of the smaller stations relaying the programmes from the big stations is likely to prove very popular. A good example of this is the relay from Motala. The Stockholm programmes are not always very easy to pick up because they are considerably interfered with, and it seems that 450 metres is just a little too close to the ships' wave-length for safety.



From the table shown in the centre of this photograph the Beam service from Grimsby is controlled.

Easily Received Station

Motala, which has a power of 30 kw., is quite easy to pick up, although the wave-length is 1,305 metres and, no doubt, will be interfered with by atmospherics, etc., as the summer progresses.

The atmospheric bugbear is indeed one which becomes felt more acutely as each summer comes along, but perhaps there is some hope for the future, for war has recently been declared on atmospherics by a committee of the Royal Meteorological Society, and at a meeting which was held recently it was explained that forty-eight observers situated all over Europe have been enlisted to help. After seventeen days of observation and the collection of data from these observers, the following conclusions were drawn up:

1. That the average range of many atmospherics exceeds 1,850 miles and reaches 4,500 miles;
2. That very few atmospherics have a range of less than 100 miles; and
3. That the random reports sent in from observers require fuller examination in regard to the meteorological environment of individual observers.

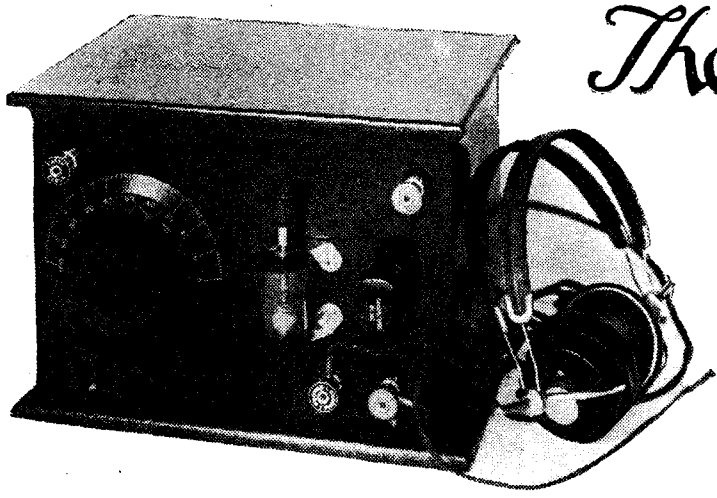
Tracking X's

It seems to be a new game these days to collect atmospherics just as the DX listener collects and logs the largest number of distant stations. Up to date, the leading "X-hound" is Mr. W. L. Fox, of Falmouth, who, while listening to 5 X X recently, recorded a mean number of about 90·3 atmospherics. The next largest number was 58·9, recorded by a gentleman listening in at Wraysbury, near Windsor.

The scheme of observation in connection with this war on atmospherics is rather interesting. It has been based on the use of the individual syllables of a broadcasting talk as "time-marks" to which could be referred the time of incidents of individual atmospheric disturbances.

Accurate Charts

Up to date a certain amount of success in connection with this war on atmospherics has been claimed by the Meteorological Society, and it has been decided to apply to all the meteorological services of the world for full data of thunderstorm disturbances on the seventeen dates of the observations which were recently held. It is hoped that from this information it will be possible to compile thunderstorm charts for the whole world, on which to base, for future use, a detailed report showing the connection between the atmospheric disturbances of the dates in question and the world meteorological situation on those dates.



The "CUT-OUT" CRYSTAL SET

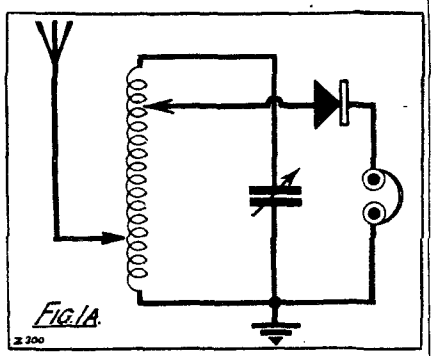
Owing to the rapidly increasing number of stations it is often necessary to have a really high degree of selectivity, even in crystal sets.

By G. P. KENDALL, B.Sc.

MY experience of crystal users' difficulties in the Query Department of the WIRELESS CONSTRUCTOR has convinced me that it is time that rather more thought be given to the requirement of selectivity in designing crystal sets. In the first place, there are a number of areas which are within crystal range of a station, but in which spark Morse jamming is a really serious problem; the average crystal set is absolutely helpless to minimise such interference, as many dwellers on the South Coast and elsewhere know to their cost.

Daventry Junior

Secondly, there is the possibility of an alternative programme being provided on the 250–550 metre wave-band, and if and when this comes to pass there will certainly arise a very awkward situation for users of the older type of non-selective crystal sets, which must lead to a good deal of scrapping and rebuilding. With this fact in mind it would certainly seem advisable to see that any new crystal set which one builds shall possess a sufficient degree of selectivity to cope with possible developments of this sort when they arise.

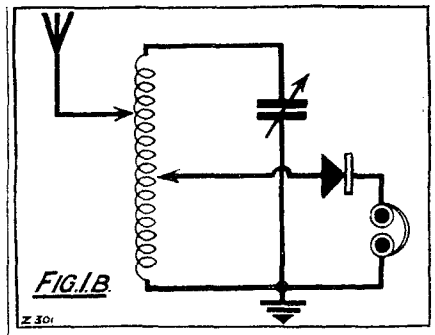


The best position of the tapping clips is found by experiment.

It is quite possible to achieve a useful degree of selectivity in a crystal receiver without any loss of signal strength as compared with the old type with a plain tuned aerial circuit, and this without any undue complication. The receiver illustrated in the photographs in this article has been made to show how simply the desired end can be achieved; the only special feature is the home-wound coil arranged to use a well-tried type of circuit, and the results are certainly very pleasing.

Results on Test

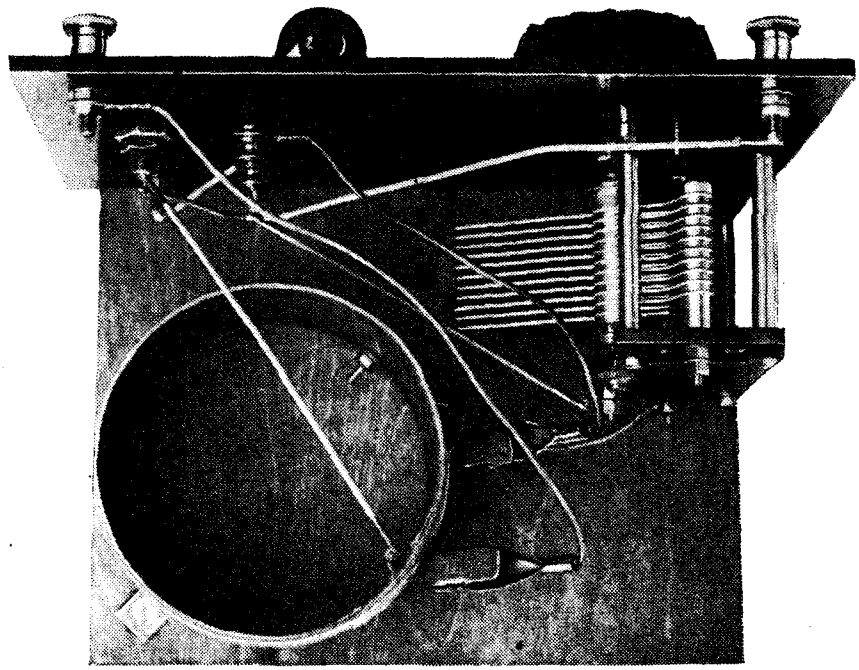
Tested on a full-size outdoor aerial at 8 miles from 2 L O, the degree of selectivity was found to be quite useful, being of a standard capable of minimising jamming quite considerably, while the signal strength was



With a small aerial the tappings may be best located like this.

equal to the maximum obtainable from the best set of the direct-coupled type once the correct position for the aerial tap had been found.

Mention of the aerial tap brings us to a consideration of the circuit used, and diagrams showing this will



The two small brackets used for securing the coil to the baseboard were a pair of grid-leak clips.

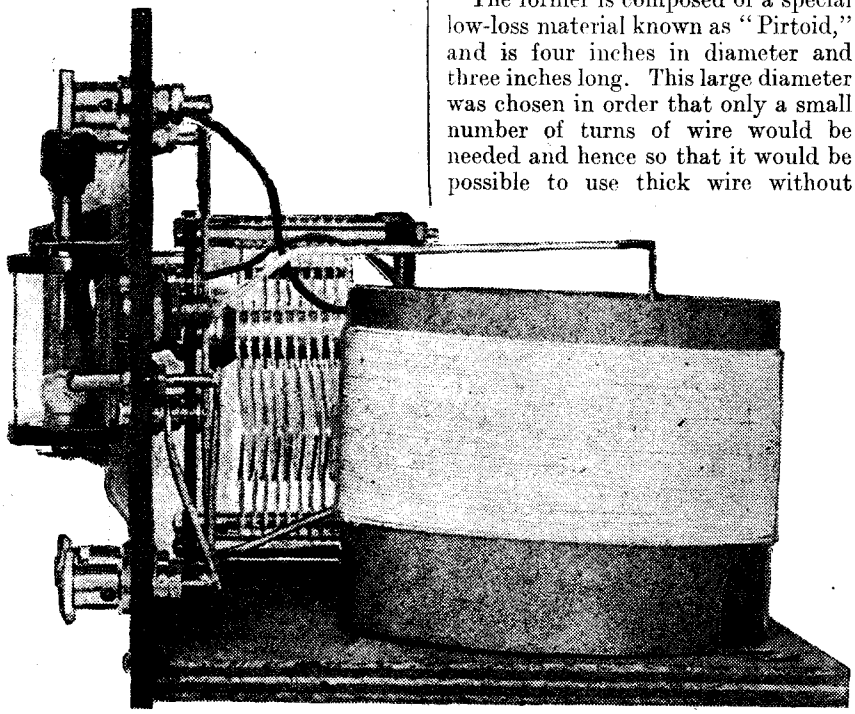
The "Cut-Out" Crystal Set—*continued*

be found in Figs. 1 A and 1 B. These are simplified diagrams drawn to illustrate the uses of the various tappings on the coil, and it will be seen that the arrangement called "auto-coupling" is used. In this scheme the aerial and earth are tapped across only a part of the coil (usually about one-third), thus removing to a large extent the damping usually produced in the tuned circuit by the high resistance of the average aerial-earth system.

COMPONENTS AND MATERIALS USED.

1 ebonite panel, 8¾ in. × 5¾ in. × 3/16 in.
1 baseboard, 8 in. × 6 in. × ⅜ in.
1 cabinet to fit (Camco).
1 ·0005 variable condenser (Cyldon).
1 crystal detector (Gecophone).
1 panel-mounting coil socket (Bowyer-Lowe).
4 terminals (Eelex).
1 Radion dial, 4-in. (American Hard Rubber Co.).
1 piece of Pirtoid tubing, 4 in. diameter, 3 in. long (Messrs. H. Clarke, Manchester).
¼ lb. No. 22 D.C.C. wire.
2 tapping clips (Burndept).
Glazite, screws, etc.

This in itself is a great aid to selectivity, and once the correct tapping-point has been found for the aerial there is no loss of strength. Indeed, on a poor aerial there is an actual gain as compared with a direct-coupled circuit. I must emphasise the fact, however, that it is essential to find the right tapping to suit a particular aerial on the wave-length of any given station.



With so small a baseboard the panel can be secured by passing screws through it instead of by means of the usual angle brackets.

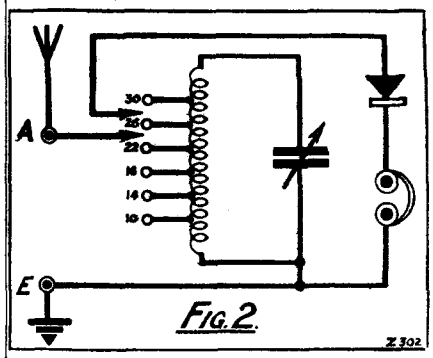
The Crystal Tap

Another feature which produces a marked improvement in selectivity and at the same time leads to a slight gain in signal strength is the use of a "crystal tap," which is simply an arrangement to permit the detector and 'phones to be connected across varying parts of the coil instead of the whole, as in the simple type of set. How these two arrangements for the use of tappings are carried out may be understood by observing the two flex leads bearing clips upon their ends which may be seen in the photographs and in the wiring diagram.

The actual constructional work, involving the drilling of the panel, mounting of the components, and wiring-up, is extremely simple, and I think calls for no more guidance than the diagrams give. The winding of the coil is probably the only point needing explanation, and this follows.

Low H.F. Resistance

The former is composed of a special low-loss material known as "Pirtoid," and is four inches in diameter and three inches long. This large diameter was chosen in order that only a small number of turns of wire would be needed and hence so that it would be possible to use thick wire without making the coil too long. A favourable ratio of length to diameter has been obtained in this way, although quite thick wire has been used, and the result is a coil of really low H.F. resistance.



This diagram shows the actual positions of the tappings.

Winding the Coil

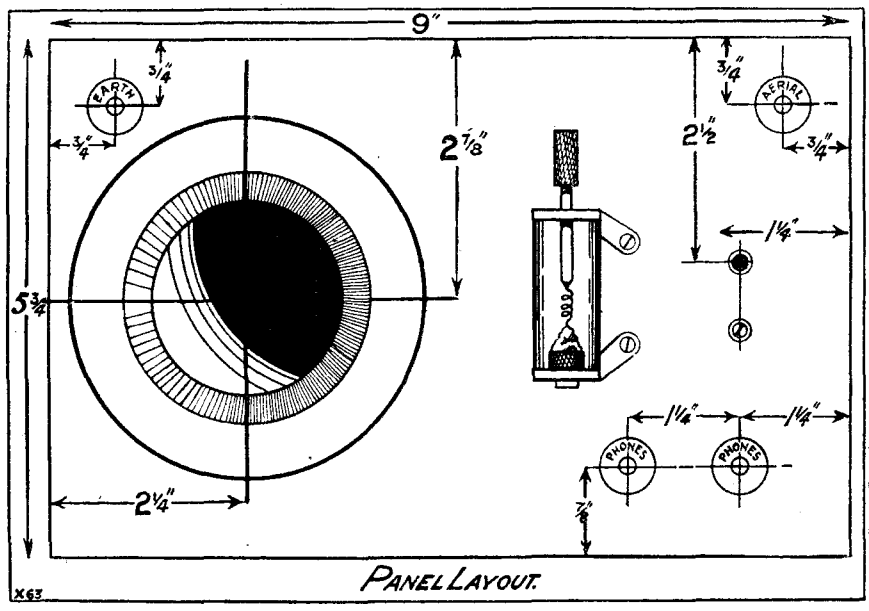
The coil consists of 45 turns of No. 22 D.C.C. wire wound in a single layer, the ends being secured by passing them through small holes drilled in the former. Tappings are made at the 10th, 14th, 18th, 22nd, 26th and 30th turns, and the method of making these will depend upon the skill of the constructor. I used the tape loop method, and this is probably the neatest, but it is not easy, and if you are not familiar with it the following procedure is advised. Wind the whole coil complete without tappings, then take a penknife, carefully insert the blade under the 10th turn from the start and prise it up a little. Insert half a matchstick under the turn and pull out the knife. The matchstick will hold the wire up sufficiently for a small space to be scraped clear of cotton so that a tapping clip can be attached here if desired. The same process is then to be repeated at each desired point.

Method of Mounting

The coil is mounted with the beginning end upwards, the method of mounting being to use a couple of small brass brackets, such as grid-leak clips, or any others that a well-stocked junk-box may yield.

When the set is finished the procedure is to attach the "crystal-tap" clip to the 30th turn, the aerial-lead clip being attached to the 18th turn. Tune in the local station and adjust the crystal to the best point you can

The "Cut-Out" Crystal Set—*continued*



PANEL LAYOUT.

find. Now proceed to try the aerial clip on each tapping in turn, retuning on the condenser each time, until you are sure you have found the best tap. Then try the crystal tap on each point, also retuning a trifle each time. You will probably find the loudest signals are obtained at about the 18th or 22nd turn, but this depends upon the resistance of your 'phones, the specimen of crystal, and other factors.

To receive Daventry, the shorting plug in the loading-coil socket should be replaced by a No. 100 or No. 150 coil (according to the size of your aerial) and the aerial clip should be attached to the fixed plates terminal of the variable condenser. The crystal-tap clip can be left in its previous position.

An Interesting Experiment

It will be noted that no scheme for varying either the aerial tap or the crystal tap is provided on the Daventry wave-range, for the reason that it was not considered that any particularly high degree of selectivity was needed on these waves: the ordinary simple single-tuned circuit seems quite adequate here. Incidentally, it is perhaps only fair to point out for the benefit of the beginner that the special virtues of this set are confined to the 200 to 500 metre band, and it would not be worth while to make it simply for use on Daventry alone in those localities where 5 X X is the only station which can be heard.

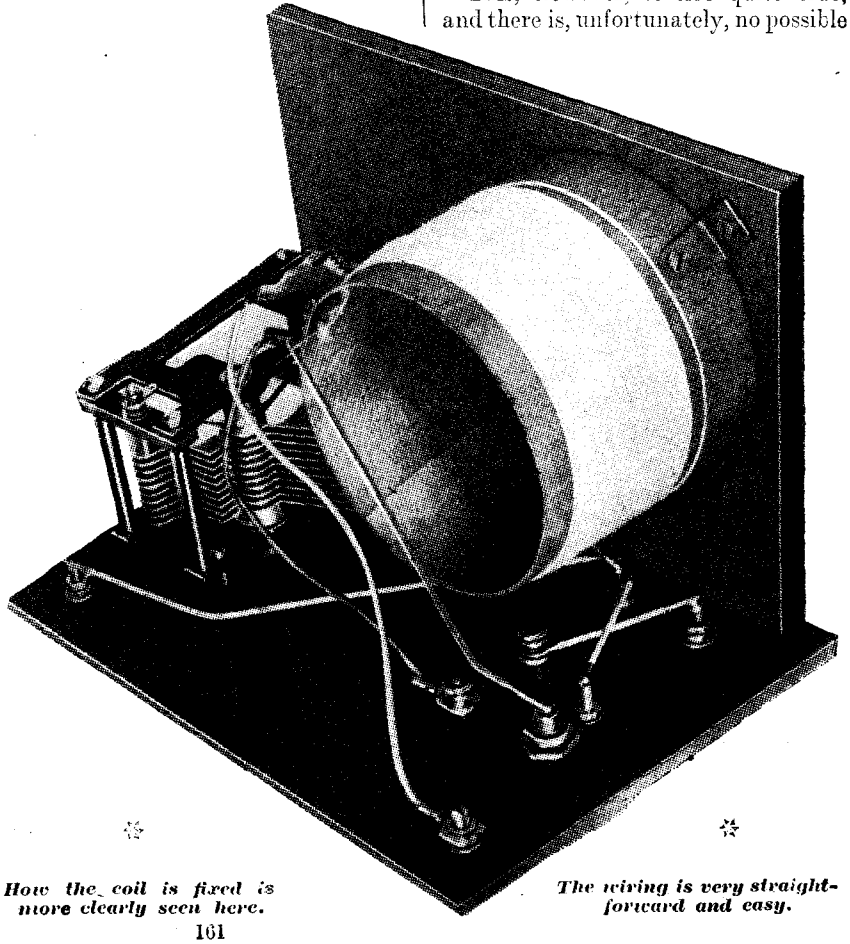
The adjustment of the crystal tap will be found quite a fascinating experiment by those who have not previously used a set incorporating one; as a matter of fact, although I have made a number of such sets for publication in various journals, it is always interesting to me to note how the tuning sharpens as the tapping is brought down the coil, and how signal strength actually *increases* at the same time! Although one may be familiar with the theoretical reasons it always seems extraordinary to see the crystal and 'phones connected across perhaps 20 turns and yet to hear louder signals than when they are placed across the whole coil.

Damp-Proof

A point concerning the coil which perhaps deserves a word of mention while we are dealing with various miscellaneous matters is the question of damp-proofing. It was once fashionable to use all sorts of elaborate varnishing and impregnating schemes, some of which have since been found to have in themselves an objectionable effect upon the efficiency of the coil. Of late it has become quite a rarity to see a proofed coil, and it might be concluded that modern views discountenance it altogether.

Serious in Some Cases

This, however, is not quite true, and there is, unfortunately, no possible



How the coil is fixed is more clearly seen here.

The wiring is very straightforward and easy.

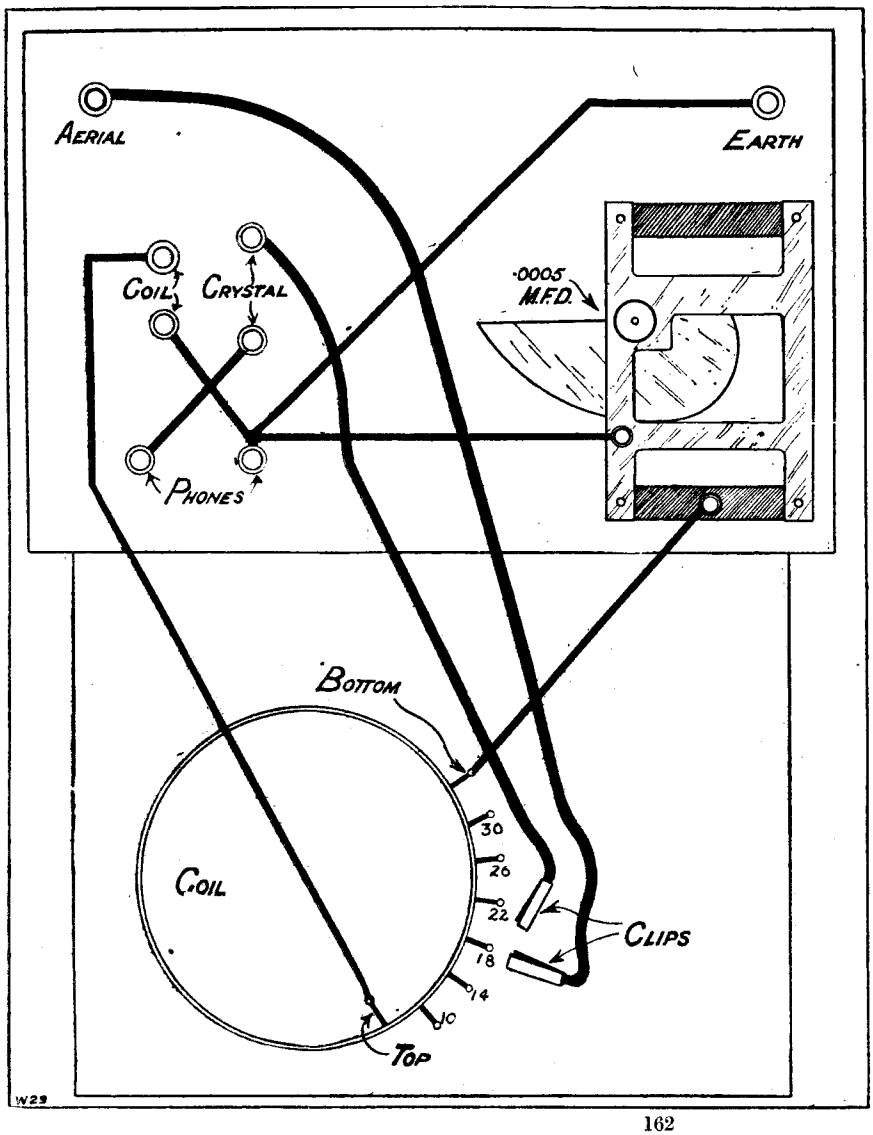
THE "CUT-OUT" CRYSTAL SET

—concluded

room for doubt that a serious amount of damp in a coil is a most harmful thing, putting up the H.F. resistance quite seriously. Really definite information is lacking as to the worse evil—*i.e.* losses produced by damp-proofing and those which may be produced by a possible amount of moisture—but one rather rough and ready measurements which I carried out some two years ago threw a little light on the question.

These tests seemed to show that the effect of moisture depended very largely upon the type of the coil. A tightly-wound multi-layer coil was found to be very susceptible to damp, while an ordinary single-layer coil which was not very closely wound was not much affected by any amount of dampness likely to be met with in an inhabited house. A good method of proofing, however, such as the use of a moderate quantity of the best shellac and thorough baking out, did not seem to introduce any very serious losses (remember that my method of detecting losses was not a very delicate one), and seemed desirable where a coil was to be used in a damp spot. For ordinary living-room conditions, on the other hand, a single-layer coil appeared to be fairly safe without any special protection. The point seems to be one requiring further investigation, and I hope to carry matters a little further with improved methods in the near future.

The results already obtained, however, indicate that so far as this set is concerned it is safe to leave the coil without protection when used in a living room. In a rather damp spot, however, a thorough drying out is indicated.



LEAKS

FOR some time past there has existed a doubt in the minds of many listeners as to whether or not the H.T. battery should be disconnected when shutting down the set. That being so, the following experience will be of interest.

Using a set quite recently, with an external aerial and usual earth, the loud speaker was connected with a rather long lead which touched the floor. Since the set was under test, a milliammeter was connected in series with the H.T. negative lead, and, strange to relate, it was noticed that when the set was shut down by means of the filament switch the milliammeter gave a reading of 1 milliamp, slowly dropping to a quarter of a milliamp, and there remaining. The condensers across the H.T. battery were disconnected, but still the reading of the milliammeter stood at ·25, until by accident the loud-speaker lead was lifted off the floor, when lo and behold, the milliammeter needle dropped to zero! The explanation of this phenomenon seems to be that the insulation of the loud-speaker lead was faulty and making partial connection with the earth, virtually connecting H.T.+ to earth and so shorting the H.T. battery through the earth connection proper on the set. This experience seems to indicate that the H.T. battery should be disconnected when shutting down.

Boxes of Trouble

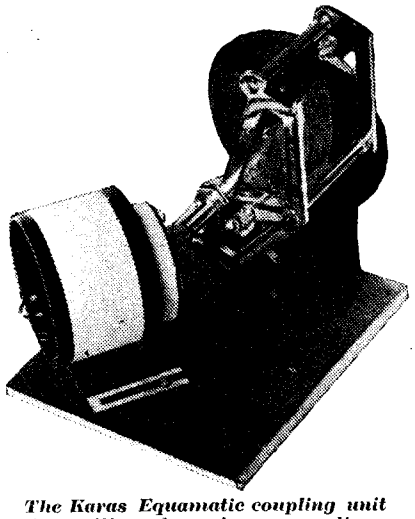
Another possible source of waste in H.T. current is that of H.T.condensers, for unless these are really sound they can discharge an H.T. battery at a rate of 1 to 1·5 m.a. without the listener being aware of the fact until he inserts a milliammeter in circuit. A really dud condenser will, of course, short the battery to the extent of rendering the receiver useless as to results until the faulty component is removed, but in less obvious cases it is as well to make perfectly sure that the H.T. condensers in use are really condensers and not merely boxes of trouble.

Transatlantic Tendencies

An interesting article describing some of the recent radio receiver developments in the U.S.

By PERCY W. HARRIS, M.I.R.E.
(Editor.)

THE study of American radio tendencies is always of interest and value to the British experimenter, although the differences between conditions in the two



The Karas Equamatic coupling unit in position of maximum coupling.

countries must never be forgotten. The essential differences between these conditions have an important bearing upon set design, for whereas the American listener has no need to buy or to build a set to receive wavelengths over 600 metres, the European amateur must always think in terms of Radio-Paris and Daventry, with the accompanying complications of set design.

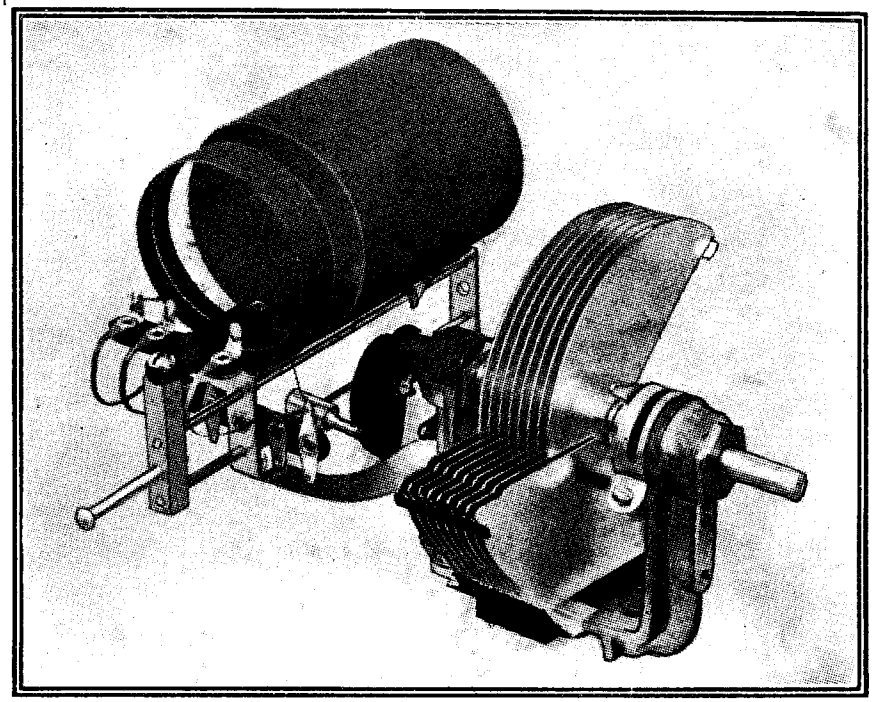
Selectivity Problems

Again, selectivity problems are different. It is true that we now have a multiplicity of stations "on the air" in Europe, but we are not yet, fortunately, blessed with that local concentration of broadcasting stations which stimulates the American designer to perform still greater feats of selectivity. In both New York and Chicago, to mention but two of the great cities, there are more staions working simultaneously within a radius of five miles than are possessed by the British Broadcasting Corporation throughout the whole of this country.

Yet, although the American listener has not to cope with the long-cum-short wave problem as we are compelled to do, the extension of the wave-band down to 200 metres has given him a taste of the problem, making efficient design still more difficult. One of the chief problems to be faced in making a set to tune from 200 to 550 metres, is that of H.F. coupling between valves. If adjusted for best efficiency at the lower end of the scale (*i.e.* the shorter waves), it is much too loose at the upper end. Similarly, if we adjust the coupling to suit the longer waves, it is much too tight for the shorter ones. This question of coupling has an important bearing upon both self-oscillation of the receiver and selectivity. The tendency to self-oscillation can be checked by one of the several neutralising methods frequently described in these pages, by introducing damping into the grid circuit, by reducing the voltage applied to the H.F. valve by means of a resistance in the plate circuit, or as is very frequently done in the cheaper American sets, by keeping the coupling between stages so loose that even on the shortest wave for which the set is designed there is not sufficient coupling to give the feed-back which produces self-oscillation.

Ingenious Coupling Adjusters

In so far as these last sets are concerned, they work quite well on the shortest wave-band, that is to say, the coupling which is just loose enough to prevent self-oscillation occurring gives good selectivity and a reasonable measure of signal strength. The trouble of these sets is that as we turn the dials towards the longer wave-lengths the effective coupling becomes looser and looser, so that we not only get a coupling far looser than need be, but our signal strength drops far below the desirable figure. When sets were built to cover 300 to 500 metres the "compromise

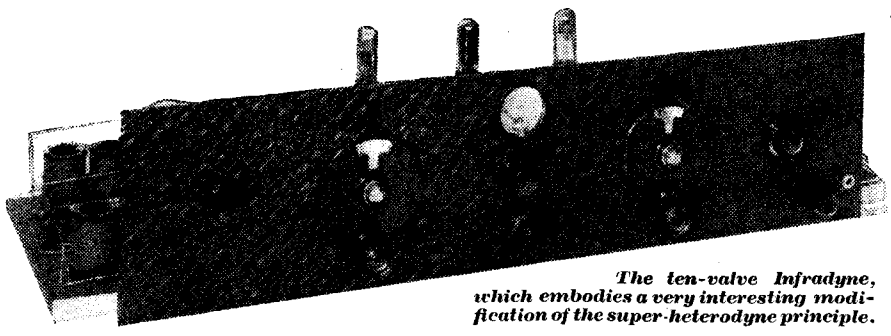


The Hammarlund method of varying the inductive coupling between circuits simultaneously with capacity adjustments.

Transatlantic Tendencies—*continued*

coupling" as it may be termed, was not too bad, and the overall efficiency was reasonable, but now that sets must be designed to take waves from 200 to 600 metres, the brains of the radio industry have been turned towards finding an adequate solution of the problem.

Several quite interesting and successful solutions, or partial solutions, of the problem have come into being during the last twelve months, and examples of the chief methods are now in my laboratory. One of the most successful and practical, and certainly most ingenious, is what is known as the Karas Equamatic system, which is based on the King patents. In this the radio-frequency transformer consists of a fixed secondary and a movable primary, this latter attached to a continuation of the condenser shaft. With this arrangement, the coupling, when all the condenser plates are interleaved (corresponding to the longest wave-length to which the circuit is used) is arranged to be tight enough for efficiency. Now, as we turn the condenser dial, reducing the capacity and increasing the frequency to which the circuit is tuned, the coupling is progressively decreased, so that when we reach the bottom of the condenser scale and minimum capacity, the strength of the coupling is correct for that position, too. By suitably proportioning the windings and the separation between them the set can be arranged to have an optimum coupling over the whole range.



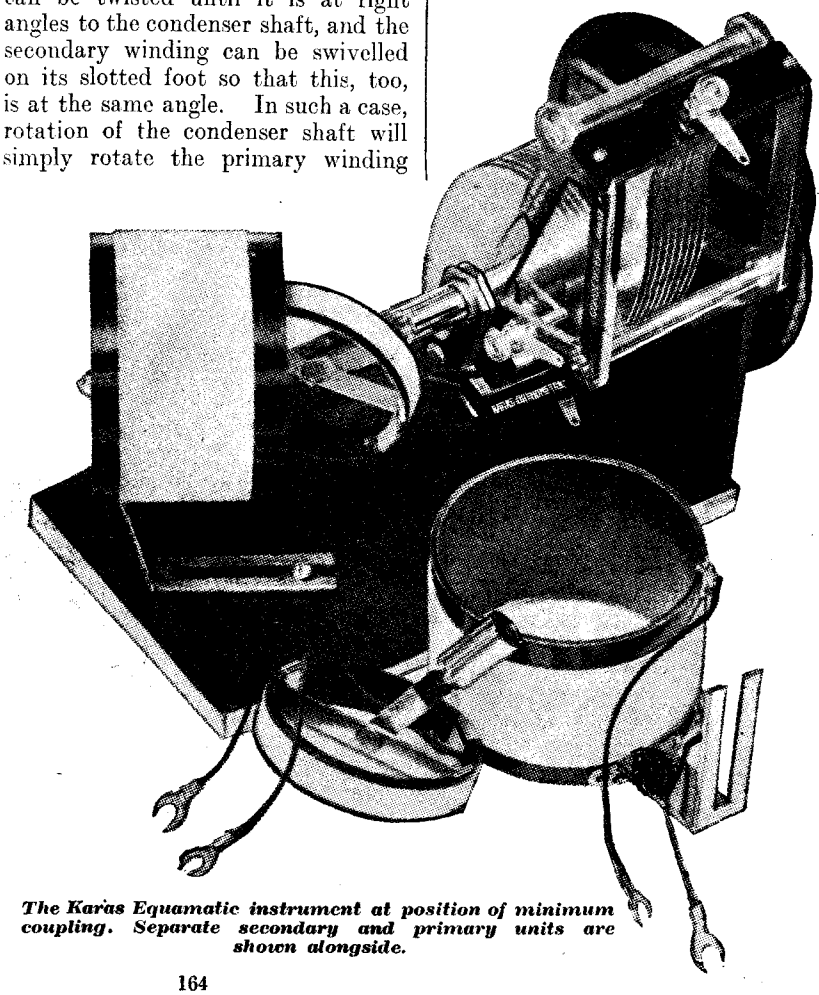
The ten-valve Infradyne, which embodies a very interesting modification of the super-heterodyne principle.

Constructional Details

Photographs accompanying this article will show the details of the coupling as erected on an experimental board for test purposes. The secondary winding is a single-layer solenoid of 60 turns on a 2½-in. bakelite tube, while the primary consists of 14 turns on a 2-in. bakelite tube. The secondary is carried on a slotted metal foot so that its angle to the condenser shaft can be adjusted, as well as the separation between primary and secondary tubes. The primary winding is pivoted in its centre, the pivot being attached to a small tube sliding over the extension of the condenser shaft and being secured to it by a grub screw. If necessary, the primary winding band can be twisted until it is at right angles to the condenser shaft, and the secondary winding can be swivelled on its slotted foot so that this, too, is at the same angle. In such a case, rotation of the condenser shaft will simply rotate the primary winding and will not alter the coupling between primary and secondary. At the other extreme the primary winding can be placed almost in the plane of the condenser shaft and the secondary to correspond with it, giving very great changes of coupling as the shaft is rotated. The best angle has been found to be when the secondary winding is placed at an angle of 58° from the condenser shaft line. The primary winding is then pivoted to give maximum coupling when all plates of the condenser are in mesh.

Suiting the Valve

Once this angle has been found the secondary winding can be slid closer to, or farther away from, the winding to tighten or loosen the coupling to suit the valve. I consider this a very important practical point. The degree of coupling given by a particular setting of primary and secondary coils will remain approximately constant over the whole



The Karas Equamatic instrument at position of minimum coupling. Separate secondary and primary units are shown alongside.

Transatlantic Tendencies—*continued*

band. If therefore we change the valve and the set oscillates over the whole scale, we can slide the secondary away from the primary slightly to keep the set below the oscillation-point throughout the whole reading.

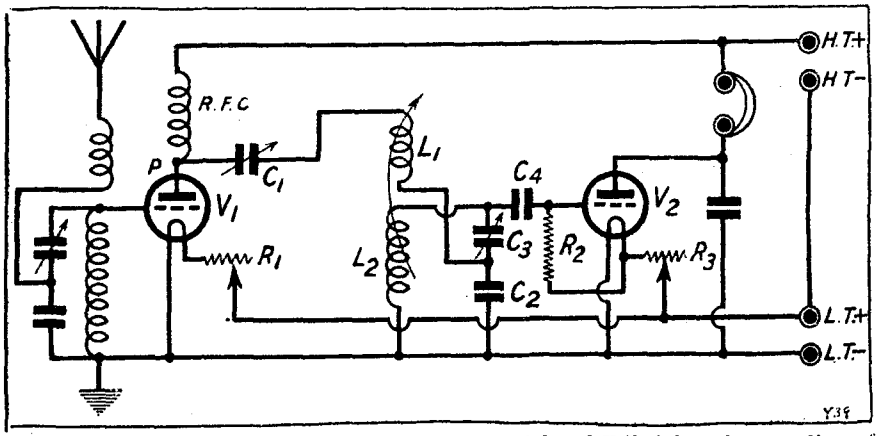
The Hammarlund Method

Another very interesting method which I am now trying is the Hammarlund, in which the coupling between primary and secondary windings is varied by means of a cam attached to the end of the shaft of the condenser. In this case, instead of the primary winding changing its angle in relation to the secondary it changes its separation. Obviously the movements throughout the condenser scale can be made to vary in any required degree by altering the shape of the cam. The secondary winding of the Hammarlund coil is 2 in. in diameter, and has about 90 turns of wire space-wound, separation being about equal to the thickness of the wire, the former being very thin celluloid. The primary, which is of slightly finer wire, consists of 30 turns of $1\frac{3}{4}$ in. diameter, with a centre tap so as to be used for circuits similar to those of the "Special Five" or the "Solodyne."

Loftin-White Scheme

Perhaps the most interesting of all, however, is the Loftin-White method, which has no mechanically moving coupling, but gets the same effect by a circuit arrangement. Briefly, the Loftin-White method is based on the following facts. If we pass a radio-frequency current through a given coil, this coil will offer a resistance to the flow of the radio-frequency current (using the term resistance in a very broad sense, and not necessarily in the electrical sense at the moment) depending upon the size of the coil and the frequency of the current passed through it. This means that the resistance to the current will increase as the frequency increases, or put in another way, as we increase the frequency of the current so the difference of potential across the two ends of the coil will increase. If now this difference of potential across the coil is used as a means of coupling to a subsequent valve, it will be seen that as we increase the frequency (or decrease the wave-length) so the coupling effect will increase.

Now, consider the case of a condenser. If we pass a radio-frequency current through a condenser it will, for its part, offer a resistance to the flow, but as we increase the frequency this time so the resistance which the condenser will offer to the flow will *decrease*. It will thus be seen that if the differences of potential set up across this condenser be used as a coupling method to a subsequent valve, the coupling will decrease as we increase the frequency or reduce the wave-length. The Loftin-White system uses a combination of these two forms of coupling, *i.e.* inductive and capacitative, and the circuit arrangement is shown in the accompanying diagram.

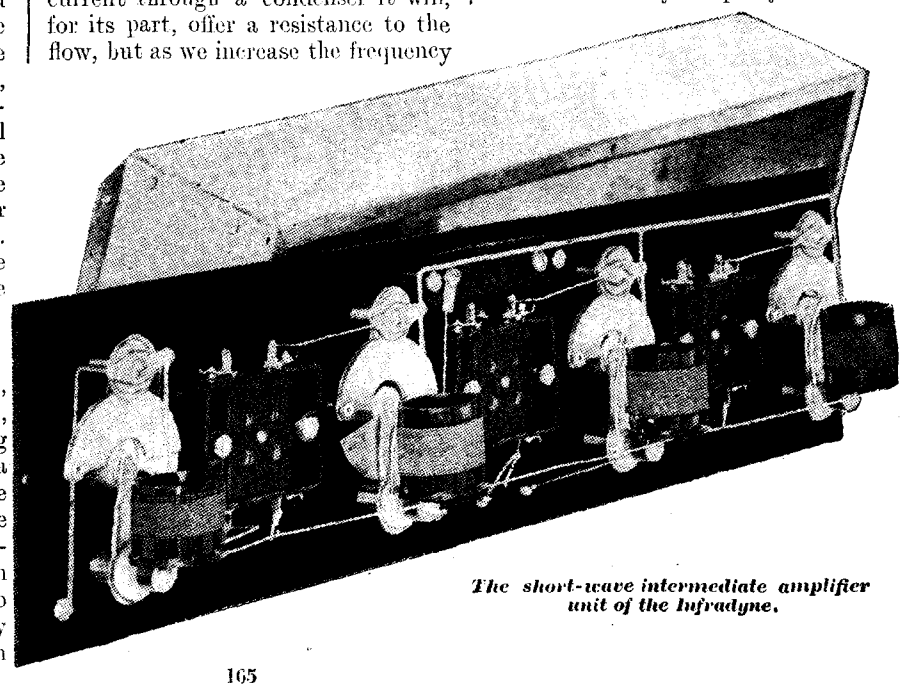


The Loftin-White principle applied to both the aerial and H.F. intervalve coupling of a two-valve H.F.-Det. circuit.

Automatic Compensation

By using a combination of inductive and capacitative coupling, the decrease of coupling occurring as we increase the frequency with the condenser can be exactly compensated by the increase of coupling given in similar circumstances by an inductive winding. By causing the capacitative coupling to predominate, it is possible to produce the interesting effect of having a set which tends to oscillate more readily towards the longer wave-lengths, or when the capacity is getting towards the maximum, than at the other end of the scale; and, of course, by letting the inductive predominate the opposite effect is obtained.

I have rigged up this circuit on my experimental bench, and so adjusted the vanes that a two-valve set, consisting of one stage of H.F. and a detector without reaction, is automatically kept just below



The short-wave intermediate amplifier unit of the Infradyne.

Transatlantic Tendencies—*concluded*

the oscillation-point throughout its whole range. But this is not the only interesting point about the Loftin-White circuit. By using a parallel feed to the plate, and a condenser in series with the inductive coupling winding and the condenser, we are able to alter the phase relationship of the feed-back current so that feed-back effects are very largely neutralised. To give a rough analogy, the state of affairs is somewhat like that of a boy pushing a swing in such a way that his pushes are not in correct relationship to the movements of the swing itself. Obviously if the swing is pushed just as it swings away from the "pusher," the maximum effect will be obtained, and if it is pushed just as it swings towards the "pusher," then the pushes will tend to neutralise the swing. The effect of this condenser between stages is to alter the relationship of the pushes to the swing, thus enabling quite a tight coupling to be used without self-oscillation or feed-back effects.

The Infradyne

Super-heterodynes still retain a considerable measure of popularity among the more advanced experimenters, and quite a field of excitement has been created by the arrival of the "Infradyne," a very interesting modification of the super-heterodyne principle. I recently had an opportunity of testing a completely-built Infradyne—a ten-valve receiver—so that I am able to give WIRELESS CONSTRUCTOR readers a few ideas of its general working and principle.

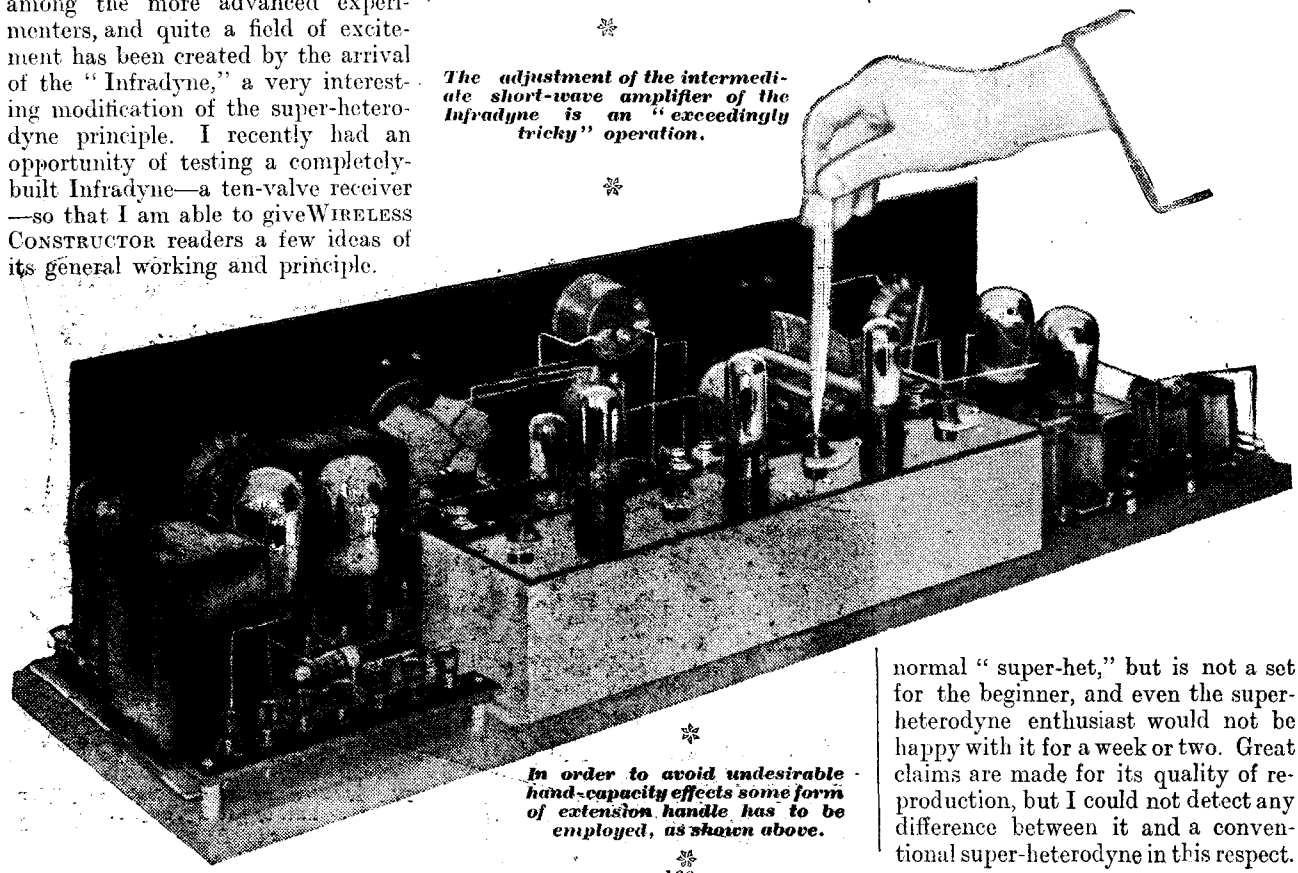
As readers know, the principle of the super-heterodyne is to tune the circuit to the incoming signal and superimpose upon these incoming signals locally generated oscillations of a slightly different frequency, so that a beat-note is produced, this beat-note being separated out as oscillations of a longer wave-length, and magnified by intermediate-frequency stages. After magnification of two or three stages, this note-beat is rectified and magnified by note-magnifying stages in the ordinary way. One advantage of the super-heterodyne is that the intermediate frequency is always kept the same and the received oscillations can be arranged to keep a constant frequency difference for the beat-note. Several tuning controls are thus eliminated.

Short-Wave Amplifier

When the locally generated oscillations and the received oscillations are mixed up we have not only a beat-note or *difference* frequency produced, but also a *sum* frequency—that is the addition of the two frequencies. The Infradyne takes this "addition," which, of course, is of a very high frequency, and magnifies it in a fixed *short-wave amplifier*, thus getting away from long-wave interference, mush, and several other disadvantages of the ordinary super-heterodyne. A special advantage it possesses is that instead of having two positions on the oscillator dial for each station—a disadvantage of the ordinary super-heterodyne—there is only *one*.

Sensitive Receiver

In the ten-valve Infradyne illustrated there are two preliminary, and gang-controlled, radio-frequency stages, a first detector, an oscillator, three intermediate stages, a second detector, and two transformer-coupled note-magnifying stages. The preliminary adjustment of the instrument is exceedingly tricky, as the intermediate short-wave amplifier, which operates on a wave-length of 95 metres, must be set with dead accuracy to suit the particular valves in the sockets. The set, by the way, works on an outdoor aerial, and as stable H.F. stages precede the first detector it is non-radiating. Once adjusted, it is amazingly sensitive, although not more so than the normal "super-het," but is not a set for the beginner, and even the super-heterodyne enthusiast would not be happy with it for a week or two. Great claims are made for its quality of reproduction, but I could not detect any difference between it and a conventional super-heterodyne in this respect.



The adjustment of the intermediate short-wave amplifier of the Infradyne is an "exceedingly tricky" operation.

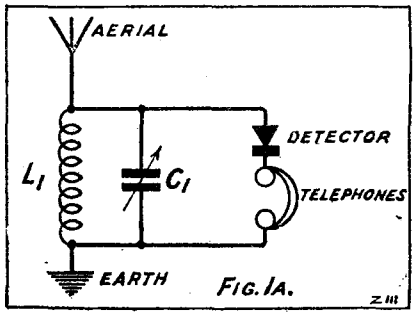
In order to avoid undesirable hand-capacity effects some form of extension handle has to be employed, as shown above.

The "EXCHANGE" RECEIVER

With this change-over set three different circuits are available, any one of which can be brought into action by merely plugging in the 'phones.

By A. S. CLARK.

I HAVE called this set the "Exchange" Receiver because it is possible to change from one circuit to another by simply altering the position of a plug, much in the same way as a telephonist changes a subscriber from one number to another. Any one of three really different circuits may be used, and since there are no switches or wires to be manipulated it is not necessary for the family expert to do the changing. It will thus be found



very interesting to compare the results obtained with the various arrangements on a particular aerial.

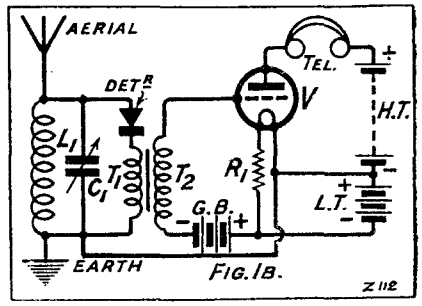
Three Circuits

The actual change from one circuit to another is made by plugging the telephones into one of the three jacks seen at the bottom of the receiver. In Figs. 1A, 1B and 1C the three circuits available are shown. The first is a straightforward crystal set, and although a direct-coupled arrangement is shown, if greater selectivity is desired an X coil, or a centre-tapped coil, may be used in the aerial circuit. This, of course, applies to all three circuits, where greater selectivity than that obtained with a direct coupled arrangement is desired.

The second arrangement consists of the crystal circuit of Fig. 1B, followed by a transformer-coupled amplifier. This arrangement is for cases where great strength is required from the local station. It will work several pairs of telephones, or at short distances from the local station loud-

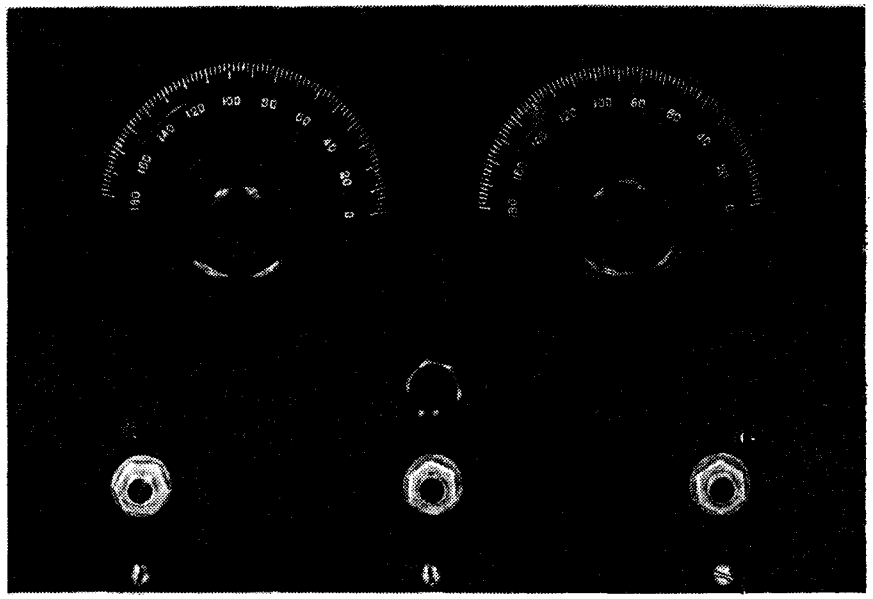
COMPONENTS REQUIRED.

Panel (9 in. × 6 in. × $\frac{3}{16}$ in.)
Cabinet for same, with baseboard 8 in. deep.
Terminal strip, 6 in. × 2 in. × $\frac{1}{4}$ in.
5 terminals marked as indicated.
On-and-off switch.
·0005 variable condenser.
·0003 variable condenser.
Semi-permanent crystal detector.
H.F. Choke.
·0003 fixed condenser with grid-leak clips. (Dubilier, Lissen, etc.)
2-megohm grid leak. (Dubilier, Lissen, etc.)
Valve holder.
2-way coil holder with long handle. (Lotus.)
Fixed resistor to suit valve used. (Amperite.)
Multi-ratio L.F. transformer. (Radio Instruments.)
Glazite wire.
6-volt grid-bias battery.
Single-circuit closed jack. (Lotus.)
Filament single-control jack. (Lotus.)
Filament double-control jack. (Lotus.)



speaker results may be obtained with the characteristic purity of the crystal detector.

The third arrangement is used when it is desired to reach out and bring in distant programmes. It is a standard



The front of the panel, showing the plugs, crystal detector, and tuning controls.

The "Exchange" Receiver—*continued*

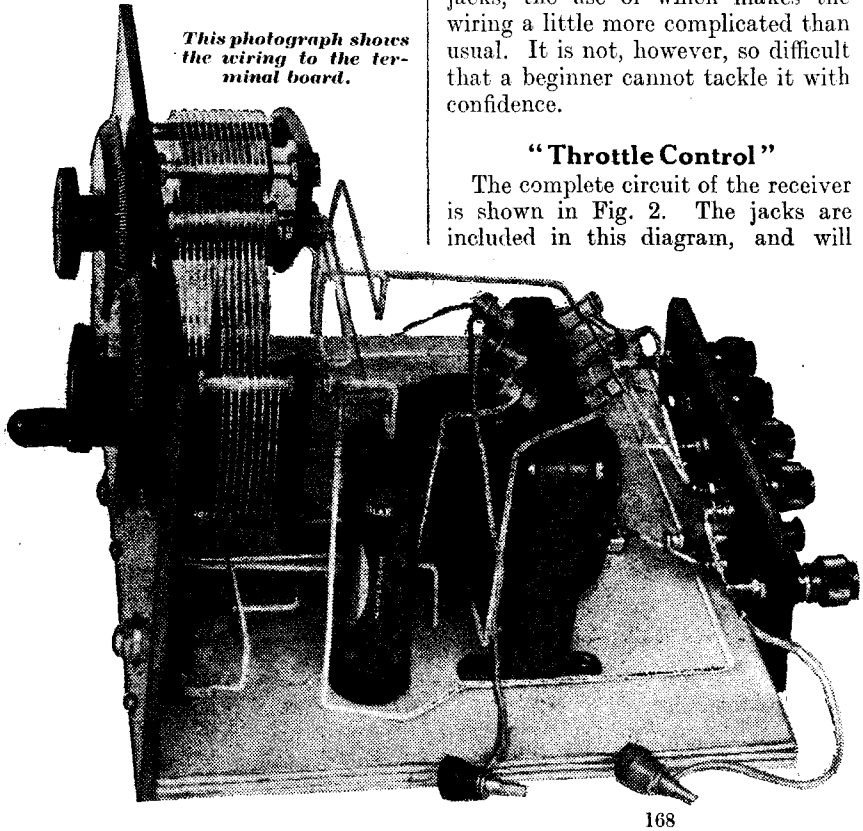
single-valve reaction receiver, smooth control of oscillation being obtained by means of the "throttle" method of adjustment.

Assuming that the same aerial arrangement is used in all cases, the tuning of the aerial remains constant for each circuit, apart from a slight effect produced when reaction is employed.

Several Advantages

The advantages of this set will be quite clear from the foregoing. Take, for instance, the cost. The only extra items over those required for an ordinary single-valve set are the transformer, the crystal detector, and two of the jacks. Thus for a slight extra expense one has in effect three complete units, a crystal set, an amplifier for it, and a good single-valve receiver. There is also the advantage of compactness obtained by having them all in the same cabinet. If your batteries run down, or for some reason you do not want to use a valve set, you are free from the trouble of disconnecting one set and connecting up another.

The receiver is contained in the usual type of cabinet with upright panel and terminals at the back, together with an on-and-off switch for the valve filament. The valve is placed inside the cabinet and the coils are carried in the two-way coil holder at the side. This coil holder is used for obtaining the best fixed coupling of the two coils, and is not used for controlling reaction, all adjustment of which is done on the right-hand variable condenser.



This photograph shows the wiring to the terminal board.

The changes in connections necessary to produce different circuit arrangements are performed by the jacks, the use of which makes the wiring a little more complicated than usual. It is not, however, so difficult that a beginner cannot tackle it with confidence.

"Throttle Control"

The complete circuit of the receiver is shown in Fig. 2. The jacks are included in this diagram, and will enable the method of switching from one circuit to another to be followed. When the telephone plug is inserted in jack 1, the circuit of Fig. 1A is obtained; when it is put in jack 2, the second arrangement (Fig. 1B) is used; and plugging the telephones into jack 3 brings the reaction circuit into action (Fig. 1C).

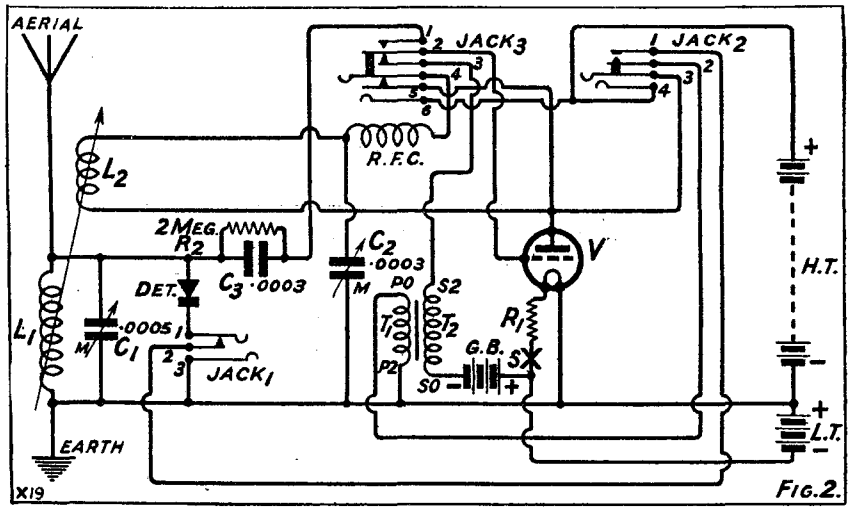


FIG. 2.

No appreciable amount of high-frequency current can pass through the reaction coil L_2 when the condenser C_2 is at its minimum setting, because of the high-frequency choke. As the capacity of the variable condenser is increased a shunt path for the high-frequency currents is produced, and so the reaction effect is increased as the value of C_2 is increased. The coupling between L_1 and L_2, being adjustable, enables the best control of reaction to be obtained.

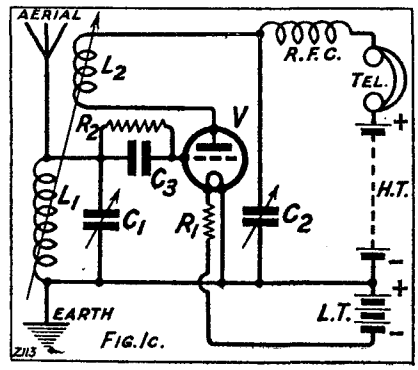


FIG. 1C.

A list of the components required to construct this set will be found in another part of this article. The makes of the actual parts used in the original receiver are indicated after the components. It is not, of course,

The "Exchange" Receiver—*continued*

necessary to use the same parts, and any others of good quality and suitable size may be satisfactorily substituted.

Take care that you obtain the right types of jacks, or all sorts of complications may arise. Although the tapped transformer makes it easy to obtain the best ratio for the crystal and the particular valve in use, one of ordinary type can be used, providing it is designed for a first-stage amplifier. When all the parts required have been collected together the construction of the set may be commenced.

The first thing to do in the construction of the receiver is to mark out the panel. This must be done with a scriber of some sort. In Fig. 3 will be found a diagram of the front of the panel, from which all the necessary dimensions may be obtained. When you have marked out the panel, after centre-punching all points where holes are to be drilled, you may proceed to do the drilling.

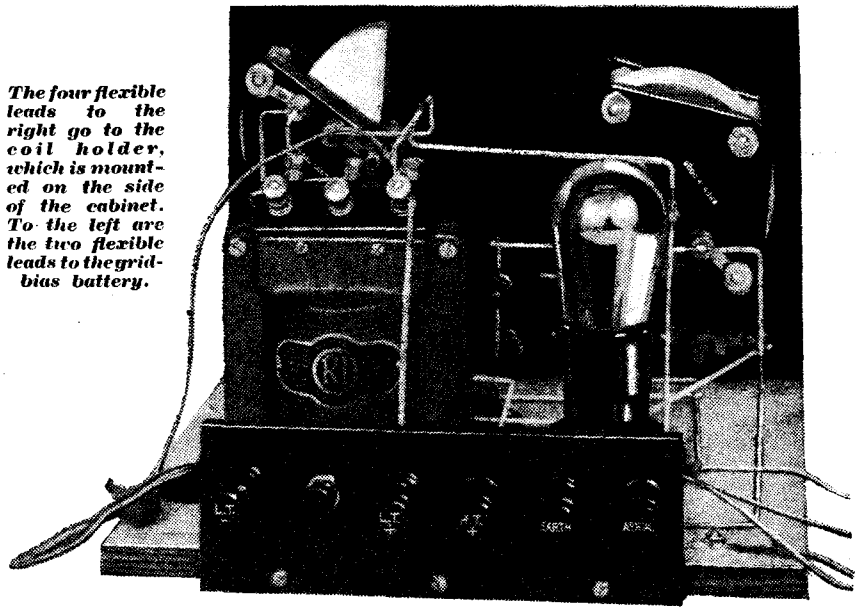
Constructional Details

The drilling of the panel is a simple job. All the holes, except the three small ones at the bottom for the fixing screws, are for single-hole-fixing components. They may, therefore, be made with a $\frac{3}{8}$-inch drill. If you intend to use panel transfers, these should be fixed at the present stage of construction.

You have now to mount the components on the panel. This will present no difficulty. Make sure that you get the jacks in the right positions, and that the variable condensers are turned to such a position that they clear any fillets at the side of the cabinet.

Concerning the Wiring

Before any components are mounted on the baseboard, the panel and the terminal strip must be fixed to it. This is best done with the panel, baseboard, and terminal strip inserted in the cabinet, otherwise a good fit may not be obtained. Now remove the cabinet and mount all the components except the transformer on the baseboard Some of the wiring has to be done before the transformer is mounted. The correct point at which



The four flexible leads to the right go to the coil holder, which is mounted on the side of the cabinet. To the left are the two flexible leads to the grid-bias battery.

Despite the variety of circuits available the back-of-panel wiring is relatively simple, as shown here.

WIRING IN WORDS.

(Make following connections before mounting L.F. transformer.)

Join contact 1 of jack 1 to one side of crystal detector.

Join contact 2 of jack 1 to contact 1 of jack 2.

Join contact 3 of jack 2 to contact 5 of jack 3 and A. of V., fixing flex lead for one side of L_2 to A.

Join contact 4 of jack 2 to contact 6 of jack 3: contact 6 of jack 3 to H.T. +.

Join contact 1 of jack 3 to one side of C_3 and R_2.

Join contact 2 of jack 3 to G. of V.

Join contact 4 of jack 3 to one side of R.F.C.

Join one side of R_1 to L.T. − of V.

Join other side of R_1 to one side of S.

Join other side of S. to L.T. −, fixing flex lead for G.B. + to L.T. −.

(Now mount L.F. transformer.)

Join contact 2 of jack 2 to P.O. of T_1 T_2.

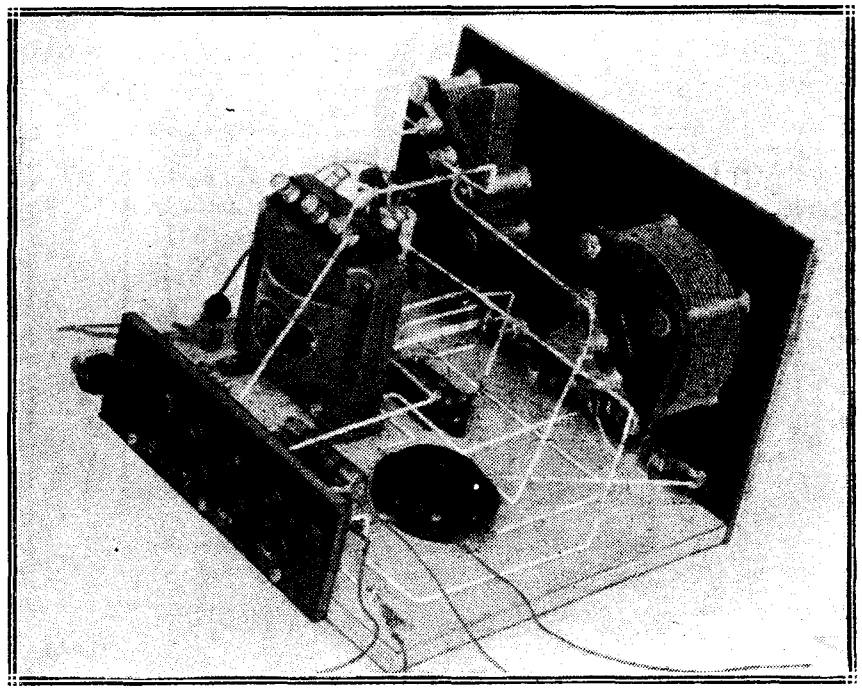
Join contact 3 of jack 3 to S2 of T_1 T_2.

Join flex lead for one side of L_1 to aerial, and join aerial to remaining side of R_2 and C_3: same side of R_2 and C_3 to remaining side of crystal: same side of crystal to fixed plates of C_1.

Join flex lead for one side of L_1 to earth, and join earth to L.T. +: L.T. + to P2 of T_1, T_2: P2 of T_1, T_2 to moving plates of C_1, moving plates of C_2, contact 3 of jack 1 and L.T. + of V.

Join fixed plates of C_2 to remaining side of R.F.C.: same side of R.F.C. to one side of L_2 via flex lead.

Join flex lead for G.B. − to S.O. of T_1 T_2.



No H.T. negative terminal is provided, as the flex connections can conveniently be taken from L.T. plus.

The "Exchange" Receiver—*continued*

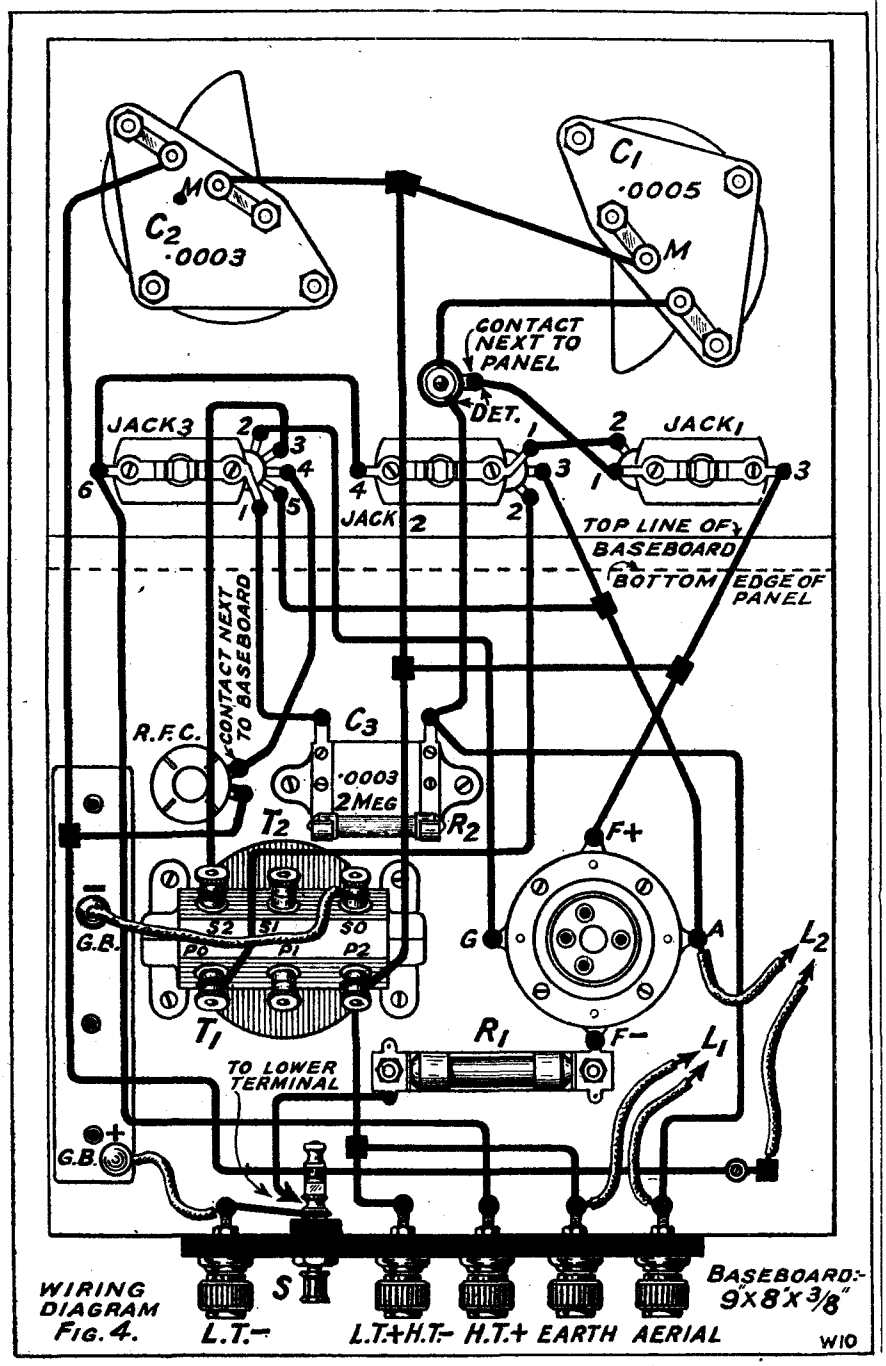
to mount this component is indicated in the wiring instructions.

Suitable Coils

A point which will simplify the wiring may with advantage be mentioned here. All soldering tags should be tinned before the components are mounted. Especially does this apply to those on the jacks. Personally, I tin them so heavily with little balls of solder that no extra solder needs to be used in the actual operation of wiring.

Fig. 4 gives a complete plan of the back of the panel and the baseboard, and shows all the wiring. The wiring is also described in a table. When making the connections, which are done before the transformer is inserted, take care to allow plenty of room for it. Room must also be left for the valve and for the grid-bias battery. Reference to the photographs of the wiring will be found a help. The two flex wires, which are for the coil L_2, are connected to the moving socket of the coil holder. Those from aerial and earth are connected to the fixed holder. It is necessary, in order that connections may be correct for the use of X coils, that the flex lead from the earth terminal should be connected to the pin of the fixed coil holder.

If it is found on testing the set that bringing the two coils together does not increase reaction the leads to the moving holder, and not those to the fixed, should be changed round. When X coils or centre-tapped coils are employed, the aerial, instead of being connected to the aerial terminal, is connected to the centre-tap terminal on the coil, or to one of the terminals on the coil in the case of the X coil.



WIRING DIAGRAM FIG. 4.

Operation

Either a general-purpose valve or one of the small power types of valve may be employed with suitable H.T. values and grid-bias voltages. A higher voltage will be found better when working the valve as an amplifier than when using it as a detector.

Commence by plugging the telephones in the first jack and tuning in the local station, and obtaining a sensitive spot on the crystal detector. Now insert the plug in the second jack switching on the filament. The grid bias should be adjusted to give best results. If you are near to your broadcasting station this circuit will give you better results than the third arrangement on the local station. At my home at eight miles from 2 L O I obtained really good loud-speaking with this arrangement.

A Peculiar Fault

In order to help any who should come up against a similar trouble, I will describe a little fault that arose on plugging into the third socket. The set was extremely insensitive, although it oscillated very readily, but the reaction control was very jumpy. Adjustments of the crystal detector made alterations to the reaction. Eventually the trouble was traced to the second jack. It was found that the two contacts were touching all the time, when they should only have made contact when the telephones plug was inserted. This, of course, shunted the crystal detector

The "Exchange" Receiver—*concluded*

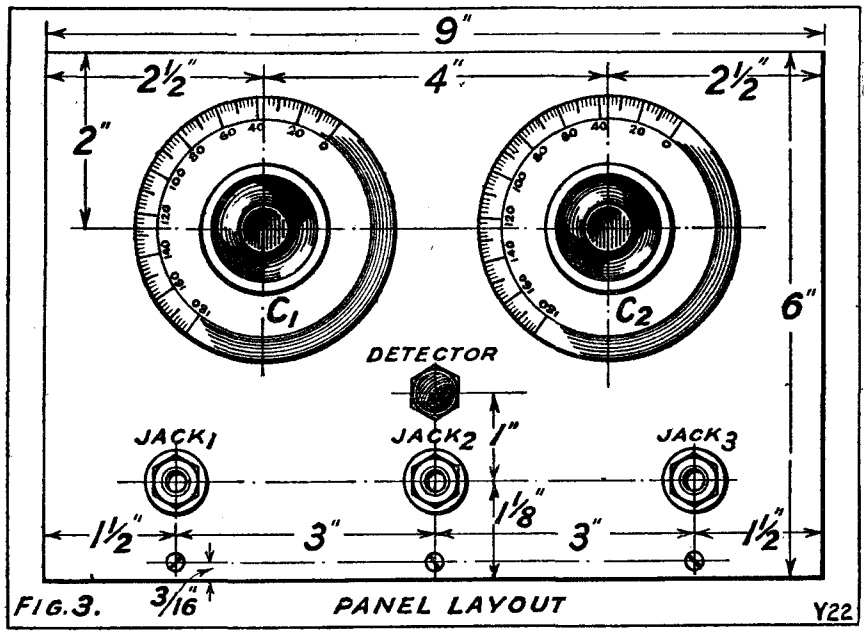


FIG. 3. PANEL LAYOUT Y22

and primary of the L.F. transformer across the aerial and earth. The remedy is obvious.

It was generally found best to have the reaction coil at an angle of about 45 degrees to the aerial coil. If this position makes it necessary to have the reaction condenser all out before oscillation stops, a smaller coil should be used. If, on the other hand, it is necessary to have the reaction condenser all in to obtain reaction, a larger coil may be employed. Of course, 45 degrees of coupling will not necessarily give best results and is only mentioned as a guide. The best position must be found by the operator.

Results Obtained

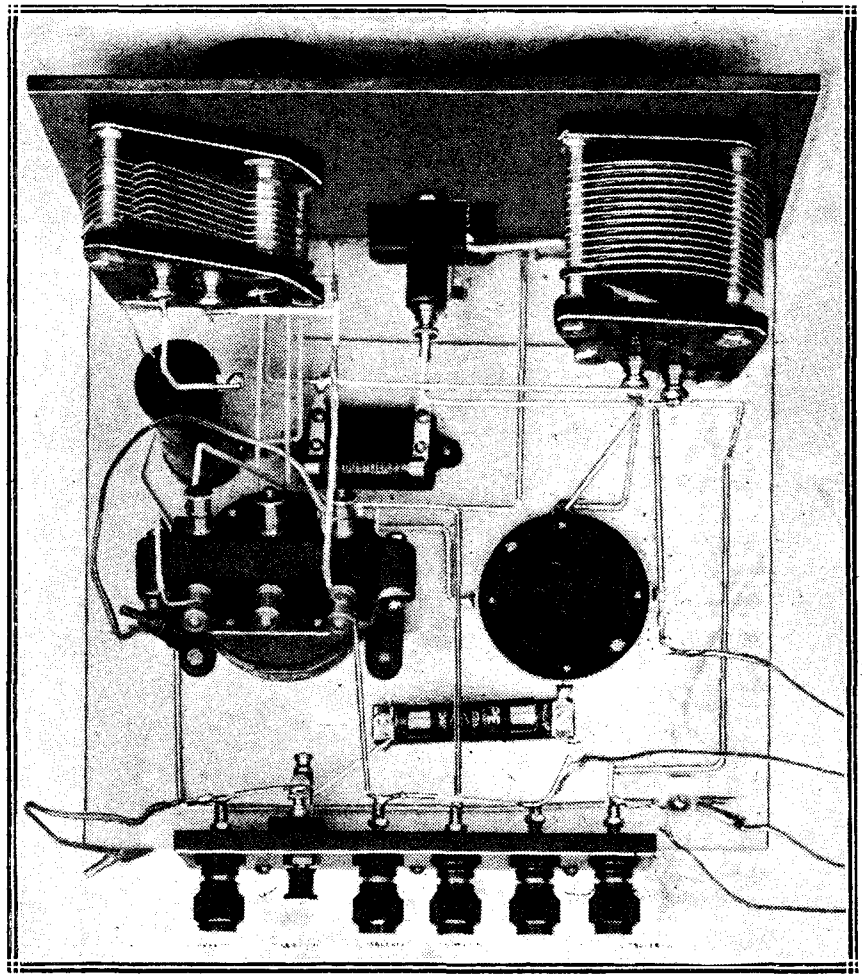
Very little hand capacity was noticed, and although tuning was fairly sharp on the third arrangement, slow-motion dials are not really necessary. They may, however, be fitted if desired for distant reception.

It was not much use trying to hear distant stations with the direct-coupled arrangement when the local station was working. However, when using a No. 60 centre-tapped coil, 10 stations could be tuned in with more or less freedom from the local station. These stations included Aberdeen, Birmingham, Bournemouth, Vienna, Frankfort, Toulouse, and Rome.

If you already have a regular large receiver this set will make a very good stand-by set which can be used in many ways with advantage. It is also the ideal set for the beginner and the experimenter with small means.

Reaction Control

If the reaction control is not used properly it may easily cause interference to other listeners. Since the amount of reaction required varies with the wave-length on which the set is working, it is necessary to adjust the reaction condenser at the same time as the aerial tuning condenser. Therefore, once the set has been brought to its most sensitive point, namely just before oscillation commences, searching is easily carried out by increasing the capacity of the reaction condenser as the capacity of the aerial condenser is increased, and so keeping the set at its most sensitive point over the whole of the tuning range.



This photograph should be compared with the wiring diagram.


"THE FIRST"
YOUR FIRST TOOTH MAY HAVE CAUSED A MILD SENSATION
YOUR FIRST PAIR OF THESE AND LATER THESE WERE SORT OF MILESTONES IN YOUR LIFE —
YOUR FIRST KISS WAS AN OUTSTANDING AFFAIR
SO WAS THE ARRIVAL OF YOUR FIRST-BORN —
IT WORKS
- BUT I'LL WAGER THAT NONE OF THESE EVENTS CREATED THE ECSTASY YOU FELT ON THE SUCCESSFUL COMPLETION OF YOUR FIRST VALVE SET.
TELEGRAMS
DAILY MOAN
EDITOR
ERN SHAW

This informative survey of events at Broadcasting Headquarters deals with the critical times in store for the B.B.C., and with other "inside" broadcasting news of interest to every listener.

Happenings at Savoy Hill

By OUR SPECIAL COMMISSIONER

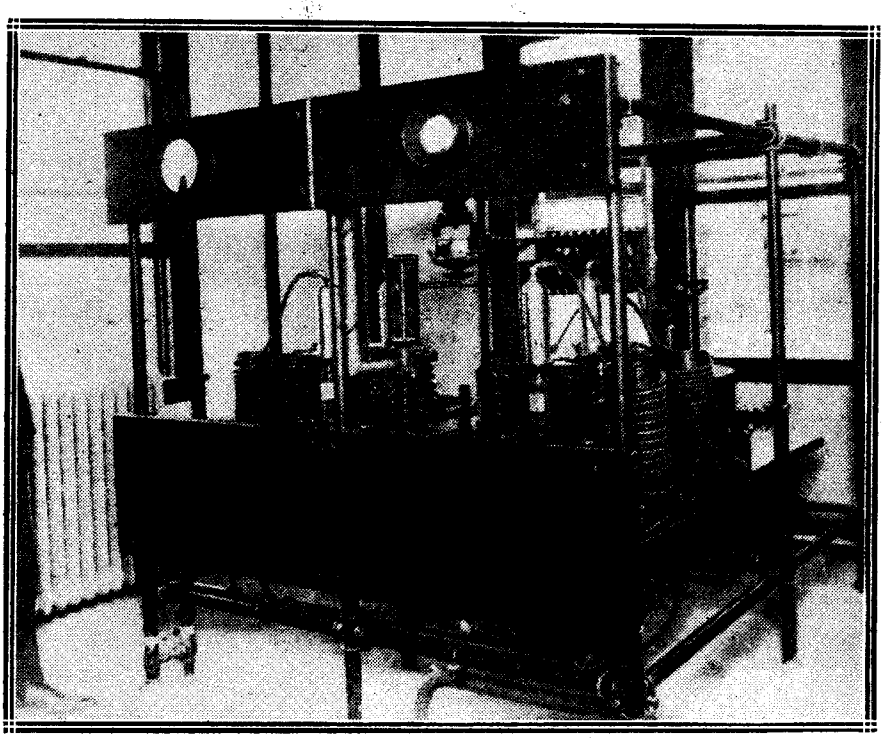
BY a curious contradiction a real improvement in programmes and a more ready response to public demand are taking place at the same time as the B.B.C. finds itself faced with perhaps the most serious crisis of its existence. The returns for licences show a danger signal. There were barely 18,000 new licences taken out in March—which should be one of the best months. This falling-off was all the more significant when the success of the sporting narratives and the new features are taken into account. The basic trouble, of course, is the delay in the provision of alternative programmes, and the eclipse of the British system of distribution by the German. It may be said that the new Daventry station will tend to restore the balance; but it is doubtful if even this will be taken as a substantial augury of better things to come. What must be done simultaneously is a better international arrangement, and one which will be obeyed. The International Union of Broadcasters, with its headquarters at Geneva, has evolved several excellent schemes for ordering the ether; but governments will not recognise or implement these schemes, with the result that after a tolerable period during which a kind of "gentleman's" agreement is observed, the chronic disturbance breaks out afresh. One or two malefactors upset the whole plan, and the ether becomes a bear-garden. Distant listening is much more in vogue than it was, but present conditions will kill it.

Difficult Time Coming

The B.B.C. would be well advised to go slow with financial commitments not directly associated with essential programme service, or likely to produce a reasonable monetary return. The financial years 1928 and 1929 are likely to be lean. Of course, this year is already stabilised at about £800,000, which is little enough for changing the system of distribution and carrying on programmes at the same time. But if the Savoy Hill people retain that admirable reserve and imperturbability which has recently characterised their policy, in contrast to previous jumpiness and inconsistency, they will pull through all right. But they are in for a difficult time, and will be well advised to make it clear that they have no funds whereby outside entertainment enterprises may be subsidised.

Should Radio Artistes Be Seen?

Ladies' Night at the Press Club this year was enlivened by the transfer there of 2 L O. The whole of the main part of the London and Daventry programmes, beginning with the Second News, was relayed from the banqueting-hall of the Press Club.



Part of the transmitting gear at K D K A—an American station which is quite familiar to British short-wave listeners.

The experiment was undoubtedly a success, and those present were extremely appreciative. But the incident gave rise to a renewal of the discussion of whether, in the nature of things, it is wise for the B.B.C. to allow its artistes to appear in public. Captain Eckersley is understood to be the energetic leader of the school of thought which

Happenings at Savoy Hill—*concluded*

would not tolerate this in any circumstances. The Chief Engineer feels that it is contrary to the whole art of Radio to bring in the visual element in this way. Just as he opposes the public discussion of devices for securing radio effects, so he thinks that the radio artistes should remain as voices to the listening millions. Perhaps naturally, the other point of view is maintained most firmly by those responsible for B.B.C. dramatic work. Mr. R. E. Jeffrey, the Dramatic Producer, aided and abetted by his chief, Mr. R. H. Eckersley, brother

This Philadelphian sculptor is conversing by transatlantic 'phone with a friend in Europe, in connection with the war memorial upon which he is working.

of the Chief Engineer, declares that the successful development of any kind of dramatic work requires an audience for vital performance. The music people seem about equally divided in their view of this problem. The forthcoming solution would appear to be a compromise.

Most of the studio work will continue without audience; but some concerts and plays for the microphone will be given in outside halls. Ultimately, however, events will probably accord with the view of the Chief Engineer of the B.B.C. The great radio artistes will not appear on the stage.

Miss Hilda Matheson

The appointment of Miss Hilda Matheson, formerly political secretary to Viscountess Astor, as head of the B.B.C. Talks Department was not generally welcomed. There was, indeed, some hostile public criticism. Events have proved that the critics were wrong. Miss Matheson has brought about a veritable revolution in B.B.C. talks. The wireless correspondent of the Press Association has acclaimed them as excellent, and his opinion is shared by a multitude of listeners. There was, of course, vast room for improvement, and no doubt there is still much to be done. But where real progress has already been recorded is in regard to the topicality and vividness of the talks, and in regard to the selection of appropriate speakers. There are not wanting those in close touch with Savoy Hill who look upon Miss Matheson as a potential head of the whole Broadcasting Service.

Public Opinion Changes

Less than twelve months ago the B.B.C. was embarrassed by local protests at the diminution in the proportion of local material broadcast. Petitions and public representations were common experience. Subsequently, however, the improvement of land-line relaying made it possible to adopt the new policy of concentration, which was accompanied by a general betterment of programmes. And now, far from a demand for more local broadcasts, there are areas in which listeners are protesting against any local programmes at all. The chief of these is Plymouth, where a considerable popular agitation is now being directed against the one programme a week which is produced by the local relay station. Plymouth listeners want their London unadulterated.

Should Summer Transmissions Be Shortened?

There are signs that the B.B.C. is proposing to reduce the hours of transmissions during the summer. The educational transmissions, of course, will be scrapped in the ordinary way, and are unlikely to be replaced. There is little doubt that most listeners would agree with a policy of seasonal reduction of transmissions, especially if this meant more money for autumn and winter programme building, and perhaps also greater opportunity for research and experiment. The B.B.C. would not be far wrong if it reduced its hours of transmission by half in July and August. It would be understood, of course, that the right times and right material would be retained.

Sir John Reith's Future

There are persistent rumours about Sir John Reith's future. Carlton Club gossip has it that the able head of the executive side of the B.B.C. is about to set out in search of new worlds to conquer. There is no confirmation of this to be found at the Athenæum or at the Caledonian, and it is, of course, useless to seek it at Savoy Hill. Nevertheless, where so many rumours converge, there must be some slight substratum of truth. It is profoundly to be hoped that the Government is alive to the value of Sir John Reith's services to broadcasting, and will not let him slip out easily. It is up to the P.M.G. to see that he stays with the Broadcasting Service at least until the end of the present licence.

The RICE-KELLOGG LOUDSPEAKER

Interesting details of what is considered to be the latest advance in loud-speaker design.

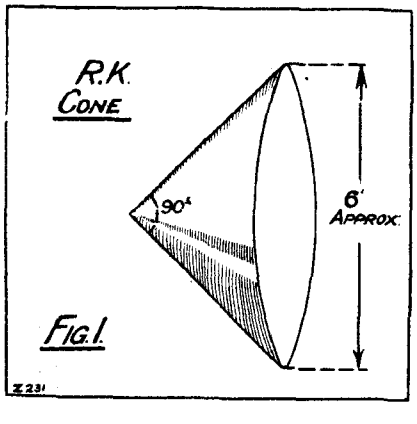
By Capt. H. J. ROUND, M.I.E.E.
(The famous radio research worker and engineer.)

THE American loud speaker known as the Rice-Kellogg (R.K.) Cone is probably the best loud speaker on the market at the present time. Unfortunately, it is not on the market at a price that is within the reach of many, and for the moment it seems as though a fairly high price is necessary. The construction of a good instrument is necessarily expensive, for the magnet system is of considerable size, and the workmanship must be good to give the very fine results obtainable with it.

A Stiff Diaphragm

The American models are worked with an electro-magnet, but the B.T.-H. Co. in England have issued a very good permanent magnet substitute.

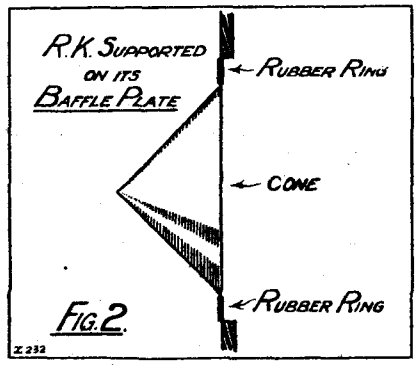
In this type of cone loud speaker, the general idea is to get a perfectly stiff diaphragm so that any force



applied to it moves the diaphragm as a whole, and Rice and Kellogg have found that one about six inches in diameter, and made in the form of a right-angled cone, approaches this ideal.

In practice it will be found that this diaphragm (illustrated in Fig. 1) very often has a high-pitched resonance, the effect of which, however, can be almost completely removed in a very simple way, which I will describe later.

Rice and Kellogg found that if this diaphragm were suspended in the middle of a flat board of as large a size as possible (Fig. 2), then the radiation of sound from it could be



calculated fairly exactly. If the diaphragm is suspended so lightly that its swing period is only ten or twenty per second and a constant amplitude of force is applied at all frequencies, then, they pointed out, the law of motion will be correct to give a sound wave very fairly duplicating the original one which strikes the microphone, providing the microphone, etc., is also correct. No ordinary magnetic system such as a Brown relay or a balanced-arm relay will be of much use, because obviously a stiff spring is always necessary with such mechanism, and to get a swing period of the diaphragm of only twenty or thirty per second will be difficult with these moving iron relays.

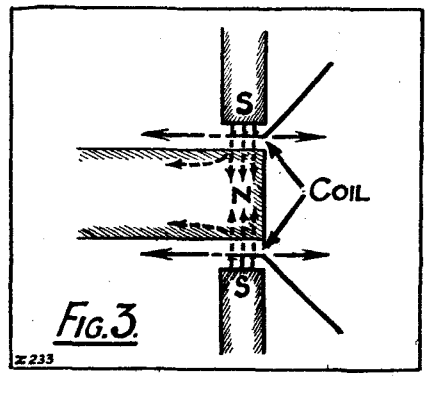
The Current-Carrying Coil

They were forced to use a system originally invented by Sir Oliver Lodge, in which a coil of wire, carrying the speech and music current, is suspended in a strong magnetic field. When no current is flowing, no force is applied to the coil, so that no springs are necessary to keep the system stable. Such a coil in a magnetic field is shown in Fig. 3. The forces on the coil are in the direction of the arrows—the direction of the dotted arrows shows the direction of the magnetic field. The complete magnetic and diaphragm systems are shown in Fig. 4. In Fig. 5 I give a section of a magnetic system which will be found satisfactory, and which can be wound for six volts and two amperes or for, say, 100 volts and ·1 ampere, the latter arrangement running satisfactorily off the mains.

Details of the Winding

The magnet system in Fig. 5 must be cast of dynamo steel and the central pole and top of the same material. This coil, for 6-volt working, can be made of No. 16 enamelled copper wire wound on a metal or fibre bobbin.

The making of the moving coil is not too easy. A piece of brass rod 1 in. in diameter should have about three or four layers of writing paper wound round it, then one layer of the same paper formed into a tube on top of this. Shellac can be used for stiffening, but for the experiment seccotine will be found easier to use,



although there is more tendency with seccotine to remove the enamel from the wire. No. 36 wire should now be wound on this paper tube in a coil, just a little longer than the gap depth, and as many layers of wire as possible put on, testing all the time whether the outer plate of the magnet will

The Rice-Kellogg Loud Speaker—*continued*

easily go over it. Each layer should be varnished or seccotined, so that the whole of the winding when it is dry is a rigid mass. The paper tube and its three layers of paper underneath will slip off the brass and the three layers of paper will easily come out of the tube, unless some varnish has soaked through, which can be prevented either by using seccotine or by waxing the under layers of paper. These three layers of paper will give, as a usual thing, sufficient clearance from the central pole, but several coils will have to be made before a really satisfactory job is obtained. This coil must now be stuck on to the cone and the apex of the cone removed.

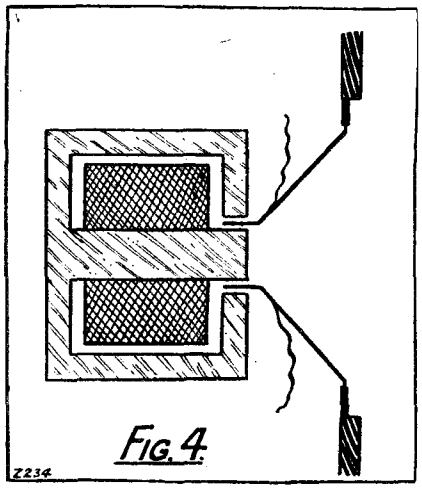
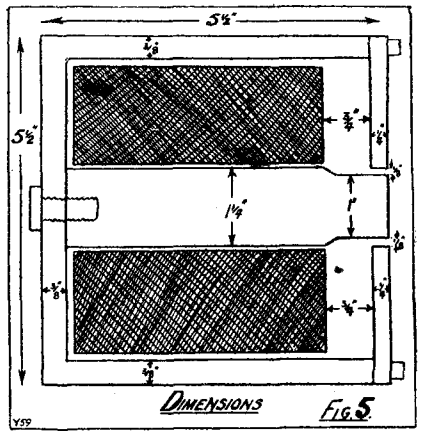


FIG. 4.

I usually fix my diaphragm and coil system on a disc of cardboard and my magnet system to the baffle board, the latter having in it a hole a little larger than necessary. Experimental fixing for the magnet system on to the baffle board is shown in Fig. 6. The object of the diaphragm on a separate cardboard disc is to enable one to lift up the coil in the gap so that it is moving quite freely—a tricky job unless the gap is large, when, of course, the magnet system will be weaker or more current will be necessary.

Flex Connections

When alignment is obtained the card can be pinned or screwed on to the board. The two leads from the coil should be stuck a little way along the cone, and then connections brought away with very light flex. Rice and Kellogg use an additional



DIMENSIONS FIG. 5.

steadying washer to assure the centralisation of the coil, but this is not essential in an experimental instrument.

The Paper Cone

The diaphragm and cone must move absolutely free from all contact with pole pieces, through a distance of at least $\frac{1}{8}$ in. either way. Sheet rubber or linen can be used for fixing the cone to the cardboard disc, and one method I use is as follows:

Make the paper cone of drawing paper, and stick it face downwards to a similar piece of paper with seccotine. Then, when it is dry, cut practically all the flat paper away with some curved scissors, leaving an edge of about $\frac{1}{8}$ in. either way for rigidity. This scheme makes the cone very rigid. The coil can then be stuck on to the cone apex. The cardboard disc can now be cut out, and a sheet of thin rubber, washleather, or linen, stuck over the hole, but not stretched seriously. The cone can now be stuck on to the rubber centrally, leaving about $\frac{3}{8}$ in. of rubber all round, again using seccotine, and then, when dry, the central disc of rubber can be removed.

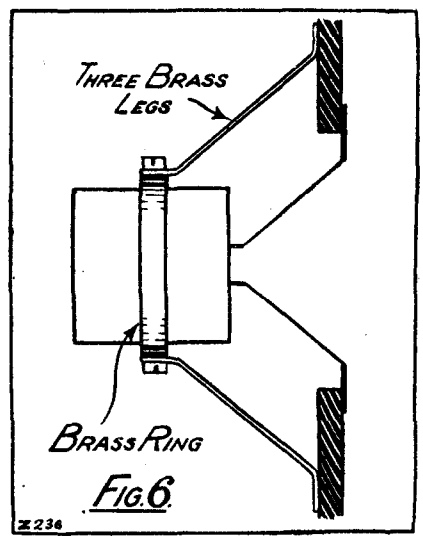


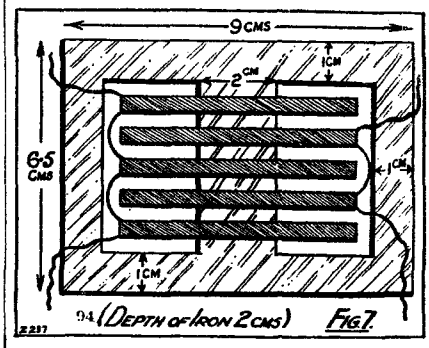
FIG. 6.

Transformer Design

The next process is to design a transformer for the loud speaker, and the following method although neglecting certain effects gives good results. The resistance of the moving coil must be determined, and usually a milliamperemeter and a voltmeter will give this accurately enough. Thus, supposing 100 milliamps flow with 2 volts, then the resistance will be:

$$\frac{2 \text{ volts}}{\frac{1}{10} \text{ amp.}} = 20 \text{ ohms.}$$

For those without instruments for measuring, the length of wire and its gauge will enable the resistance to be



9½ (DEPTH OF IRON 2 CMS) FIG. 7.

approximately obtained from a wire table.

The primary winding of the transformer is fixed by the power valve used. I will take a D.E.5 as a standard at 150 volts H.T. The valve resistance will be about 8,000 ohms. A suitable transformer primary:

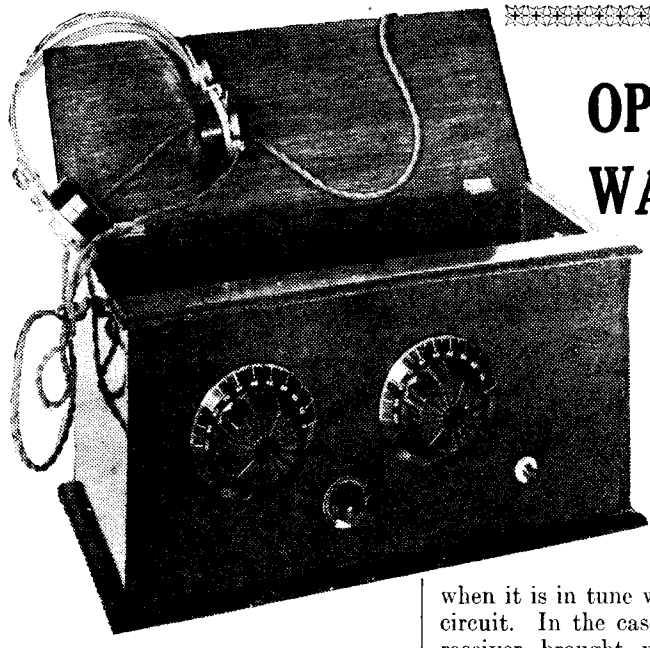
One D.E.5, primary winding, 5,000 turns.

Four D.E.5's in parallel, primary winding, 2,500 turns.

Then, if the loud-speaker resistance is say, 20 ohms, the ratio of primary to secondary turns should be the square root of twice the valve resistance divided by twenty.

Thus: One D.E.5 requires a transformer ratio of 28 : 1. Four D.E.5's

(*Continued on page 206.*)



OPERATING THE SHORT-WAVE "RADIANO" SET

By PERCY W. HARRIS, M.I.R.E.

"The technique of handling a short-wave set is somewhat different from that of an ordinary receiver. Certain peculiar effects will occasionally be observed, and it is the purpose of this article to explain how they can be avoided."

By the time this article appears many readers will already be working the Short-Wave "Radiano" and will have tested, perhaps for the first time, the peculiar joys of short-wave reception. They will have found the remarkable sensitivity of the set on these low waves, and the ease with which the two leading American short-wave broadcast transmissions can be picked up. If, in addition, they have a knowledge of the Morse code they will have listed amateur calls from maybe a dozen countries, and certainly from many districts of the United States.

At the same time the technique of handling a short-wave set is somewhat different from that of an ordinary receiver. Certain peculiar and puzzling effects will occasionally be observed, and it is the purpose of this article to explain how they can be avoided.

Radiation Resistance

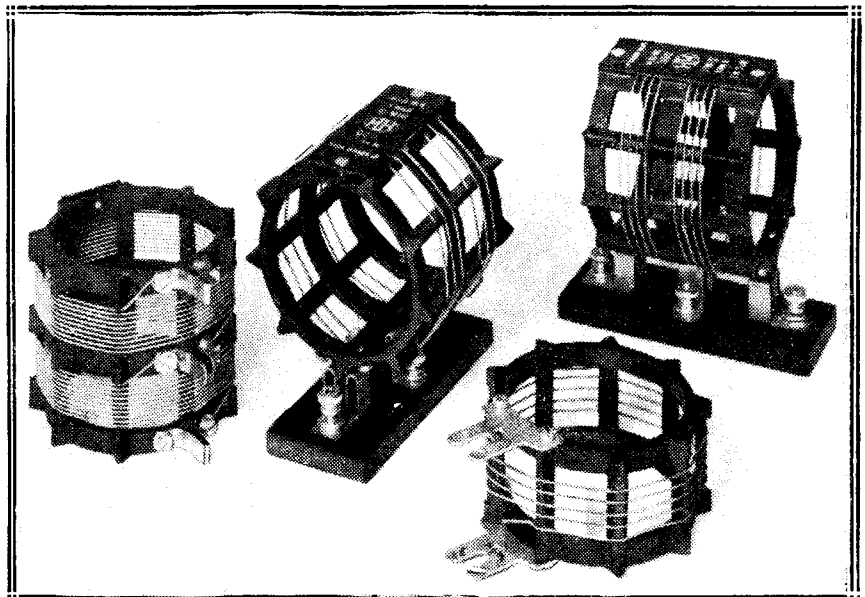
For example, you will always find "dead patches" and probably several points where the set runs into uncontrollable oscillation. "Dead patches," or parts of the tuning scale where the set will not oscillate, however much reaction is applied, are an indication that, at the frequencies for which the set is tuned at these points, the aerial is tuned either exactly or to a harmonic of that frequency. This requires a little explanation, and at the same time will make clear to readers the meaning of "radiation resistance."

Just as an aerial will receive best when it is exactly in tune with the incoming signal, so it will radiate best when it is in tune with an oscillating circuit. In the case of a short-wave receiver brought up to oscillation-point the radiation will be comparatively feeble with an "untuned" aerial, such as we are utilising in the present case, but if the aerial with the coupling coil happens to have a natural wave-length corresponding with that to which the grid circuit is tuned, then the aerial will draw so much energy from the grid circuit and radiate it into the surrounding ether that unless oscillation is extremely strong it will actually damp out the oscillation altogether.

Now, if we have an oscillating circuit and we stop it by introducing resistance, the cessation of oscillation is due to the absorption of energy by the resistance, which dissipates it in the form of heat. When oscillation is checked by the aerial coming into tune with the grid circuit the aerial is absorbing energy just as would a plain resistance, and we can, in fact, express the loss by radiation in ohms. Thus, an aerial can be said to have a radiation resistance of, say, ten ohms, when it radiates as much energy as would be absorbed by a ten-ohm resistance similarly introduced into the circuit.

Shifting the "Dead Spot"

Obviously, if the grid circuit comes into tune with our aerial, and this stops the set oscillating, we can start oscillating once more by detuning the aerial. The most convenient way to do this is to insert between the aerial lead and the aerial terminal of the set itself a small fixed condenser, say, of ·0001 mfd., or even smaller, so that it



Some of the coils that are suitable for use in the Short-Wave "Radiano" Set.

Operating the Short-Wave "Radiano" Set—*concluded*

will change the natural frequency of the aerial-coupling-coil combination. Of course, this detuning of the aerial is really shifting the "dead spot" to another portion of the scale. However, as we do not wish to tune over the whole scale at once this does not matter, and by having a condenser on hand we can quickly remove any dead spots we happen to encounter.

In speaking of oscillation here I do not intend to imply that the set should always be made to oscillate, but as the most sensitive state of such a receiver is that just below the point of oscillation we want to be able to control reaction to a nicety, and such a dead spot will prevent us from doing so. For telephony reception, in which my readers will be mainly interested, the set *must not oscillate*, or distortion will occur, and incidentally interference will be caused to any listeners within the vicinity who are trying for the same short-wave station. For the reception of continuous-wave signals from amateurs the set should be kept just feebly oscillating so that the oscillation frequency of the set will "beat up" with the oscillation frequency of the received signal and give a "beat-note" of a suitable tone to enable us to receive the Morse signal. This is what is called "heterodyning the carrier wave" of the C.W. station.

Cause of "Live Spots"

Just as we may find dead spots, we can find also particularly "live spots" where, even when the reaction condenser is set to a minimum, the set still oscillates furiously. This is a plain indication that the plug-in choke coil is of the wrong size for the particular portion of the band over which we are tuning—and happens to tune to the frequency of the grid circuit. If this occurs, for example, on a certain portion of the tuning scale when you are using a 35 plug-in coil, take it out and substitute, say, a 25 or a 40. Remember that the radio-frequency choke must never tune to the same frequency as the grid circuit, or uncontrollable oscillation will be set up.

And now a word about the home construction of coils for this set. The actual construction of the coils is a relatively simple matter, any difficulty which may arise being due to the necessity of making these coils interchangeable. The simplest way of making these coils is to obtain several pieces of Paxolin or "Pirtoid" tube (the latter is sold by Messrs. Clarke, who make the Atlas components), and wind on to them the requisite number of turns given in the next paragraph.

Constructing the Coils

These tubes look like thin varnished cardboard, although the material is really quite different. They are strong, light, and thin, and have excellent electrical qualities. Pieces of tubing with a diameter of 2½ in. and a length of 3½ in. can be obtained ready cut, and after the coils have been wound (remember there will be two separate and distinct coils on each tube) the flexible ends of the wires can be finished off with Clix terminals or any other convenient plug-in terminals of which several excellent varieties are now sold. Four sockets corresponding with these plug terminals should be fastened to a strip of ebonite and the leads taken to them.

When changing over from one coil to another, it is a matter of a few moments to detach the plugs from the corresponding sockets and substitute the new coil. The aerial coil can be wound on a piece of tubing of the same diameter, but half the length, say, from 1½ in. to 2 in., attachment to a little ebonite base being by the plug-and-socket method. An alternative scheme is to use four valve pins and four valve sockets for the larger coils and two pins and sockets for the aerial coil. The coils can lie on the baseboard without any separate insulation, or if you prefer to make a slightly neater job, a kind of wooden cradle can be made for each coil so as to keep it in the same position. The best coupling for the aerial coil to the grid coil will be found by moving the aerial coil on the baseboard or pivoting it.

The Number of Turns

Now as to the number of turns. In all cases the separation between the two coils on the larger former should be approximately half an inch. A coil corresponding with the Dimic S.W.1 should have ten turns on each half, S.W.2 seven turns on each half, S.W.3 four turns on each half, and S.W.4 three turns on each half. The turns should not be touching, but should be so spaced that whichever sized coil is made the windings occupy about half an inch. Thus the S.W.4 coil, which you will very rarely use (and then only with difficulty, as it goes down to such very short waves), will have its turns spaced roughly a quarter of an inch apart, while the S.W.1 will be spaced little more than the thickness of the wire. Number 22 or 24 S.W.G., D.C.C. can be used.

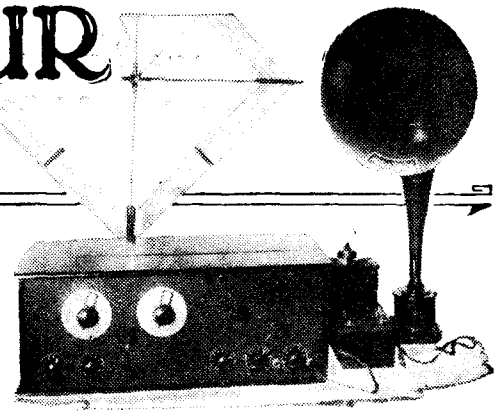
When you are first searching for telephony and you hear speech and music, do not immediately assume that you have picked up America, for you will find that your nearest broadcasting station probably has a number of "harmonics" or radiations on wave-lengths which are sub-multiples of that on which it is actually working at the time. For example, a station working on 300 metres may be heard on 150 metres, 75 metres, 37·5, and even lower. A strong harmonic of the 2 L O transmission is often heard very close to K D K A 63-metre transmission. When you do pick up America, however, you will have no difficulty in identifying it by the statements of the announcers and the peculiar quality of the transmission, which you will soon learn to recognise.

Aerial Coupling

All readers who build the Short-Wave "Radiano" are recommended to read the other articles on short-wave reception, such as "Short-Wave Adventures" and the "Attaboy Two," which have appeared in recent issues of this magazine. They should also keep an eye on the news items, as new short-wave stations are opened up from time to time, and may prove a considerable source of enjoyment. After you have become used to receiving the shorter waves try varying the aerial coupling by swinging the Unimic coil from one side to the other. There is a best coupling for a particular wave-band and the aerial used at the time, and when this has been found you will get appreciably better signals.

The "Beam" stations will be heard on S.W.3 Dimic about the middle of the condenser scale. They can be recognised by a steady "br-r-r-r," which is really the high-speed automatic transmission, and, of course, it is totally unrecognisable as Morse to the human ear.

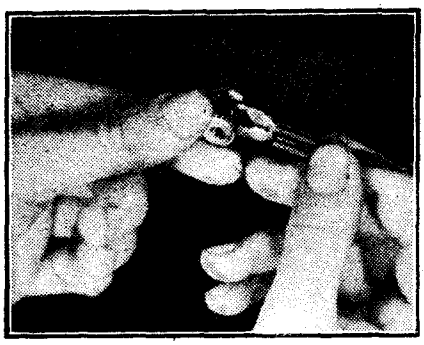
CHOOSING YOUR ACCESSORIES



After having decided upon the set to be built, the constructor has the difficult task of making up his mind about the accessories he will use. This article will be of interest and practical assistance to all readers.

By THE EDITOR.

In a previous article hints were given on choosing crystal detectors, valves and accumulators. This month I want to tell you something about the choice of H.T. batteries, loud speakers, and one or two useful accessories which make for tidiness and comfortable working.



Spade terminals ensure a neat and efficient connection.

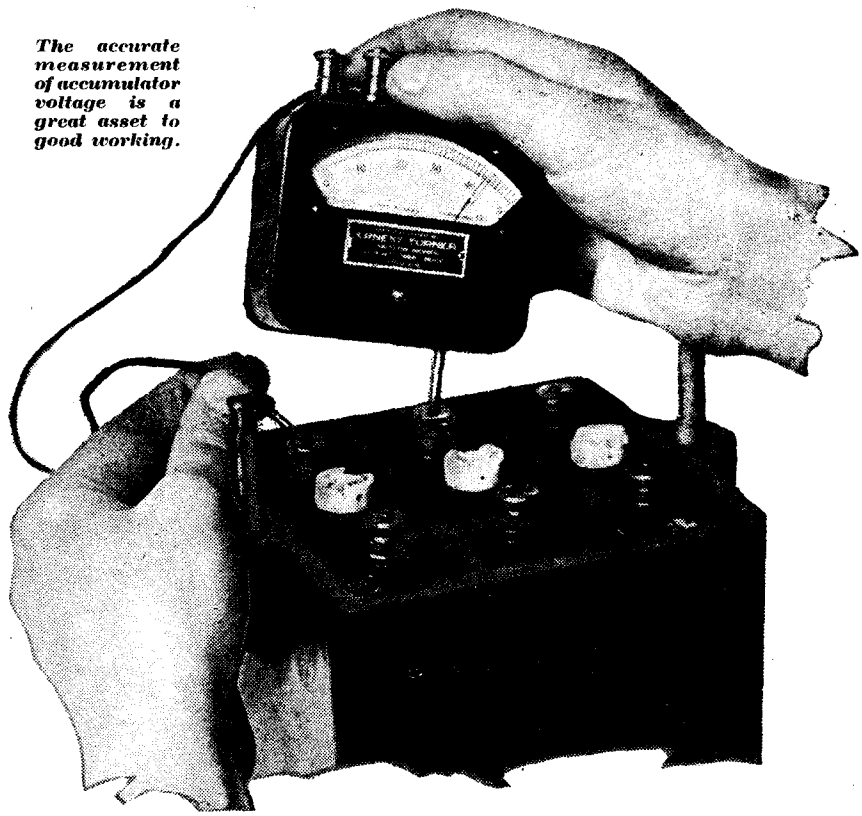
The H.T. battery is one of the most vital parts of the wireless installation, and I am sorry to say it is given far too little attention. Too many listeners are apt to consider all H.T. batteries as good provided they have the right voltage—or, rather, if they are *said* to have the right voltage! Far too often I have heard valves, loud speakers, L.F. transformers, and even aerials blamed for distortion or weakness due entirely to the H.T. battery. If the purpose, use, and construction of these batteries were better understood, many listeners would get far better reproduction with much lower maintenance costs.

Buying a Battery

It so happens that the valves we use to-day require an electrical pressure of anything up to 120 volts applied between the plate and filament, if the necessary electron flow is to be obtained. Remember that *all* the current which operates the loud speaker is derived from the H.T. battery itself. In addition to this, each valve in the set takes at least some current, the amount drawn by each depending upon the plate voltage, the grid bias, and the valve and exterior impedance. The more positive the grid of the valve (other things being equal), the more current it will take from the H.T. battery.

Economical Running

Thus an H.F. valve which is stabilised by means of a potentiometer used to place a positive bias on the grid, may take as much H.T. current as three H.F. valves of the same type when using a neutralised circuit. Similarly, an L.F. valve used without grid bias will be far more extravagant than one used with the correct grid bias. Again, a high-impedance valve used as an H.F. coupling will be much more economical than one of low impedance similarly used. As a practical example, take the popular neutralised circuit with two stages of H.F., a detector, and two note-magnifiers. If the H.F. transformers in this set are designed to work in conjunction with a valve having an anode impedance of 20,000 ohms and a magnification factor of 20, the H.T. drain will be much less than if they work with a valve such as the D.E.5, which has an anode impedance of only 8,000 or so.



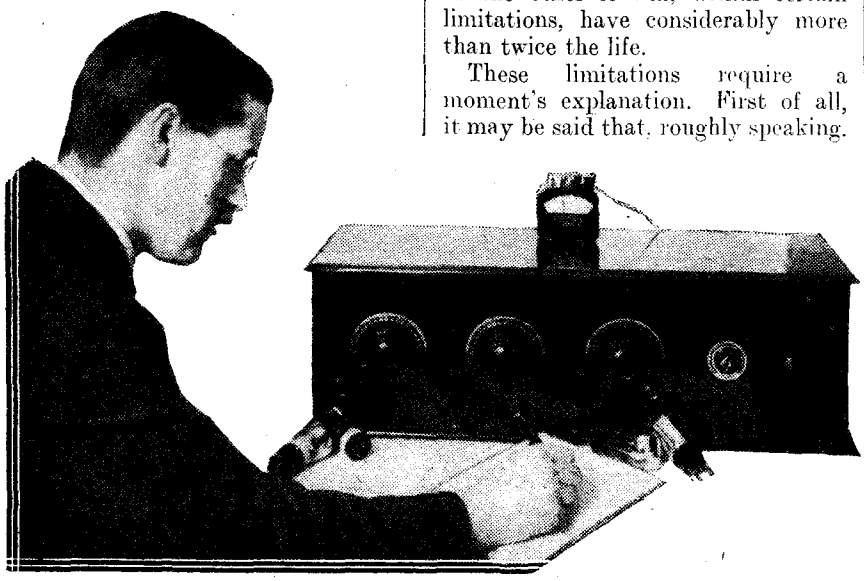
The accurate measurement of accumulator voltage is a great asset to good working.

Choosing Your Accessories—*continued*

Similarly, a high-impedance detector will be more economical than one of lower impedance, although, if satisfactory results are to be obtained with such a valve, the L.F. transformer used with it must have a suitable impedance. Another source of extravagance in H.T. current is using a needlessly high voltage on the H.F. valve. In a neutralised circuit with a high-impedance, high-magnification valve, a high voltage is definitely advantageous, but with many of the older receivers which are still in use, particularly those which are stabilised by means of a potentiometer, no better results are obtained by using a higher voltage than by one of a figure round about 40. In such sets use the lowest voltage which will give good results on the H.F. valve. The note-magnifying valves should have as high a voltage as you can give them to provide the necessary grid-swings to give undistorted reproduction.

H.T. Battery Renewals

Having briefly outlined some of the points which make for high consumption in the H.T. current, let us see what kind of dry batteries we should choose. The ordinary type of H.T. battery sold in 60, 66, or 72 units, is generally made in a box measuring about 9 in. by 4 in. by 3½ in., costing about 12s. 6d. or 15s. at the most. Such a battery is quite suitable for a one- or two-valve set, and will give a reasonably long life, say eight or nine months of average use.



Using a milliammeter to check plate-current consumption.

With a three- to five-valve set, particularly when a small power or a super-power valve is used in the last stage, such a battery will give satisfactory results for a week or two, but it will then fall off very rapidly and soon become useless. Many people, on changing from a small to a larger set, continue to buy the same size of H.T. battery and, finding that they must discard them very frequently, look upon this as a necessary evil which must always accompany the use of a larger set. The use of small-size batteries for large sets is a gross extravagance, and is the cause of a great deal of trouble in wireless reception.

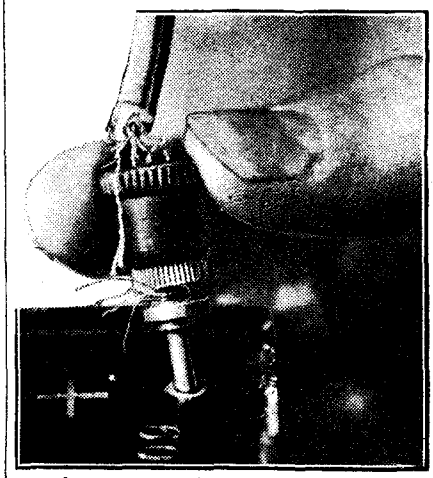
The Rate of Discharge

"But," the reader may say, "is it not just the same if I buy two small batteries rather than one large battery? The large batteries cost a great deal more than the smaller ones, even if they *do* last longer!"

People who reason thus overlook one very important aspect of the case. If one H.T. battery is twice as large as the other it will, within certain limitations, have considerably more than twice the life.

These limitations require a moment's explanation. First of all, it may be said that, roughly speaking, each size of H.T. battery has a maximum economical rate of discharge. Provided one does not exceed this maximum figure the battery will be satisfactory and economical to use. If, however, this maximum is exceeded for a particular battery, then its life is considerably shortened by much more than would be expected by the increased rate of discharge. If, for example, you discharge the H.T. battery at twice this maximum figure, you will get not half the life, but perhaps a quarter.

Thus we see that the economical way to buy H.T. batteries is to purchase a size which has a maximum economical discharge rate not less than that we desire to take from it. If you have, say, a five-valve set with two stages of H.F., a detector and two note-mags., the first of which is a small power valve and the second a super-power valve, the current consumption will be such that for real economy you must run it from a mains unit, H.T. accumulators, large-capacity Leclanche batteries, or the largest and special sizes of dry H.T. batteries.



Are your wander-plugs like this?

Comparative Costs

The cost of mains units and H.T. accumulators will be quite considerable, as you will see by consulting makers' catalogues and advertisements. The wet Leclanche type of H.T. battery will be slightly cheaper but a little more messy, and renewing the electrolyte is rather a tedious task; while if you desire to use dry H.T. batteries you will find the largest sizes cost you about 25s. per 45-volt unit. Thus three of these will cost you £3 15s. (for this you will have 135 volts, which is ample for giving undistorted loud-speaker reproduction with a super-power valve). One hundred and thirty-five volts in the small sizes of H.T. batteries of good make (avoid the cheap H.T. batteries of unknown make as you would avoid the plague) will cost you about a

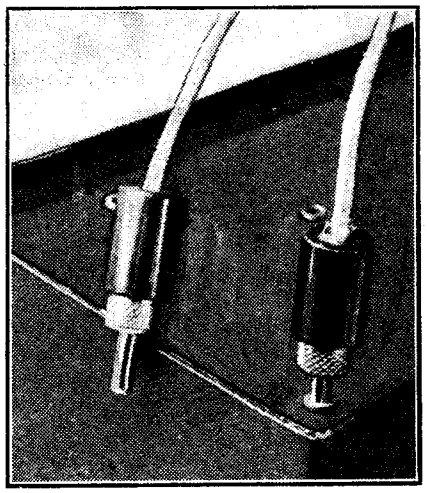
Choosing Your Accessories—*continued*

pound to twenty-five shillings, although some good batteries are now obtained at somewhat cheaper prices. Now, if you want pure, undistorted reproduction, and you use such a set as I have mentioned regularly and must use dry batteries, your annual bill for H.T. will be *less*, and the results much *more satisfactory* if you take the plunge and buy the larger sizes at once.

So much for H.T. batteries. Let me give you a few hints regarding loud speakers—the choice of which is an important matter and not merely one of price.

A Simple Analogy

To understand the best way to choose a loud speaker, having regard to both economy and efficiency, let us remember that first of all a loud



An efficient modern wander-plug.

speaker can do no more than give faithful sound reproductions from the electrical currents passed into it. If these currents carry distorted reproduction then the best loud speaker in the world cannot correct that distortion. To take a simple analogy, no matter how good the lamp you put inside a dirty lampshade, you cannot make that lampshade look clean.

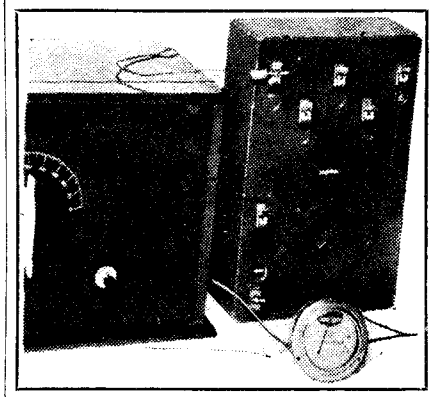
The Choice of a Loud Speaker

Now the bearing of this upon the choice of a loud speaker is a very important point. If you have a set which, to give loud-speaker reproduction, must be pushed up to the limit of reaction, the output is bound to be distorted, and if you try half a dozen loud speakers of varying qualities you will not be able to detect a great deal of difference between them.

If, however, you are getting (by means of a properly designed receiver with the correct valves, good transformers or suitable resistance-coupling, proper grid bias, and the like) a really faithful reproduction of the excellent quality given by the broadcasting station, then you will be able to notice a very appreciable difference between loud speakers. Strangely enough, comparatively few people have ever heard a really good set operating properly. If it were otherwise we should not hear "tinniness" so frequently attributed to the metal horns of loud speakers, or distortion put down to loud-speaker overloading. Almost any loud speaker of horn or cone type will give a volume of music far louder than is pleasant to hear in even a large living-room without reaching "saturation" point. The overloading effect is nearly always due to an unsuitable valve in the last stage.

Large Types Best

Many people think that small loud-speakers are for use with a small set, and that a large loud speaker will "strain" a small set. No matter what receiver you use, small or large, if it is sufficiently powerful to give loud-speaker reproduction you will invariably get better results on the full-size loud speaker than on the small or baby pattern. These latter are sold by the manufacturers to cope with the demand for inexpensive loud speakers, and no manufacturer claims for his small type equality with the larger. It is purely a matter of expense. Pay the price for a larger loud speaker and you will get a better instrument, for it is impossible

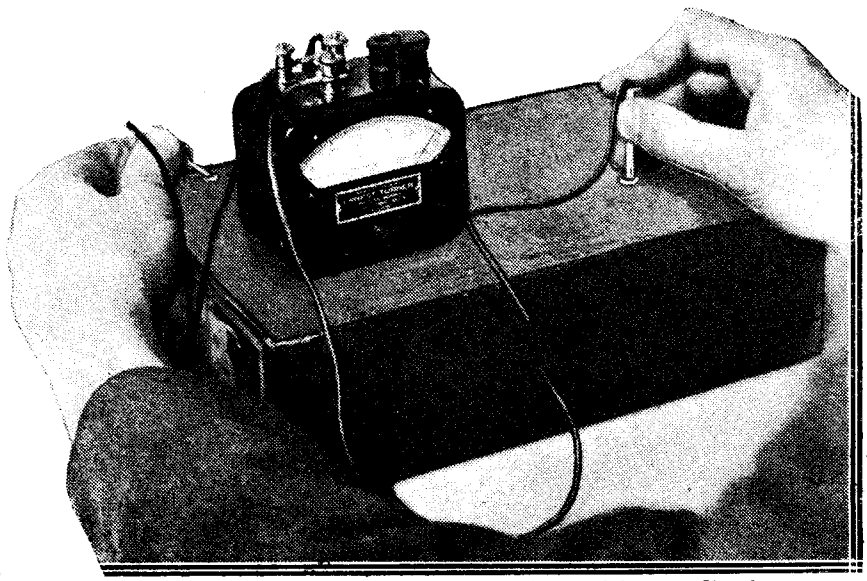


The milliammeter is connected in the H.T. negative lead.

to give as good reproduction with a small horn as with the larger, while the larger types have mechanism capable of giving distinctly better reproduction.

Horn or Cone?

The choice of horn or cone must be left to individual taste. All cone loud speakers are not better than all horn types. The horn types are generally more efficient so far as strength is concerned for a given input, but they are not liable to reproduce the low notes as well as the cone types unless the horn is far larger than is practical for home use. A cone type generally



H.T. voltage must be measured with a high-resistance voltmeter.

Choosing Your Accessories—*concluded*

suffers slightly in the reproduction of the higher notes. On the whole, my own opinion is that the balance is in favour of the good cone type, and there is every likelihood that cone, or disc, loud speakers will gradually replace the horns as time goes on.

In this respect it will be noticed that practically all loud-speaker manufacturers are now producing the cone type as well as the horn. Beware, however, of choosing a loud speaker on type alone, *i.e.* do not assume that of two reasonably priced loud speakers the cone is bound to be better than the horn. Have a practical test wherever possible on a set which is capable of good reproduction.

An Important Detail

If your own set is unfortunately not able to give reproduction of the highest quality, try and arrange to test any loud speaker you intend to buy on it to see how it suits *your* conditions. It often happens that a slightly distorting set sounds better with one make than another, although there would be nothing to choose between the speakers on a better set.

To turn to another matter, do not forget that tidy leads make a great difference to the general workmanlike appearance of your receiver. Take, for example, the aerial lead. It is by no means necessary to bring the actual aerial wire (which is clumsy and thick) to the aerial terminal of the set. A much better way is to use a lead-in tube with a good substantial terminal, and then to take a piece of twin flex from that terminal to the set. There is no need to separate the twin flex into its two leads. Bare both wires at each end and twist them together so that you are using the two leads in parallel. There are a number of excellent spade terminals sold, and these can be used to finish each end. The earth lead can be similarly treated.

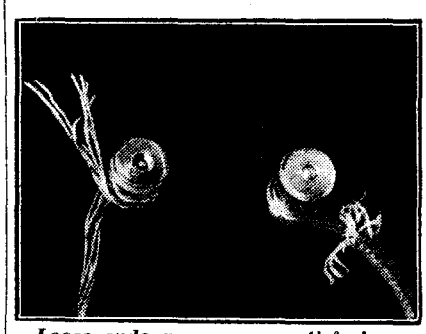
Tags for Terminals

I am a great believer in spade tags for finishing off all leads which go to terminals. They make a neat, sound electrical joint, have a good appearance, and there is far less likelihood of their slipping off. Take, for example, the leads which go to the accumulator. These must be taken off and put on at regular intervals, and if the method of connection is merely to twist two or three strands of wire underneath the terminals, it is by no means easy to make a rapid change, and very often an unsatisfactory joint is made. Complete battery cords in which high tension and low tension are combined are available from several manufacturers, and a small expenditure for these is well worth while to give a neat appearance.

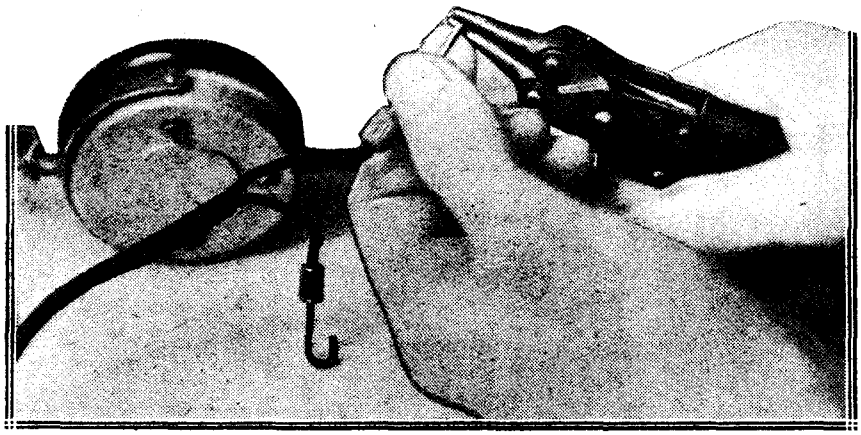
Though not absolutely essential, a very useful accessory is a good-quality combined voltmeter and milliammeter, the voltmeter windings being of the high-resistance type suitable for H.T. battery testing. Admittedly such an instrument will cost more than the cheapest voltmeters and milliammeters, but these latter are often so thoroughly unreliable as to be worse than useless.

Several makers sell combined instruments, which by turning a switch can be converted from a six-volt reading to a 50-volt reading or 120-volt reading, according to type, and by using other terminals and changing the switch to a suitable position, milliamperes can be read. Articles have recently appeared in the WIRELESS CONSTRUCTOR explaining how to use a milliammeter and a voltmeter, so that there is no need to repeat the instructions here.

So far as accumulator testing is concerned, if you are not in the position to obtain a good and reliable voltmeter, do not purchase a cheap one, but buy instead a battery hydrometer which will cost you only three or four shillings, and will enable you to test the specific gravity of the acid. A hydrometer is a very simple instrument to use, as the end of its tube is simply dipped into the acid and by means of a suction ball the acid can be drawn up into the hydrometer tube. A small float inside the tube will give an immediate indication of whether the battery is fully charged, partially charged, or completely discharged.



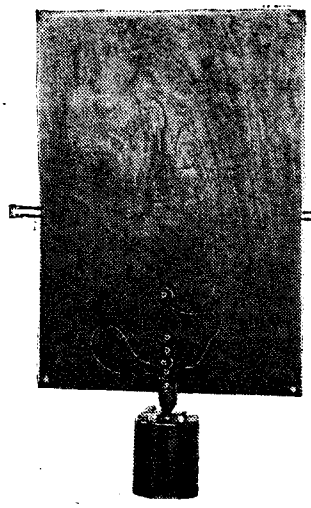
Loose ends are very unsatisfactory.



It is often advantageous to bend the 'phone tags into loops.

Accumulator Tests

Experts consider that specific-gravity reading in this way is much more reliable than the voltage reading, for with a good accumulator the voltage will keep up to two volts per cell until practically the end of its safe discharge, making it quite impossible by voltage reading to tell whether a battery is fully charged or nearing the end of its useful charge. As the specific gravity of the acid in an accumulator steadily falls as the charge is taken out, an approximate idea of the state of the battery is thus readily obtained from its readings.



A "Non-Twist" Frame Aerial Mount

An inexpensive but very useful device for all who use frame aerials.

By H. BRAMFORD.

ALL those who use frame aerials will appreciate the simplicity and the usefulness of the component which is about to be described in this article. The device when finished presents a neat and pleasing appearance, as will be seen from the accompanying photograph. In design it also has several distinct advantages, the principal being that one is able to rotate the frame aerial in any direction without having to bother about twisting the flexible connecting leads.

The means whereby this result is obtained is somewhat unusual for the home constructor, as an ordinary open-circuit jack is employed for this purpose. Terminals are provided upon the jack itself for making connection from the frame aerial to the receiving instrument. In addition to this and as a refinement, a compass has been attached to the stationary base as a useful means for locating any given direction in event of the entire frame being moved from place to place.

We will first deal with the constructional work entailed. This is simple and costs little.

Making the Base

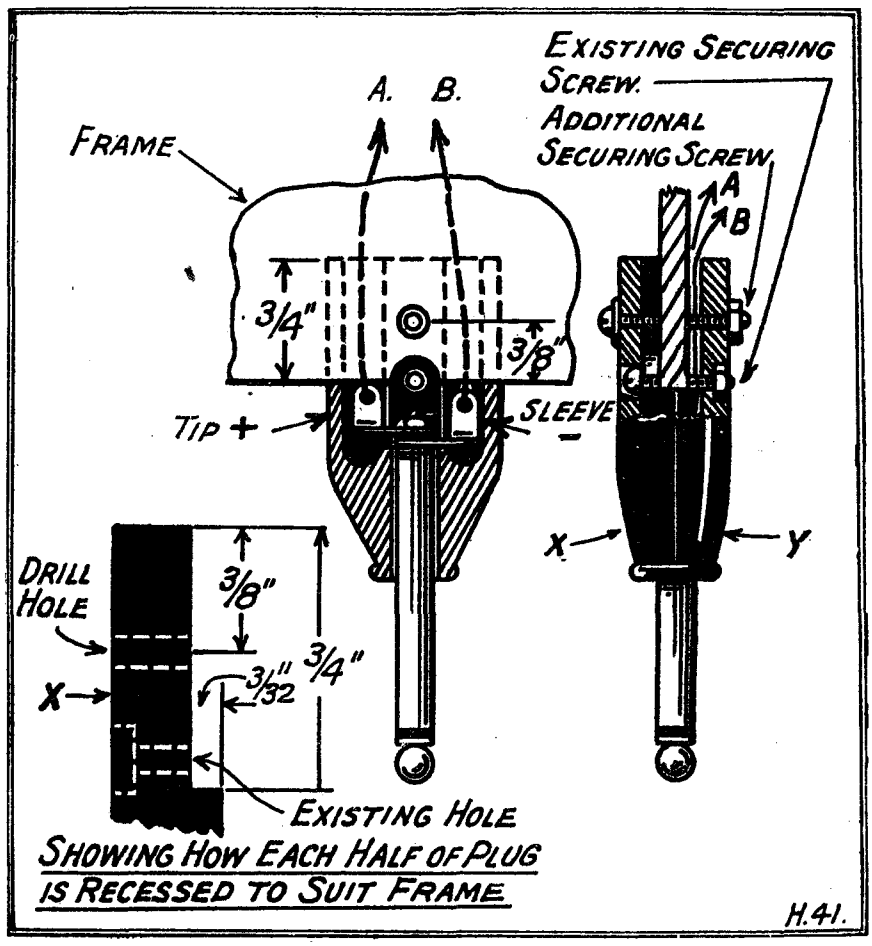
First prepare the base, which is entirely independent of the frame aerial itself. Full working details, together with the principal dimensions, are shown clearly in the drawings. If one is in possession of two discarded variable condenser ebonite end-plates of the type shown, very little need be done as regards this part of the work. The end-plates, it will be seen, are supported by four pieces of $3\frac{5}{32}$-in. diameter wood rods. These rods should be cut in equal lengths of 4 inches each. If holes are made in the ebonite end plates with a $\frac{5}{32}$-in. drill, the rods will be found to fit quite tightly, but to ensure rigid workmanship a little glue may be used. The jack is mounted upon the top plate, as indicated, together with the two terminals. When this is done, connection is made from one terminal to one of the jack soldering tags, the remaining jack soldering tags being connected to the other terminal. The compass is finally mounted upon the top plate in the position shown, in any desirable manner. The one mounted upon the actual component was securely and permanently fixed by means of seccotine.

LIST OF THE COMPONENTS.

- 2 ebonite variable condenser end-plates (old pattern), or, alternatively, 2 circular discs of ebonite $3\frac{1}{2}$ in. dia. x $\frac{1}{4}$-in. thick.
- Some strip fibre, $3\frac{3}{8}$ in. wide by about 1 ft. long.
- Some lengths of $\frac{5}{32}$-in. dia. wood rod, such as is supplied in packets of Glazite wire.
- 2 W.O. terminals, nickel.
- 1 open-circuit plug and jack (Igranic-Pacent No. 40). Note: This type must be used.
- 1 compass, any pattern, of about 1 in. diameter.

Mounting the Frame

To finish the base, cut the fibre strip to the width shown, viz. $3\frac{5}{8}$-in., and wrap round the end-plates. Suitably secure the overlap edges with glue, tie with string, and leave until



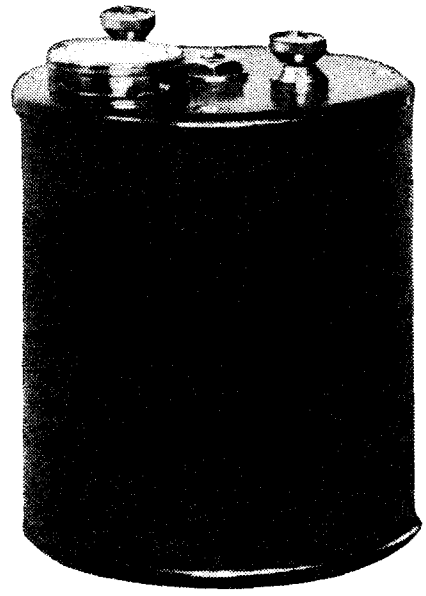
A "Non-Twist" Frame Aerial Mount—*concluded*

the glue is perfectly dry, when the string may be removed. This final operation has the advantage of giving the component a particularly neat and finished appearance.

Any type of frame may be used. The frame used in the actual component described consisted of a winding made upon a rectangular base of $\frac{3}{16}$-in. plywood. It is important, however, to describe how the plug itself is prepared, in order to be able to secure it to any type of frame. If the frame to be used is thicker than that which is described, it is only necessary to recess the wood down to the given thickness.

Supporting the Frame

A diagram is shown which gives complete details of the plug, showing how it is attached to the frame. It is essential to do this work neatly and securely, as it has to bear the weight of the frame itself; but if the work is done well it will be found to be quite satisfactory. The first task to do is to recess each side of the plug, which will be found to consist of two halves when the existing securing screw is removed. Details and dimensions of the cut-away to be made on each side are shown in the drawing. When this is done, a hole should also be drilled in each side, as shown, in addition to the existing securing hole. The position for this hole is easy to locate, as on the inside of the jack a circular boss will be found in an identical position to that in which the hole is required. Finally, drill a small hole in a corresponding position to the upper hole of the plug in the frame itself, and slightly recess the frame to allow for clearance with the lower hold in the plug. Before securing the plug to the frame, take a flexible lead from the positive-tip tag and a further flexible lead from the negative-sleeve tag. Each of these leads should be about 12 in. long, and the ends should be provided with Clix plugs. This latter detail, however, is only necessary if the frame itself is provided with sockets, as alternatively the leads will be dispensed with and taken direct to the winding upon the frame. The plug is now secured to the frame by means of the additional securing screw, as shown, and finally by means of the existing securing screw. When this is done the frame is ready for use, and with the plug thus attached is inserted into the jack upon the base. The frame can be rotated completely, unbroken contact being made at all times. The advantage of adding the compass has been explained.

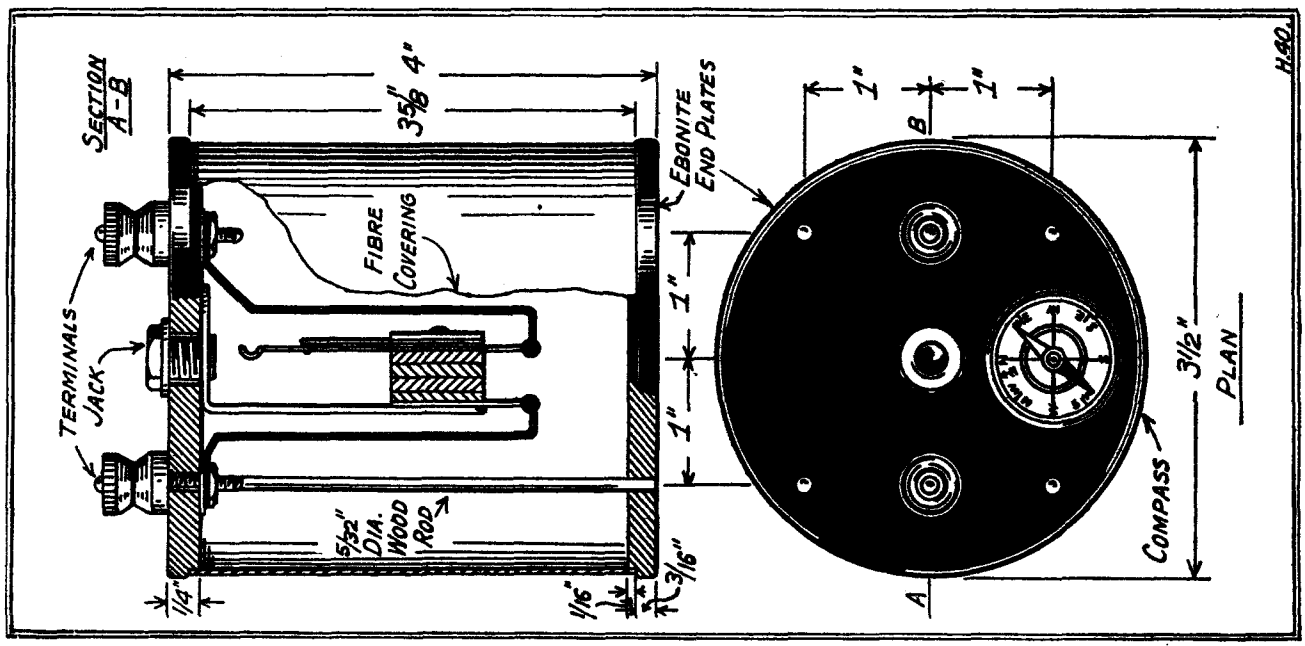


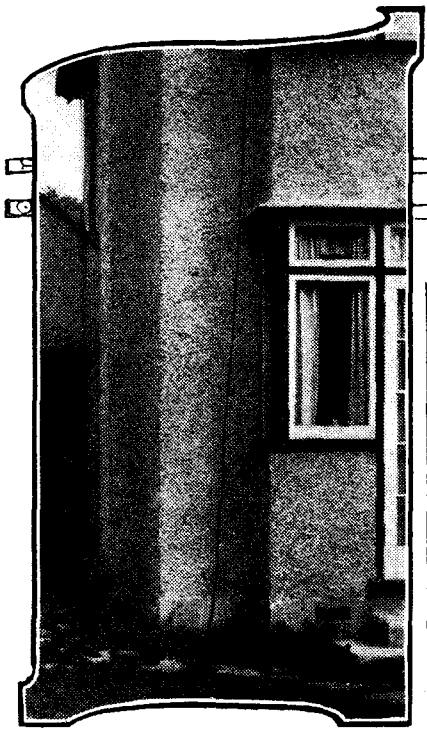
A photograph of the complete device.

COUNTERSINKING IN EBONITE

When constructing a wireless set it is often found necessary to countersink those holes in the panel which take screws for the panel brackets, or those screws along the bottom edge which help to keep the panel and baseboard safe and secure.

If the constructor does not possess a countersinking bit a good plan is to use a large twist drill. The drill used for making holes for one-hole fixing components will be found suitable, and two or three turns of this will quickly bring about the desired effect. Do not press too hard on the drill, as it will bite into the ebonite and either leave a jagged hole or else make much too deep a countersink.





Are You Really Earthed?

An article on a subject of importance to every listener.

By R. W. HALLOWS, M.A.

AN interesting little incident which occurred recently brought home to me in a rather startling way the supreme importance of making sure that the earth connection is all that it should be. Here is what happened. A friend who knows nothing whatever about wireless had installed a perfectly good three-valve set, but was failing to get anything like the results that should have been his.

A Puzzling Fault

Yielding to his almost tearful entreaties, I went round in an endeavour to discover the source of the trouble. The circuit was a perfectly ordinary and straightforward one, incorporating an H.F. valve, a rectifier, and a note-magnifier; it was well made and all the components appeared to be of good quality. Now, though my house is only a short distance away from his, three valves similarly arranged give me all the volume that I want from 2 L O, the local station, and bring in quite a number of others at varying degrees of loud-speaker strength. Yet when I tuned in the London station upon my friend's set, only the feeblest little bleating issued from his loud speaker.

Naturally, one suspected the batteries; there was nothing wrong with them. The valves, the components, and the wiring were all next tested out, no fault being found anywhere. The aerial was an excellent one, some 30 feet in height at the free end, well insulated and unscreened; it was, in fact, a very great deal better than my own, for telephone wires crossing the garden prevent me from getting quite as much height as I would like.

This being so, the likeliest cause of the trouble that remained to be investigated was the earth connection, and this at first blush appeared to be as much beyond reproach as all the rest of the gear. A short, stout insulated wire ran to a copper tube some three feet in length, which was driven right home into the soil of a flower-bed immediately below the wires of the aerial.

When a bucket of water was emptied on to the bed round the earth tube—a moderately dry spell was in progress at the time—there was an immediate slight improvement in signals. It was not a great improvement, still there was no doubt that the volume was just a little bigger.

All this business had taken so long that I had to return home without being able to do anything further that evening. Two days later my friend told me that signals were just as weak as they had ever been.

A Bed of Clay

The facts that in the first place the set responded so rapidly to the effects of wetting the soil, and, secondly, that the improvement was so short lasting, seemed to show that there was something highly unsatisfactory about that earth connection. I resolved to investigate the matter thoroughly as soon as possible. Though there had been no great amount of rain for some time, the weather had not been dry enough to parch soil for more than an inch or so below the surface. The inference was that the earth tube must have been driven into a particularly porous layer which was quite incapable of holding moisture for any length of time, and on that account very soon developed a high resistance.

On digging down we found a state something like that illustrated in the drawing. For rather more than three feet from the surface the soil was of a very light gravelly kind with no clay in it. From that point downwards it became rapidly heavier, and at four feet was a bed of sticky clay.

The Critical Six Inches

An interesting field for experiments was opened up at once. We found that into no matter what part of the bed the tube was driven to a depth of only three feet poor results persisted. On taking it, however, into the hole that we had dug and pushing its point only six inches or so into the clay we at once obtained enormously improved reception.

One of the earthing-plates mentioned in this article.

After making further tests we found that driving the tube deeply into the clay appeared to make no further improvement; so long, in fact, as its point was thrust in a few inches deep perfect working was obtained. Directly we removed it from the clay and placed it into the gravel again there was a noticeable falling off, even when the soil was thoroughly wetted.

I had previously heard reports that in this particular neighbourhood

Are You Really Earthed?—*concluded*

certain houses were particularly bad as regards wireless reception. They were, in fact, regarded, both by their owners and by experts who had endeavoured unsuccessfully to obtain good reception in them, as standing in small freak blind spots. The freakishness was accentuated by the fact that reception in some of them had proved to be better with a frame aerial than with an outdoor wire.

"Blind Spot" Explained

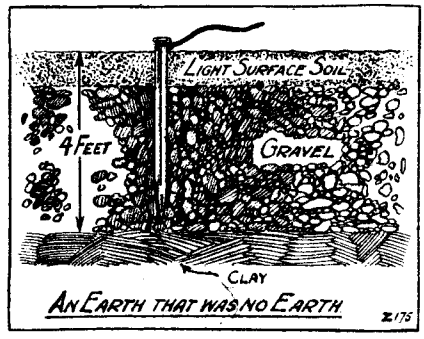
The explanation of this queer state of affairs was at once obvious. The houses were not in blind spots at all. They were built upon gravelly soil and the earth connections had not been buried deeply enough. As another friend happened to be living in one of these houses I went to see him, in order to put this theory to practical proof. On tuning in London, I found that he was quite a valve worse than he ought to have been. Actually he was using four to do work for which three should have sufficed. The earth lead was next disconnected. This affected the tuning a little, but when a slight adjustment had been made signal strength was certainly as big as it had been with the earth wire, if, indeed, it was not a little greater. The earth connection, in a word, was no connection at all. When later he had sunk his earth plate a foot deeper, he found that he was no longer living in a wireless blind spot.

"Get Down to Clay"

One wonders just how much of the bad reception complained of in certain districts round both London and other broadcasting centres can be traced to earths that are not proper earths at all. Gravelly soil with an underlying layer of clay is common in many parts of this country, the depth of the gravel varying from a few inches to several feet. Should there be clay or other heavy soil mixed in with the gravel, as is not infrequently the case, very fair results are obtainable with an average earth tube or plate buried three feet or so below the surface; but if it happens that the soil is light and porous for some distance down, a locality may easily receive the reputation of being a blind spot simply because ordinary earth connections do not answer properly.

Should any reader have encountered in his own case such freakish conditions as have been described above, or should he find that he is not getting such results in the way of reception as should be his, I would strongly advise him to turn his attention to his earth contact. The golden rule is always: Get down to the clay if you possibly can.

Not a bad test for the quality of the earth is to try the effect of substituting for it a makeshift counterpoise. Detach the earth lead, and to its terminal on the receiving set fix one end of a coil of insulated wire containing twenty yards or so. Arrange the coil loosely upon the floor. If now reception is just a little better than it was, you may feel quite



sure that your earth connection is at fault. It may be that you are unable, owing to the depth of the gravel stratum, to get right down to the clay below. In this case it is advisable to adopt some alternative to the ordinary earth tube or small earth plate.

The outdoor counterpoise often answers very well indeed, but it has its drawbacks. It is made by suspending one wire, or preferably two, below the aerial itself at a height of about eight feet above the ground.

Counterpoise Earth

If two wires are used, they should be spaced from eight to ten feet apart, and they should be for preference a little longer than the aerial. Whether it contains one wire or two, the counterpoise must be thoroughly well insulated at both ends, and the wire connecting it to the earth terminal of the set must be brought into the house through an insulating tube. The great disadvantage of the counterpoise is that it requires a good deal of space, for it must be clear of all earthed objects such as buildings, trees, bushes, and so on.

An earth connection that often answers pretty well in porous soil is one made from an entire sheet of corrugated roofing iron buried immediately under the aerial. It is by no means a bad plan to make a rectangular depression immediately above such an earth plate so that it may catch as much water as possible in wet weather. In dry weather, water should be put down every two or three days.

Independent of Conditions

There is another type of earth which I have personally found extremely good in light, gravelly soil. It has the advantage that its installation entails no deep digging, and it scores over the counterpoise in that it can be used where there is not much clear space. It consists of two pieces of stout, bare, cabled wire, spaced some ten or twelve feet apart, which run the whole length of the aerial and are buried only a few inches below the surface. The ends nearest the house are connected together and from the junction a lead runs to the earth terminal. Such wires can be put down very quickly; all that one has to do is to make a small, shallow trench for them with a pick.

When this kind of earth is used one is practically independent of the dryness or dampness of the ground. The purpose of the earth connection is, of course, to form one "plate" of the big condenser (big in size, that is, but not in capacity) consisting of the aerial and the earth. In wet weather when contact is good the ground itself forms the lower plate, but in dry weather there is a capacity field between the aerial wire and those buried just below the surface. In this case the buried wires practically become a counterpoise, since they are to all intents and purposes insulated by the bad conductor that surrounds them.

The Water-Pipe Cure

Readers may wonder why I have not mentioned the simple connection of a water-pipe as a cure. The reasons why I have not done so are two: First of all not every water-pipe, even if it is an ascending main, makes a good earth connection. Secondly, I feel that whenever an outdoor aerial is used there should always be an outdoor earth of good quality to which the aerial may be connected when the set is out of use.

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Before marketing the LISSEN New Process Battery we introduced our new policy of direct-to-dealer distribution. This cut out all wholesalers' profits and we were able to put the battery on the market at **10/6**. Not satisfied with this, the next step we took was a very bold one. We cut down our own profits on this battery and asked our retail friends to take less profit also. We then drastically cut the price of the battery to **7/11**. This battery then became the best value-for-money battery available, and the response from the buying public was so overwhelming that we had to discontinue advertising. Trade orders were cut down in every direction. Strenuous efforts for the past few months have enabled us to overtake arrears. Trade orders are now being executed in full and you should be able to get the LISSEN New Process Battery from any good dealer. If you have any difficulty, send direct to the factory; no postage charged, but please mention dealer's name and address.

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L 324

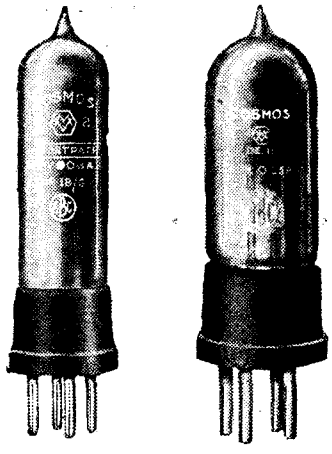
WITHIN THE VACUUM

By KEITH D. ROGERS.

(Asst. Tech. Editor of "Popular Wireless.")

Valves for Portable Sets —The B. T.-H. new 2-volt range—Changes in nomenclature.

WITH the approach of the summer months I have had quite a large number of letters from constructors of portable receivers asking for assistance with regard to the choice of valves for their sets. Most of these query the capabilities of modern valves to stand up to the



Two useful portable-set valves with strong filaments. The S.P.18 type takes 1·8 volts, while the D.E.11 requires only 1·1 volts L.T. supply.

jolting and vibrations they will receive when used in a receiver of a portable nature.

Let me answer that question right away. I have found very few valves indeed, with the exception, perhaps, of some of the ·06 filament type, which will not stand up to fairly rough handling in a portable set, provided they are properly mounted.

Accumulator Preferred

This must not be taken as an indication that ·06 valves are unsuitable for use in such receivers, but merely as a warning that if these valves, with their necessarily fragile (or comparatively fragile) filaments, are to be employed, a little extra care must be taken in rendering their holders as shockproof as possible.

Personally, I prefer to add slightly to the weight of a portable set by carrying a 2-volt accumulator of non-spillable type in lieu of dry batteries, and employing ·1 amp. 2-volt valves, of which there are many available on the market. Using ordinary non-microphonic valve-holders I have found that these valves will stand up to a surprising amount of vibration and rough handling without becoming in the least way damaged, and I have never known one to have its filament broken unless the case containing the set had been allowed to fall.

Choice of Valves

There is another point which I should like to emphasise with regard to valves and their uses in portable sets, and that is that in most cases at any rate you will have to give up all idea of choosing your valves with a view to obtaining absolute purity of reproduction, and to content yourself with moderately good results —I do not mean unnecessary distortion—in order to obtain sensitivity, and that most important point, low H.T. current consumption.

If you want to cut down the weight of your H.T. batteries you will have to give up all ideas of super-power valves, and in some cases of the ordinary power valves, and use those suitable for L.F. work having comparatively high impedances.

In this respect resistance coupling and high-magnification valves are a great asset in the construction of portable receivers, for with the valves now available really good amplification can be obtained by this means, and at the same time weight can be saved by the use of resistance coupling instead of the more usual transformer coupling. The H.T. batteries will have very little current drain upon them and quite good results can be obtained with 90 volts made up from flashlamp batteries.

I notice that the B. T.-H. Co. are rapidly coming into line with other well-known valve people by the production of a new 2-volt series. I refer to the three valves, the B21, B22,and B23 which have just been placed on the market.

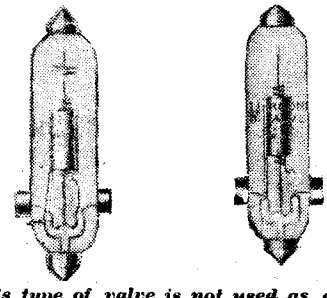
The former has an amplification factor of 16 with an impedance of 32,000 ohms, and is designed for H.F. amplification or rectification where a high impedance value is required.

I have not yet tested these three valves thoroughly, so cannot give any opinion as to their operation, though it would appear that the magnification is rather low in all cases when compared with the impedances.

The B22 has an impedance of 14,000 and a magnification of 7·5, and should make quite a useful general purpose valve, while the B23 is a power amplifier having an impedance of 8,000 ohms with a magnification of 6.

New Power Valve

This latter valve takes a filament current of ·2 amp, while the former two require ·1 each, and with regard to the B23 it is interesting to note what the makers themselves say. They point out that in designing the B23 two main features were borne in



This type of valve is not used as often as its efficiency warrants. The D.E.V. and D.E.Q. (H.F. and detector valves) shown here are very suitable for portable sets and require little space.

mind: (1) the need for a 2-volt loud-speaker valve which would approach the performance of the popular B4, and (2) the requirement of a loud-speaker valve which would

(Continued on page 206.)

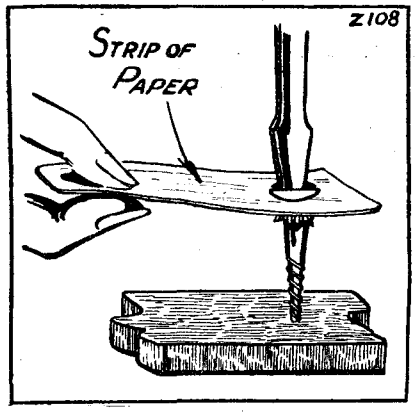
Some essentially practical notes for the set-builder who wishes to "Adopt, Adapt, and Improve."

NOTES AND JOTTINGS

By A. V. D. HORT, B.A.

The following tips include details for making Contact Studs from Screws, a Holder for Small Drills, and a useful "Skeletonised" Former for Short-Wave reception.

A TIP which is probably well known to the old hands, but which may come new to some readers, consists in a simple method of steering bolts or screws into awkward positions. As shown below, the screw is pushed through a slip of fairly stout paper or thin card. The slip serves as a handle to guide the screw into position, and steadies it while it



is started with the screwdriver. When the screw is quite firm, but before it is turned hard down, the slip is torn away.

* * *

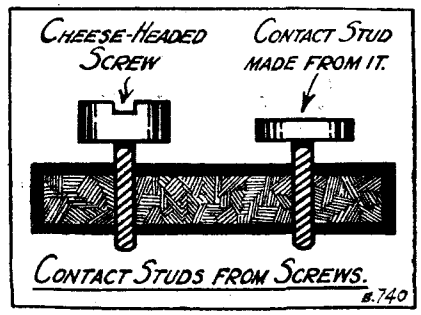
A FAULT of an unusual kind, which proved difficult to locate, was brought to my notice the other day. The trouble occurred in a short-wave set of straightforward design, and consisted in a persistent "ticking" noise audible all over the scale when the set was working. The tick was perfectly regular, fading a little at times, and most noticeable just before the set started to oscillate.

Methodical investigation of the batteries, connections and components gave no clue to the cause of the trouble. Changing the valves made no difference, and removal of the aerial and earth did not reduce the intensity of the ticking, so that the fault almost certainly lay in the set itself, and was not due to "noises" picked up from outside. Eventually "microphonic" noises were found to be responsible, and screening the valves with rubber "jackets" put matters right. With some makes of valve-holders this sort of trouble is particularly likely to occur, the holder providing ample protection against the ordinary jarring of the valves which gives rise to a humming noise in the telephones or loud speaker, but allowing so much freedom of movement to the bulb of the valve that it can touch neighbouring components at the limits of its swing.

* * *

TERMINALS with contacts held together by means of springs, as illustrated below, are very convenient for the attachment of the loud speaker to a set, the ends of the loud-speaker leads being fitted with spade tags. If these devices are fitted as the loud-speaker terminals on one or more sets which are in regular use, the leads can be attached or detached in a moment, with a certainty of firm contact when they are in position.

The construction of the terminal should be clear from the diagram. An ordinary terminal is used, a type being chosen which has a good, long shank above the centre block. The ordinary head is removed, and in its place are put two wide, flat washers, a short spiral spring, and, finally, a nut on the top. This nut should be screwed down until sufficient pressure is exerted on the washers by the spring, and it should then be soldered in position. Alternatively a locknut may be used, but this is likely to take up too much room on the shank of the terminal.



If the edges of the flat washers are slightly bent, one upwards and the other downwards, the operation of inserting the spade tags will be greatly facilitated.

* * *

IT is quite an easy matter to make contact studs for a radio panel from cheese-headed brass screws. All that is necessary is to place the screws in a small vice, one or two at a time, and to file down the heads until a perfectly flat surface is obtained. After this, smooth the screws by giving them a good rubbing on the filed surfaces with emery paper, and the radio contact studs will be ready for use.

*

This illustration shows how to make a spring washer that is very useful for loud-speaker leads.

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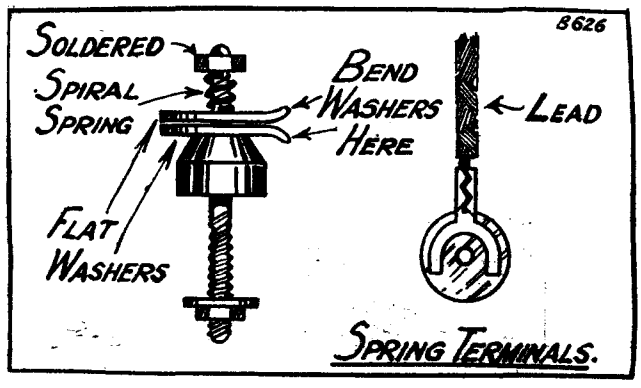
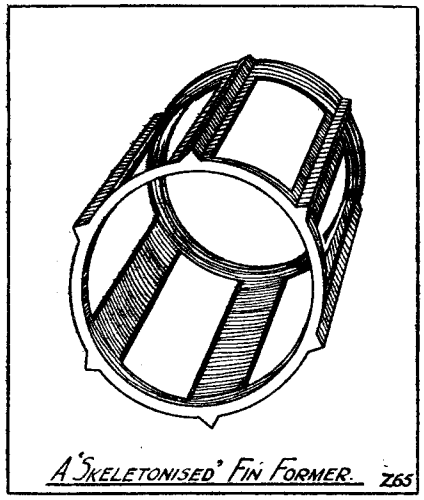


Notes and Jottings—*concluded*

One good point about contact studs made in this way is that their heads do not protrude too far above the surface of the panel, and therefore they impart a much neater appearance to the receiving set than many of the contact studs on the market.

Always use an old file for this sort of work.



A 'SKELETONISED' FIN FORMER. Z65

VERY effective short-wave coils of small self-capacity and low H. F. resistance can easily be wound upon the moulded formers furnished with "fins" which are now obtainable from several ebonite manufacturing firms. If shallow cuts are made in the fins with a triangular file or a rather wide hacksaw blade the turns can be evenly spaced and put on so securely that they are unlikely to come adrift unless the coils are subjected to very rough handling. In making short-wave coils the writer has found it a great improvement to "skeletonise" the formers as shown in the drawing. So long as they are not any more than 2½ inches in length, which should be sufficient for any short-wave coil, it will not be found that this process weakens them unduly. The superfluous ebonite is cut away with a small keyhole saw. If such a tool is not available drill a series of holes round the edges of the rectangle to be cut out and remove the webs between them with a small file, afterwards smoothing the jagged edges left with a flat file. A rim about ⅜ inch wide should be left at either end of the former, and the portions left under the fins should be half an inch or so in width.

Where longer formers are required, as, for example, for coils suitable for work upon the broadcast wave-band, a middle ring of ebonite may be left to support the cross-bars. When this is done skeleton formers of ample strength may be turned out in lengths up to 5 or 6 inches, which should be sufficient for almost any purpose.

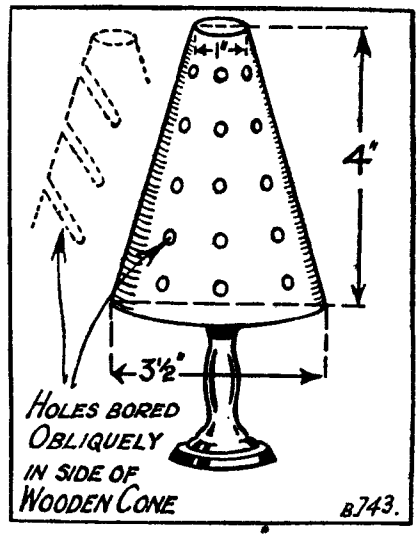
* * *

IN the accompanying illustration will be seen a most useful gadget for the busy radio constructor. It comprises a holder for small drills, such as those used for panel drilling and fine metal work. The construction of this bench drill holder is a job which can readily be carried out by the amateur who is lucky enough to possess a lathe, or, on the other hand, it is an article which any practical woodworker or cabinet-maker will turn out for a few pence.

As the illustration depicts, the drill holder consists of a wooden cone, drilled with a number of holes in its side, and suitably mounted upon a wooden base.

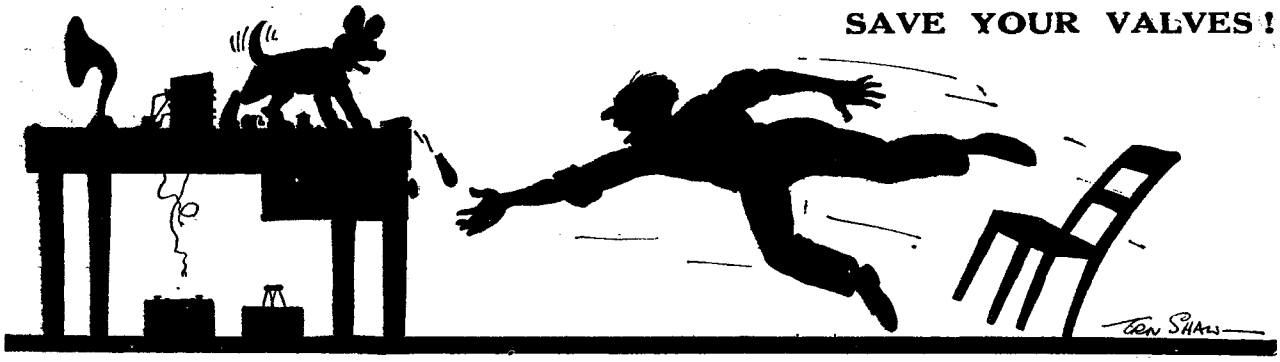
The cone itself should be about four or five inches in height. It may conveniently have a maximum diameter of three or three and a half inches, tapering to a one-inch diameter at the top. The base of the article should be substantially made, in order to prevent it from becoming top-heavy when the drills are in place.

The exact size of the holes bored in the sides of the cone must, of course, be dictated by individual requirements. One point, however, should be noted. The holes for the reception of the drills must be bored *obliquely* into the wood, that is to say, in a direction slanting downwards, otherwise the drills, when placed in the holder, will merely slip out.



The larger drills will, naturally, be placed in holes provided for them at the base of the cone, whilst the smallest drills will occupy the top holes.

One advantage of this holder lies in the fact that the drills are always available for use. The holder is a fairly portable one, and it can be carried about from room to room. Thus, the constructor using this article will always have his full complement of drills immediately at hand, a convenience which makes for rapid working, besides obviating the annoyance caused by mislaying a drill and having to make a search for it before the work on hand can be undertaken.

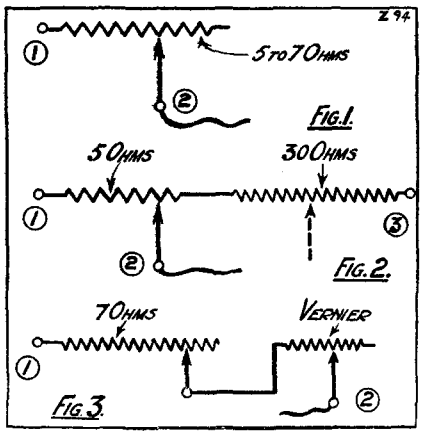


SOME CURIOUS RHEOSTAT ARRANGEMENTS

An interesting article upon the development of a familiar component.

By Dr. J. H. T. ROBERTS, F.Inst.P.

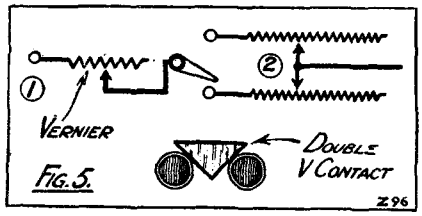
IN the early days of broadcast receivers, some three or four years ago, the filament rheostat was rather a Cinderella amongst radio components. It was necessary, of course, as a means of cutting down



the battery voltage to suit the filament, but little thought or care was given to its design or construction. Rheostats, in fact, were usually very cheap and inferior devices, and there was a prevailing belief that almost any old adjustable resistance would suffice for the purpose.

With the development of wireless receiving circuits, however, the control of the filament temperature became, in many cases, one of the critical adjustments of the circuit, and, moreover, with the general refinement which took place in receiving apparatus, it was soon recognised that a clumsy rheostat, in which all kinds of bad contacts arose as the slider moved over the resistance element, was entirely out of keeping with the other components of the set.

Consequently great improvements have been made in rheostats, and the better types of to-day may well be described as real engineering products. Not only have improvements been made in the design and operation of rheostat devices, but the component

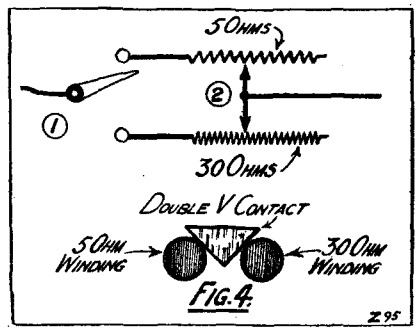


has been made in a variety of forms adaptable to the great variety of filament ratings of valves now in use. It is probably impossible, or at any rate impracticable, to design a single rheostat which will operate satisfactorily and economically with *any* type of valve, but at the same time it is quite readily possible to devise a rheostat which is not limited to one particular type of valve rating, but which may be used with a certain range of types.

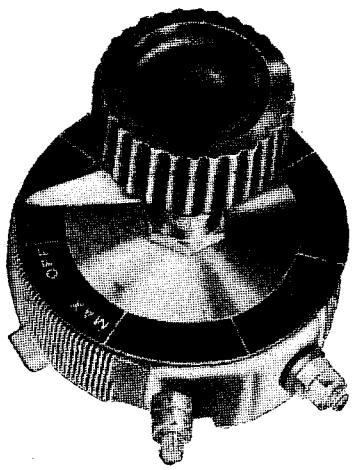
Two Elements

Some rheostats now have a double operating knob and carry two resistance elements, the main resistance element to give a coarse adjustment and a fine element to give what is sometimes called a "vernier" adjustment.

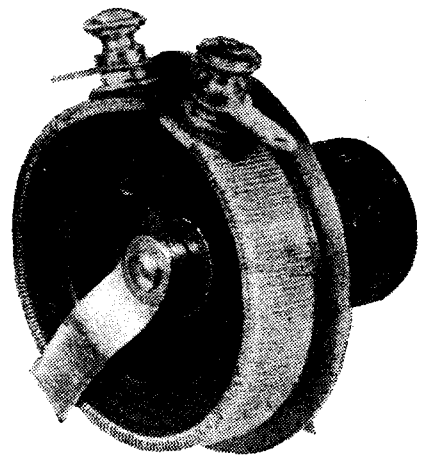
A little thought devoted to the subject of rheostats in general will show the reader that it is easily possible to evolve a very great variety of resistance arrangements. In Fig. 1 is shown in conventional diagrammatic style the usual 5- to 7-ohm plain



rheostat with a single control knob. Fig. 2 shows a well-known arrangement in which two resistance elements are provided, one of about 5 ohms and the other of about 30 ohms. This rheostat was more particularly fashionable at the time of the gradual change-over from bright-emitter valves to dull-emitter valves: the low resistance was adopted for bright emitters and the high resistance for dull emitters. If the slider were connected to one terminal of the rheostat, the other terminal could be connected either to the position marked (1) or



An example of the ordinary rheostat.



A smooth contact is made by the springy moving arm.

Some Curious Rheostat Arrangements—*continued*

the position marked (3). Alternatively, if it were connected to the junction of the two resistance elements, then either element could be brought into use by simply operating the slider on the left-hand or on the

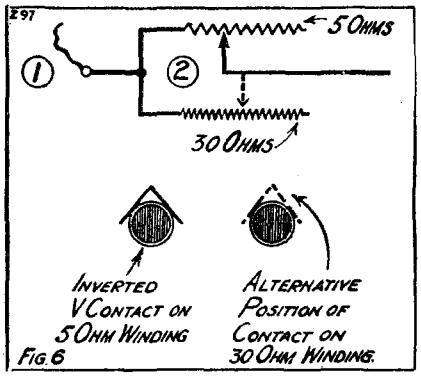


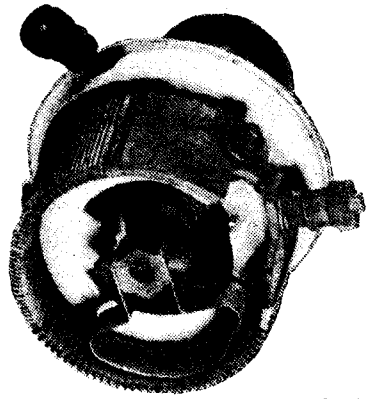
FIG. 6

right-hand element. Of course, although the elements are represented in this way diagrammatically in the figure, in practice they are either mounted round the former of the rheostat as two parallel windings, or alternatively as a single winding, one half consisting of the low-resistance winding and the other half of the high-resistance winding.

Vernier Rheostats

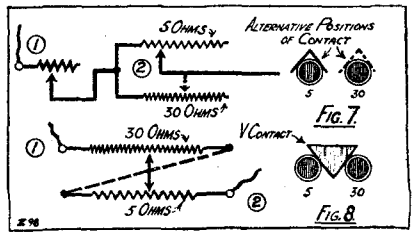
Fig. 3 shows diagrammatically the arrangement of a main resistance element for coarse adjustment, in series with a fine resistance element (that is, of very low resistance value) for vernier adjustment. Two sliders are used, operated by two control knobs, and the portions of the elements in use are, of course, in series.

The arrangement shown in Figs. 1, 2, and 3 are more or less conventional



This dual winding is made partly of thick and partly of thin wire.

arrangements of rheostats which have been for a long time on the market. In Fig. 4, however, is shown a suggested arrangement which enables either of two resistance values to be used, and which has the advantage that the whole range of motion of the contact-arm is available with either element. It will be seen that a little change-over switch is provided at the ends of the resistance elements so that the terminal (1) may be connected either to the 5-ohm element or to the 30-ohm element (values 5 ohms and 30 ohms are merely taken as representative, although, of course, any desired values may be given to these elements). The lower drawing in Fig. 4 shows a form of V-slider, which makes contact simultaneously with the two resistance elements. These two resistance elements are placed side by side around the usual cylindrical "former," being laid in two parallel grooves. The slider forms one of the terminals of the rheostat, and it will be evident that when the switch at (1)



is over to the 5-ohm element, the 30-ohm element is idle (even though it is in contact with the slider).

Fig. 5 shows precisely the same arrangement as in Fig. 4, except that a second control-knob is introduced, which operates a slider on the vernier element, so that after any particular position has been chosen for the main slider the vernier slider may be brought into operation.

An Interesting Case

In Fig. 6 a somewhat similar arrangement is used to that in Fig. 4, except that the two resistance elements are permanently connected together at the point marked (1) and the change-over or selection of the low resistance or high resistance element is obtained by means of a riding contact, which can be shifted to ride upon one element or the other.

Fig. 7 shows the same arrangement as in Fig. 6, except that a vernier element is introduced in series with either of the main elements after the manner indicated already in Fig. 5.

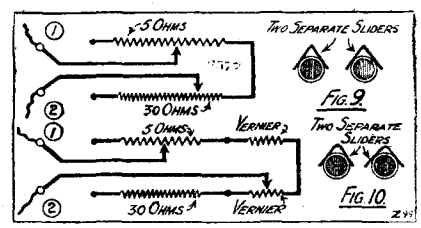
In Fig. 8 is illustrated an interesting arrangement where two elements of different value are placed side by side. The terminals of the rheostat are at the positions marked (1) and (2), and the two remaining ends of the elements are connected together, as shown by the dotted line. A double V-contact slides between the

A fixed resistor of the type now coming into general use.

two elements, making contact with both simultaneously, and it will be seen that when the contact slides the amount of the resistance due to the one element *increases* whilst the amount due to the other element *decreases* at the same time. This gives the effect of a single resistance element intermediate in value between the two values chosen, and though, as shown, it has no "off" position, it has certain vernier qualities which will be evident to the reader.

Further Methods

In Fig. 9 two elements are shown having terminals at the positions marked (1) and (2), the remaining two ends of the elements being connected together. In this case two separate sliders are used, operated by two control knobs. The resistance in circuit is the sum of the two resistance portions to the right of the two sliders, that is to say, it is the portion



to the right of the upper slider added to, or in series with, the portion to the right of the lower slider, the two portions to the left of the two sliders being idle or "dead ends."

The terminals are connected to the two sliders (1) and (2).

Fig 10 is the same arrangement as Fig. 9, except that a vernier portion is introduced at the end of each of

(*Continued on page* 215.)

A CRYSTAL SET TIP.

This short article describes a simple but efficient method of arranging a two-circuit crystal set for use on Daventry or the local station.

From a Correspondent.

IF one lives within crystal range of Daventry and a main station it is most convenient to have a means of going from one to the other without the bother of altering the coils or of carrying out adjustments of the tuning controls. Fig. 1 shows a simple and effective way of constructing a two-range crystal set or converting an existing one to receive either the local or the high-power station at will. The same idea may be used by those who are so fortunately placed that they can obtain

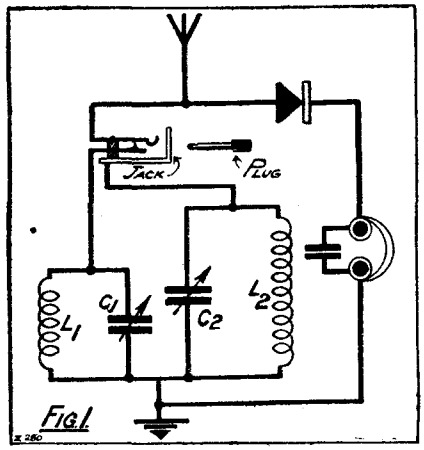


FIG. 1

crystal reception of two stations on the broadcast wave-band, but in this case L_1 and L_2 will be coils of about the same size as one another, and only the condenser settings will be different.

A Choice of Circuit

The essence of the idea consists in using a single closed circuit jack for switching the aerial connections to one tuning circuit or the other. It will be seen that in the position shown in the drawing the arm and the leaf of the jack are in contact, so that there is a path from the aerial through the circuit $L_1 C_1$ to earth, as well as through the detector and the telephones.

A Home-Made Plug

The plug is not of the standard type sold for use with jacks; it is a simple home-made affair of the type illustrated in Fig. 2. The dimensions given in the drawing are correct for Edison Bell and Igranic-Pacent jacks, though they may be a little different if other makes are used. The point of the rod is rounded off, and its other end is thrust into a cork or round wooden knob. The length of the protruding portion must be such that when the arm of the jack is raised, on the plug being thrust home, the point does not come into contact with the leaf.

When the plug is inserted the arm of the jack is raised, thus breaking contact with the leaf. There is now no path from the aerial through L_1 and C_1 to earth, but there is a way *via* the arm of the jack, the plug, and the body of the jack through L_2 and C_2.

Eliminating the Condenser

Thus, if the circuit L_1C_1 is tuned to the local station and L_2C_2 to 5 X X, the change from one to the other is made instantly by the mere insertion of the plug.

Many owners of crystal sets will not wish to incorporate a second variable condenser, and actually C_2 may be eliminated without much trouble. All that is necessary is to wind a coil which will bring in Daventry without any added parallel capacity. A very effective coil can be wound on a piece of cardboard tubing about three inches in diameter provided with glued-on cardboard "cheeks" about four inches in diameter. No. 30 wire is used and the coil is simply hank-wound.

Testing the Coil

The number of turns will depend upon the aerial in use and is best

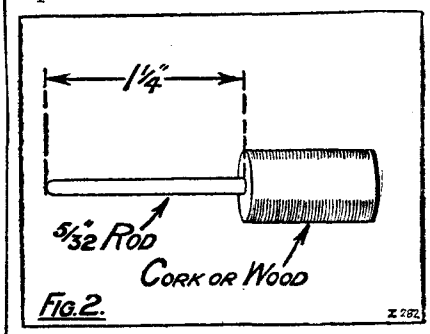
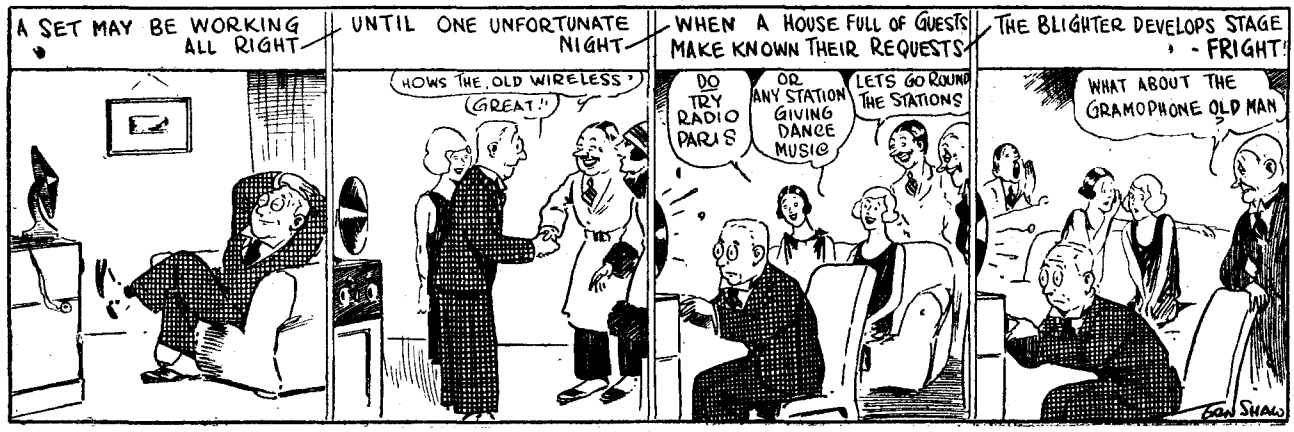


FIG. 2.

found by experiment. Put on 300 turns first of all, then secure the turns in position by means of a rubber band slipped over them, and without cutting the wire from the reel bare a very small piece on the coil and connect up whilst 5 X X is working. Shellac over the bared place, and see whether you get bigger strength by the addition of a further 50 turns. Continue until you get the number of turns exactly right. The coil is finished off by trimming off the cheeks to the level of the wire between them and giving a winding of Empire tape.

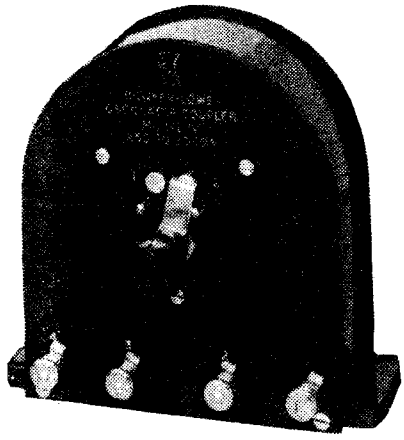


A MONTHLY REVIEW OF TESTED APPARATUS.

(NOTE: All apparatus reviewed in this section each month has been tested in the Editor's private laboratory, under his own personal supervision.)

An Interesting Supersonic Component

FROM the Bowyer-Lowe Co., Ltd., of Letchworth, we have received for test a sample of their latest oscillator coupler for use with their supersonic outfits—or, for that matter, with any other intermediates that may be suitable. The coupler is a handsome ebonite box, carrying four terminals and a two-point switch. On one position of the switch the oscillator serves for the lower broadcast band, and on the other position for the



The Bowyer-Lowe oscillator coupler.

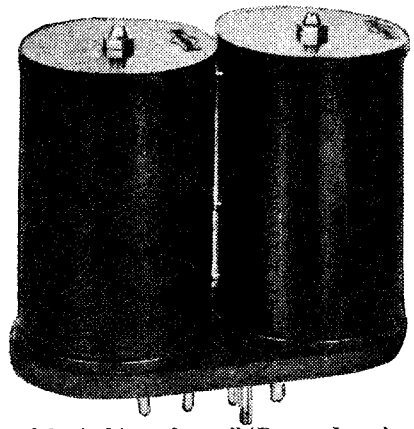
Daventry - Radio Paris - Koningswusterhausen range. For those who already possess Bowyer-Lowe supersonic outfits this single coupler can be substituted for the two now used.

The internal connections of this coupler follow the standard practice of the Bowyer-Lowe Co., which is to use the Ultradyne circuit in which the high tension for the first detector valve is supplied from the oscillator grid circuit. The detector valve rectifies this, and thus it is provided with uni-directional pulses of current of a frequency equal to that of the oscillator valve. The method, though somewhat unusual, is perfectly satisfactory, and possesses certain advantages, one of which—not the least—is an economy of H.T. current. Particulars of how to wire up this component can be obtained on application to the makers.

Columbia "Layerbilt" H.T. Batteries

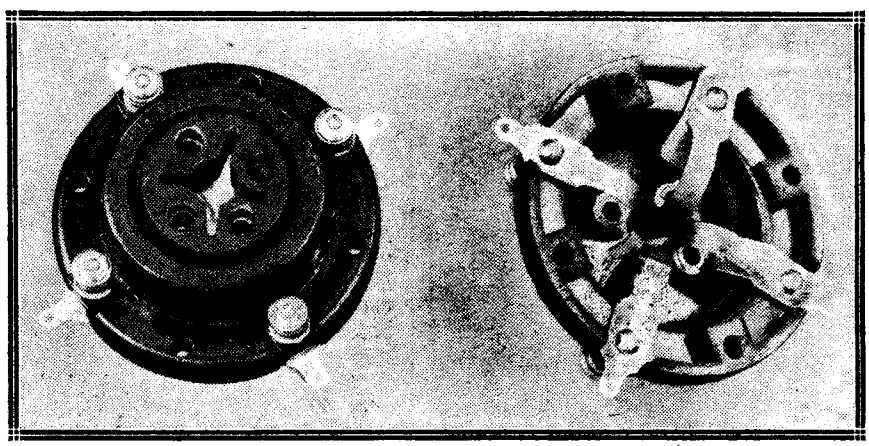
A modern multi-valve set with 120 volts H.T. and a super-power valve in the last stage forms a vastly better receiver than any we had available a few years ago, but side by side with the steadily increasing efficiency of our receivers has come the just-as-steadily-increasing demand upon our H.T. supply. There are four leading sources of H.T. supply available, each with their advantages and disadvantages. First we have what are known as "Mains" units, which take current from the lighting mains, and rectify and smooth it sufficiently to make it useful for H.T. purposes. While such units have the advantage that they do not "run down," they are expensive, and not all houses are fitted with the necessary wiring.

H.T. accumulators, while giving a perfectly smooth H.T. supply of adequate amperage at a lower cost, cannot be used in country districts where charging facilities do not exist. Even in towns the number of charging stations which can be guaranteed not to maltreat an expensive H.T.



A 6-pin binocular coil (Burne-Jones).

accumulator are relatively few. The wet type of Leclanche battery, to which reference has already been made in these pages, while efficient, is rather a messy source of supply, and finally we have the modern type of dry battery specially designed for heavy output. Of these the Columbia "Layerbilt" submitted for test is an excellent example. The test report of an H.T. battery is bound to take time to prepare, and fortunately we are in a position to pass an opinion



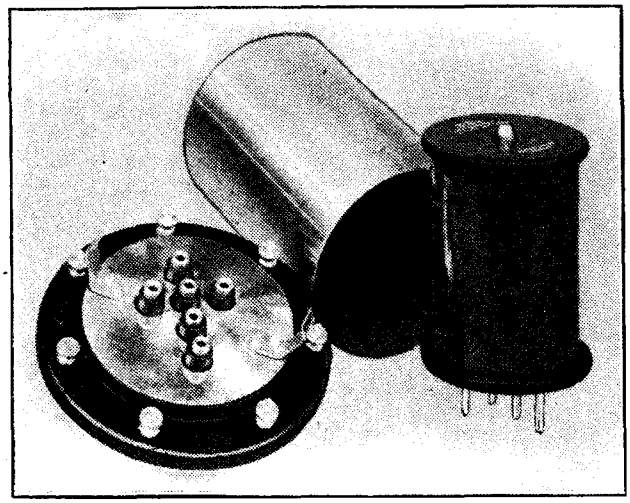
The C.E. Precision coil holder, reviewed in our March issue.

What's New—*continued*

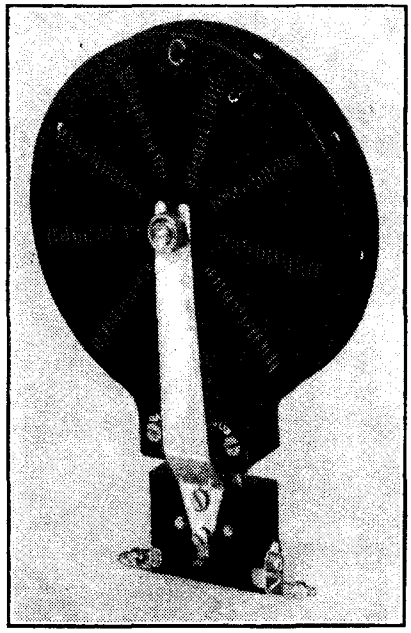
on the Columbia large-type H.T. batteries, as a number of these have been in actual use in this laboratory for the past two years. The heavy-duty batteries are made in 45-volt units, and are fitted with three terminals, of the Fahnestock spring-clip pattern, one for negative, one for 22½ volts, and one for 45 volts. These batteries are not cheap—the cost of a 45-volt unit is £1 5s., but it must be remembered that they will supply without faltering the most extravagant demands of modern receivers and still give a long life.

In experimental work and numerous tests to which receivers are subjected in this laboratory a load of 20 milli-amperes has been frequently taken for hours on end from these batteries, and in no case have they failed to do their duty. Where a very heavy current is not required, the smaller-type Columbia batteries are available. For example, the No. 4780, made in 60-volts, tapped at 30, 48, 51, 54, 57 and 60, is very satisfactory. A pair of these, giving 120 volts in all, will give perfectly satisfactory service in all but the biggest sets. The 60-volt units, being smaller cells, are cheaper than the 45-volts referred to above, costing 22s. 6d. each. Readers who are inclined to think this price a high one to pay for such batteries should bear in mind that the annual cost of high tension when using such batteries will be no more than when using the cheaper kind, when replacement will be far more frequent.

The high-duty Columbia batteries which have been tested in this laboratory have proved thoroughly satisfactory, and we are glad to welcome the new "Layerbilt" pattern which, while selling at the same price, has a still larger capacity. Two or three "Layerbilt" 45-volt units have been in continuous use for the last three months on a set using a super-power valve in the output stage, and as they still show a voltage of 43 volts each we have no hesitation in recommending them to readers who do not mind paying a somewhat higher price than usual to obtain a really long-life battery.



This illustration shows the "Efesca" version of the now universally popular six-pin coil, with base and screening cap.



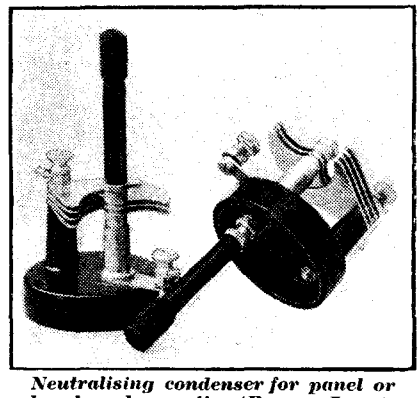
An ingenious centre-tapped Gambrell coil.

Additional Screened Coils

Messrs. Falk Stadelman & Co. have submitted for test their version of the now popular six-pin screened coils and bases. The screens are of copper, and the bases are of a moulded insulated material, the electrical qualities of which are satisfactory for the purpose. The coils themselves, which are supplied in the standard windings, have a satisfactorily low radio-frequency resistance and are soundly made mechanically. These coils and screens can be used in any of the standard circuits with satisfaction.

A New Gambrell Component

The increasing popularity of their centre-tapped coils has prompted Messrs. Gambrell to bring out a very ingenious coil holder which enables the user to dispense with the usual and somewhat unsightly flexible connection to the central tap. To achieve this an extra fitting is attached to the side of the plug, and, as is shown in the illustration, is provided with a slot. When the coil is inserted in the socket the terminal of the centre tap slips into the slot, when the terminal screw can be tightened. This component, of course, is only applicable to Messrs. Gambrell's centre-tapped coils, and can be thoroughly recommended.



Neutralising condenser for panel or baseboard mounting (Bowyer Lowe).

A Useful Neutralising Condenser

From the Bowyer Lowe Co., we have received a very well-designed neutralising condenser which can be changed in a few minutes from base-board-mounting to panel-mounting

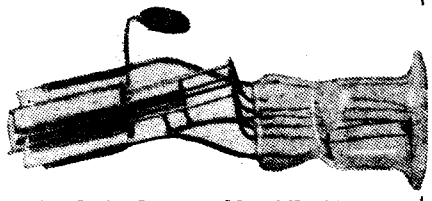
The first step in the construction of the K.L.1 valve.

What's New—*continued*

form. While the maximum capacity obtainable is fully adequate the minimum is appreciably lower than that of some neutralising condensers we have tested. The whole component is very well designed and finished, and is worthy of the high standard of this firm's products.

Valve for Alternating Current Mains

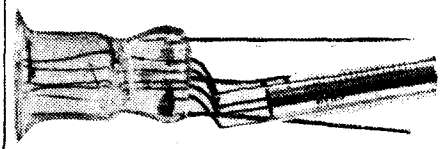
We have now completed our preliminary tests of the new Osram valve type K.L.1, a general-purpose valve designed for use with an alternating current filament supply, in place of the usual accumulator. This is an important step forward in the direction of running a wireless set entirely from the mains. It is not generally realised by the wireless beginner that it is not primarily the *electric current* supplied by the accumulator which is required for wireless purposes, but the heat



The electrode assembly of the K.L.1.

generated by the passage of the current through the filament. For this reason it is theoretically possible to have a valve in which the necessary heat is provided from a gas-burner, although such a valve is not likely to make much appeal to the average user. In the new K.L.1 valve an alternating current is passed through a heater (*i.e.* a miniature electric fire) and this heat is transmitted to the actual cathode of the valve, which is coated with a substance emitting a copious stream of electrons as soon as it becomes hot. The usual filament connection in the wireless circuit is taken to this cathode, and the grid and plate are used in the normal way.

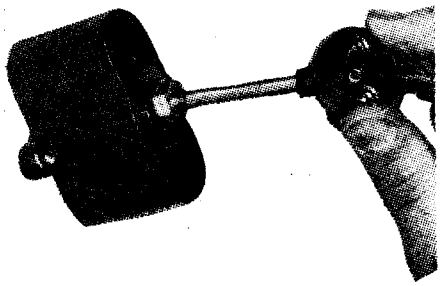
The makers' rating for this valve is 2 amperes at 3·5 volts (2 amperes for the heater), and thus we require a step-down transformer to supply the current to the valve from the alternating current mains. Two amperes may seem a large current, but it must be remembered that the voltage is low and the power consumption is but 7 watts. Allowing only 75 per cent. efficiency in the transformer, the maximum consumption from the mains is thus less than 10 watts, or not a fifth of the power required to



The K.L.1's cathode and heating element.

operate an ordinary 60-watt lamp in a living-room. So far we have only been able to test the valve for a few months in general working, but it is quite satisfactory as a high-frequency valve, grid-leak detector, or a low-frequency amplifier. The real test, however, of such a valve is its length of life, for previous experiments made in the United States with A/C valves heated from the mains have not always shown durability. However, the reputation of the makers is such that they are not likely to market a valve without having assured themselves that it will have a reasonable life.

A maximum anode voltage of 100 is recommended by the makers, the amplification factor given is 7·5, and the impedance 5,500 ohms. Certain precautions need to be taken when designing a set to use several of these valves. For example, in a three-valve set, the total current taken from the transformer is not less than six amperes, so that the filament wiring must be adequate to carry this current without loss or heating, and switching must be properly done. The making and breaking of a six-ampere current requires substantial contacts. Another point to remember is that if the transformer is used several feet from the set—and this is advisable if hum is to be reduced to a minimum—a very appreciable voltage drop in



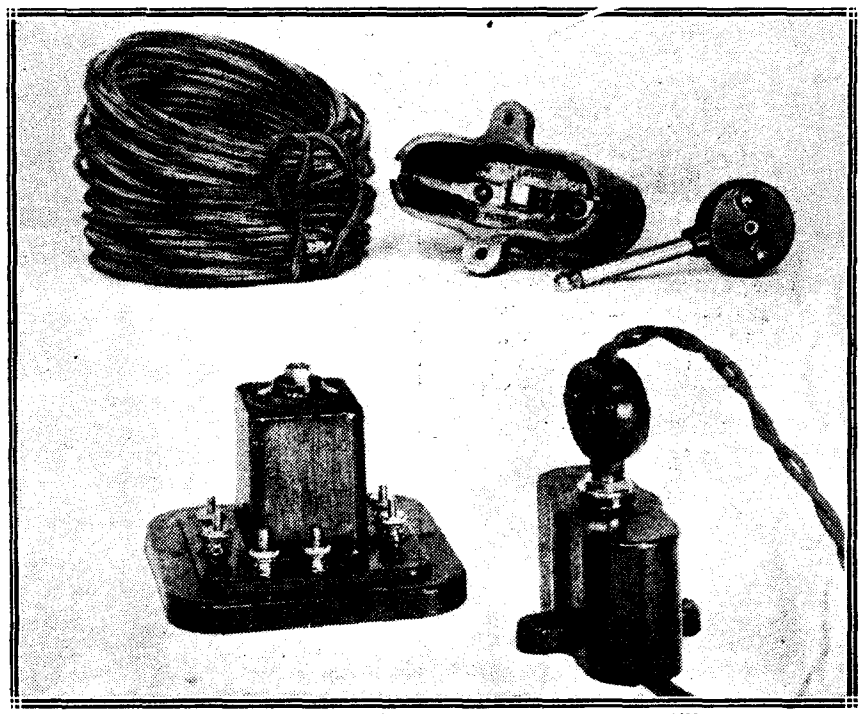
Plugging-in the Lotus distant control.

these leads will take place if they are not of adequate gauge. (Series running would appear a more satisfactory method.)

The "Lotus" Distant Control System

An ingenious scheme for controlling your wireless set from a distance and

(*Continued on page* 208.)



The complete parts of the Lotus distant control outfit.

CHATS AT THE WORK-TABLE

An article of particular interest to the practical amateur.

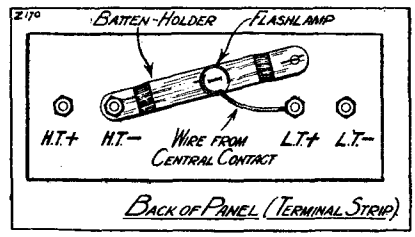
By R. W. HALLOWS, M.A.

Resistor Disadvantages

Most of us, I expect, have on our shelves any number of old components for which in our present state of enlightenment we can find no apparent use. Actually, by the exercise of a little ingenuity, many an old "has-been" can be altered slightly so as to make it distinctly useful. Probably you have long since adopted fixed resistors and not a few rheostats repose in your "junk" cupboard. Now, the one drawback to the fixed resistor, paradoxical as it may seem at first sight, is that it *is* fixed. What I mean is this. You have a 4-volt accumulator and you have been using valves requiring a potential of 3·6 and taking ·1 ampere. The set, therefore, is fitted with 4-ohm resistors. It occurs to you that you would like to try in the last holder a super-power valve requiring, say, 3·8 volts and passing ·25 ampere of filament current. There is nothing for it but to change the fixed resistor connected to the last holder, since the resistance needed is ·2 divided by ·25 or rather less than 1 ohm. Or, again, a friend may bring round some special 2-volt valve, asking you to try it out in some particular holder. You are faced with the necessity of making or purchasing a suitable fixed resistance—and in any case you must change the existing one. We do not nowadays *require* rheostats on our panels, but having them fitted may sometimes prove exceedingly useful, and at no time can they be a disadvantage.

A Flashlamp Safeguard

One may, however, in a moment of temporary insanity, make a wrong connection in the apparatus under test, or allow two leads at different potentials to come into momentary contact, with devastating results. The simplest, cheapest and altogether the most satisfactory safeguard for both valves and batteries is the flashlamp bulb with a low wattage rating. It is a good plan to place a row of batten-holders on the battery side of the distributing panel, one being in series with each lead. Then if anything untoward should occur, seven pennyworth of flashlamp will probably "go" instead of possibly pounds' worth of valves. No damage whatever will be done to either battery even by



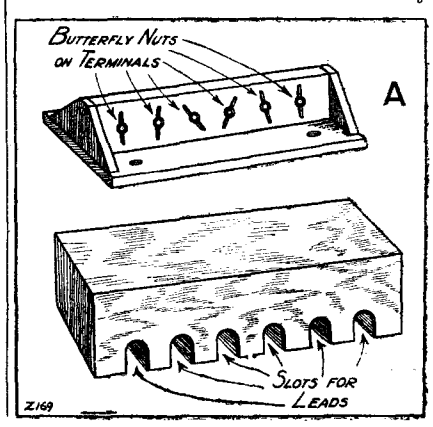
a direct short-circuit between H.T. and L.T. if flashlamp safeguards of suitable type are used. A lamp that I would recommend for the purpose is one rated at 2·5 volts, ·2 ampere; or ·5 watt. These little bulbs "blow" instantly when the current approaches ·3 ampere and even the lowest consumption dull emitters will almost certainly not be burnt out and probably not greatly injured by the passage of such a current for only a second or less. A tip which I have found exceedingly useful in the receiving set is illustrated above. Instead of using a wire to make the connection between H.T. − and L.T.+ use a batten holder between these two terminals at the back of the terminal panel. Flashlamps are cheap; valves are not!

Distributing Panels

Many experimenters find it convenient, as I do myself, to have on the bench used for trying out new sets and new circuits a distributing panel connected by leads to batteries placed on the floor beneath. My own distributing panel is mounted vertically and it has a small wooden cover which is placed over it to guard against accidental short-circuits after connections have been made or when it is not in use. The details are readily seen from the drawing below. The panel itself appears at A. It consists of a piece of ⅜-in. ebonite of suitable length mounted between triangular end-pieces which are attached to a wood base. The leads from the batteries below the table are permanently attached to the terminals on the far side, and the shanks which protrude beyond the side of the panel—that is, towards the bench—are provided with butterfly nuts so that secure connections may be very rapidly made. Where valves of different types are used it is convenient to tap the accumulator, taking a lead from each tapping-point to a terminal on the panel. One has thus low-tension terminals marked L.T. −, L.T. + 2, L.T. + 4 and L.T. + 6. The high-tension terminals may be H.T.−, H.T. + 60, H.T. + 75, H.T. + 90, H.T. + 105 and H.T. + 120. A panel of this kind is quickly made at small expense and saves a great deal of trouble when one is engaged in experimental work. The triangular end-pieces guard the terminals, preventing accidental short-circuits through the careless laying down of a screwdriver, a steel ruler, and other tools. When the cover, which fits tightly over the base, is in position a short circuit in the panel itself is practically an impossibility.

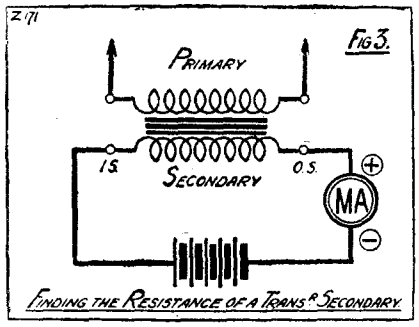
Using Old Rheostats

Why not use your old rheostats, especially those of the dual variety, as fixed resistors? All that is necessary

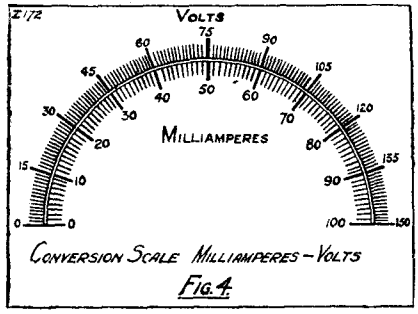


Chats at the Work-Table—*continued*

in most cases is to remove the knob altogether and to shorten the spindle so that it does not protrude at all on what was previously the panel side of the rheostat. Mount the components "panel-side downwards" on the baseboard by means of a couple of screws. You now have a resistance which is both fixed and variable—fixed when you want it to be fixed and variable when you want to vary it. Probably you have the maker's



figures for the resistance of the whole winding, or of each half of the winding in the case of dual rheostats, and if the component was made by a reputable firm these may be relied upon as approximately correct. Since the turns are usually quite regularly spaced it is a simple matter to make a pretty good guess at any given resistance within the limits of the rheostat. Suppose, for example, that it is a 6-ohm component and that you want to put 2 ohms into the filament circuit: clearly if you turn the arm about two-thirds of the way round from the off position you will not be very far out.



Or, again, if you are using a dual rheostat you know that the low-resistance winding is of, say, 5 ohms, and the high resistance of perhaps 25 ohms. Any resistance between 0 and 5 ohms can be obtained by making an intelligent guess at the position of the contact arm on the low-resistance winding. Similarly, resistances up to 30 ohms are readily obtainable by using a proportion of the high-resistance winding. The rheostat, then, may be rescued from obscurity and turned into an exceedingly useful component in the up-to-date receiving set.

Concerning L.F. Transformers

You have probably more than one that you do not use because they do not contain sufficient wire in the primaries to give the inductance values necessary for the high quality of reproduction that we look for in the modern set. Following a valve of medium impedance a transformer primary of fifty henries or more is desirable; after a power valve of the 6,000- to 7,000-ohm class from 15 to 20 henries may suffice.

The super-power valve with an impedance in the neighbourhood of 3,500 ohms requires only a comparatively small inductance in its plate circuit. Now it is clearly undesirable to pass through the windings of the loud speaker the steady plate current of a valve which may be drawing as much as 15 milliamperes or more from the H.T. battery.

You can get over the difficulty by using the well-known filter circuit. Very often an old transformer has sufficient inductance to provide the necessary impedance. If the secondary is wound with stout wire this may be used as a choke instead of the the primary, but frequently the secondaries of small transformers are wound with rather fine stuff, which is hardly up to such a big load.

Transformer Secondaries

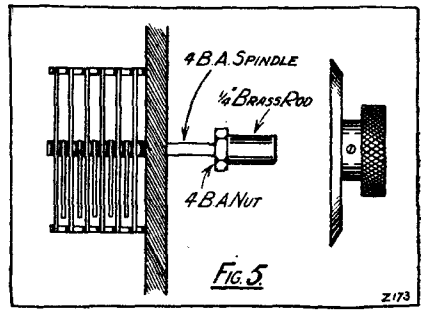
One can, however, often make use of the secondary of an old transformer in quite another way. To see whether it is of any use for the purpose about to be suggested it is first of all necessary to find its D.C. resistance. This can be done in the way shown in Fig. 3. Wire up the milliammeter and a battery of known voltage in series with the secondary winding. If you have not an accurate voltmeterthe filament accumulator, provided that it is in good condition, may be used, and the voltage taken as 2 per cell.

Once the milliammeter reading has been obtained it is easy to work out the resistance of the secondary by Ohm's law, $R = \frac{E}{I}$. Suppose that the battery voltage is 6 and that the current passed is 4 milliamperes. The calculation then is

$$\frac{6}{4} \times 1{,}000 = 1{,}500 \text{ ohms.}$$

By using the transformer secondary in series with the instrument you can now obtain direct voltage readings with the aid of the milliameter.

Since the resistance is 1,500 ohms each milliampere recorded represents 1½ volts. If your milliameter has a scale reading from 0 to 100 you can thus take H.T. battery voltages up to 150. Nobody wants to have to work out Ohm's law every time that a voltage reading is taken, and it is therefore best to make a conversion scale, as shown in Fig. 4. If this is pasted on to a card and kept on the work-table one's difficulties vanish. You may be lucky enough to find a transformer with a secondary resistance of exactly 1,000 ohms. I have one of this obliging nature, which means that each milliampere of the scale represents one volt. In any



case, whatever the resistance may be, it is by no means difficult to work out a conversion scale similar to that shown in the drawing.

Other Components

If you have adopted slow-motion dials your old dials are by no means useless. To begin with, they make quite useful protractors if they are divided into 180 degrees. But why not use them for the reaction control of a receiving set fitted with capacity reaction? Reaction is seldom so finnicky—certainly it should not be—that a slow-motion dial is required. It is a very great help if the reaction condenser, even though it be of the "micro" type, is fitted with a large dial and a pointer, for one thus gets to know the amount that may be applied over a given wave-band to bring the set to a sensitive condition without causing it to oscillate. But what is to happen if the dial is threaded 2 B.A. and the reaction condenser has a 4 B.A. spindle? Or,

Chats at the Work-Table—*concluded*

again, it may not be threaded at all, but may be drilled ¼ inch clear. Let us see how these difficulties can be overcome In the first case, that of the dial bushed with brass and threaded 2 B.A., I recommend the following procedure. Insert a 2 B.A. screw and drive it home tightly Cut it off short, trim the end flat and make a punch-mark at the centre. Drill and tap 6 B.A. Now file down the

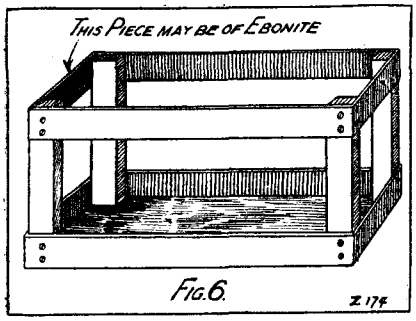


FIG. 6.

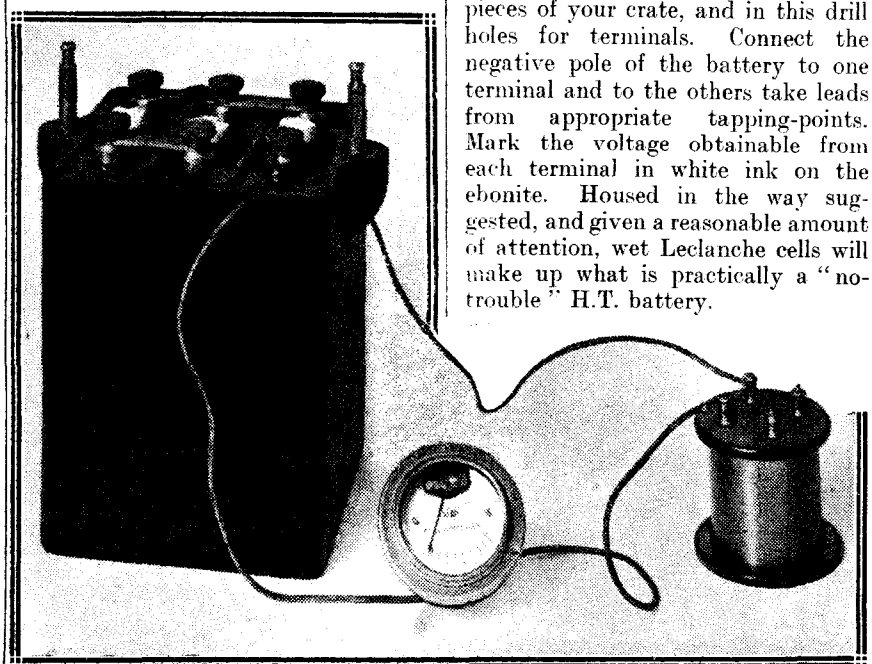
spindle of the micro condenser carefully until the threads have almost disappeared, point off and thread with a 6 B.A. die. You will now be able to secure the dial to the spindle in the ordinary way. Where the condenser is drilled ¼ inch and has a setscrew fixing take a short piece of ¼-in. round brass rod and drill through it with a No. 33 Morse drill. Tap 4 B.A. Now run a 4 B.A nut on to the spindle of your condenser and follow this with the piece of ¼-in. rod. Lock the one against the other. You will now be able to secure the dial to the spindle by means of its setscrew. Fig. 5 makes this plain.

Housing the Wet H.T. Battery

The H.T. battery composed of wet Leclanche cells is becoming increasingly popular for several reasons. First and foremost, if the cells and particularly the sac elements are of reasonably large size it will work for months without showing any serious drop in the terminal voltage; and, secondly, when such a battery does run down it is not discarded but can be renewed. The wet Leclanche battery is, in fact, practically everlasting, though both zincs and sacs must be renewed at intervals Many readers who have considered making up such batteries from the cells offered by advertisers must have pondered over the problem of providing a suitable housing for them. A mere tray is not very satisfactory, since it does not sufficiently protect the cells. A type of crate that the writer has found very satisfactory is shown in Fig. 6. The dimensions are not given, since these will depend upon the number of cells as well as upon their overall dimensions The tray portion at the bottom of the crate should be about one inch in depth and the height of the crate should be such that the cells when placed in position reach to about an inch below its top. There is no need to use hard wood for the purpose, well seasoned deal or white wood being quite suitable. It is as well to provide a lid, which can be cut from a piece of three-ply, for this greatly minimises the possibilities of an accidental short-circuit The sides of the crate should, however, be left open, since by doing so one makes it easy to inspect cells. The lid can be secured by means of four screws to the upright corner pieces

Separation and Insulation

When the crate has been completed, melt down some paraffin wax in the following way. Obtain a tin that is watertight and provide it with a handle, which can be made from wire. A small pouring lip should be made by bending the rim of the tin suitably. Put the wax into the tin, and place the tin in a saucepan half filled with water As the water is heated over a gas-ring the wax will melt without there being any danger of its catching fire When it is melted pour into the tray of the crate sufficient wax to make a layer rather more than ¼ in. in thickness Allow this to cool off and when it has set hard arrange the cells upon it so that each is slightly separated from its neighbour. Leave the cells in position, melt down some more wax, and pour it into the tray round them, making the depth again ¼ in. or a little more. When the second layer of wax has set you will find that you can lift the cells out should it be necessary to do so, and that hollows will remain of the right size and shape to fit them exactly. This wax tip is an excellent one, for half the battle with a wet Leclanche battery is to secure first-rate insulation by means of spacing between cells. If you want to contrive easily accessible tapping-points, here is a simple way of arriving at the desired end. Use a piece of ¼-in. ebonite for one of the top end-pieces of your crate, and in this drill holes for terminals. Connect the negative pole of the battery to one terminal and to the others take leads from appropriate tapping-points. Mark the voltage obtainable from each terminal in white ink on the ebonite. Housed in the way suggested, and given a reasonable amount of attention, wet Leclanche cells will make up what is practically a "no-trouble" H.T. battery.



By connecting battery, milliammeter, and transformer, as shown above, the D.C. resistance of the latter can be measured.

A PAGE OF HINTS

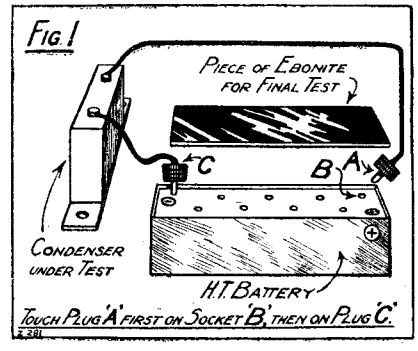
Better Than a Pulley—Test Your Mansbridge—Bus-Bar Aerial for Experimental Work.

IF a pulley is used at the top of the aerial mast for the halliards to run through, it can be the cause of a considerable amount of inconvenience. Owing to its being so exposed to the weather the metal pulley is apt to jam or to break in time through the effects of corrosion, and it not infrequently happens that the supporting rope slips from the groove in the wheel and becomes wedged between it and one of the sheaves. Only the other day a friend of the writer's had to take down his mast in order to free the halliards which had become hopelessly jammed when the aerial wires were only half-way up. A tip which avoids all trouble of this kind is to make use of a large shell insulator, as shown in the drawing, instead of a pulley. The ropes pass with very little friction over the polished surface of the porcelain and it is practically impossible for a jam of any kind to occur. The only calamity that may possibly happen is that the insulator may be broken by coming into violent contact with the mast if the aerial is let down thoughtlessly with a run. There need be no fear of this happening if a pad made of old sacking is fixed to the mast at the place where the insulator will come into contact with it when the halliards are slackened.

* * *

A COMPONENT which is usually taken on trust by the constructor, but which should be beyond reproach in design and construction, is the large-capacity fixed condenser placed across the H.T. battery. The least leakage through the dielectric material or via the containing case of such condensers will place a continuous drain on the H.T. battery and will prevent the condenser from fulfilling its proper function.

The ordinary fixed-condenser test which makes use of a single dry cell and a pair of headphones is not complete enough with the larger capacities.

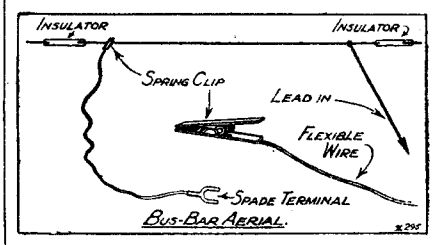


A much surer test can be carried out with a pair of wander-plugs and an H.T. battery, (see Fig. 1). Attach the leads of the wander plugs to the terminals of the condenser, put one of the plugs in the negative socket of the battery and brush the other one lightly across the positive socket. Not less than 50 volts should be used. There should be only a small, sharp spark, as the condenser charges up. If the insulation is hopelessly faulty, there will be a big spitting spark as the plug touches the socket.

To complete the test, after brushing the plug on the positive socket bring it into contact with the other plug, when there should be another small spark as the condenser discharges again. Now touch the plug on the positive socket again and then lay it down on a piece of ebonite. Come back in a few minutes' time, and if you can still get a small spark on bringing the two wander-plugs together, you can be quite sure that you will not have any trouble with that condenser.

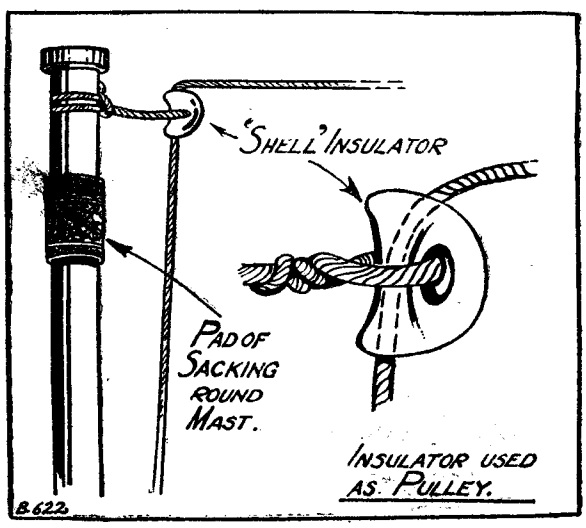
* * *

THOSE experimenters who are fortunate enough to have a room in which they can carry out their wireless experiments uninterrupted, are apt to use two or three sets in different parts of the room, and connect the aerial to one or the other as required. When the set is some distance from the lead-in, the trailing wire may get in the way, and prove very inconvenient. A good system in such a room is to erect a "bus-bar" aerial. This is a very simple device, consisting of two rod or other aerial insulators, one on each side of the room, joined by a piece of bare aerial wire pulled taut. A flexible connection, soldered to this wire at one end, is taken to the aerial lead-in. A number of flexible wires are then prepared, one end of each being fitted with a spade terminal and the other with a spring clip, specimens of which can be obtained at any wireless



accessory shop. The spring slips are soldered firmly to the ends of the flexible wires, and when it is desired to connect a particular set, a lead is clipped on the bus-bar aerial, the spade end of the lead being joined to the set. The earth terminals of all sets can be kept permanently joined to the earth lead, or a bus-bar earth wire can be run along one side of the room and used in a manner similar to the bus-bar aerial.

This bus-bar scheme must be used to be fully appreciated. It serves to keep loose aerial wires out of the way, and adds to the efficiency of reception by preventing unwanted capacity effects, which often creep in when long trailing aerial leads are used.



The annoyance of a jammed pulley and the trouble of taking down a mast may be avoided by using a large shell insulator, as shown in this sketch. The object of the pad of sacking is explained above.

WITHIN THE VACUUM

—concluded from page 188

work on a moderately low filament current and which would be more robust than "other valves of lower filament consumption, both mechanically and as regards emission."

As I have already stated I have not yet had time to test these valves, but as soon as I have done so I will give my opinions in these columns.

Resistance Coupling

With regard to the B8 valve which I mentioned previously in my notes on valves, I may say that I have given this a thorough test, and while I consider the manufacturers are to be congratulated upon the amplification they have obtained I must say I cannot agree with some of the circuits they advise in their leaflets where more than one B8 valve is recommended. Personally, I prefer to use a valve of lower magnification in the second stage of an L.F. amplifier if one of high amplification factor has been employed in the first stage. If this is not done, distortion owing to overloading is likely to occur, the overloading being usually apparent in the last stage owing to the inability of the power valve to deal with the grid voltages supplied to it. However, this may be only my experience, and I shall be glad if readers will let me know how they get on when using several valves of the B8 class in cascade.

More New Valves

By the way, I notice that Metro-Vick Supplies, Ltd., have once more altered the nomenclature of two of their valves, and the D.E.55 and the S.P.55/B valves have now been replaced by the D.E.50 and S.P.50/B. The former is described as a general-purpose valve taking 5 to 6 volts L.T., and ·09 amp. filament consumption, and having an amplification factor of 9 with an impedance of 20,000 ohms. The S.P.55/B has the same filament characteristics, but is of high impedance (50,000), and has a magnification factor of 35.

Two more additions to the 2-volt class are the Marconi and Osram D.E.H.210 and D.E.L.210 respectively for resistance-capacity coupling and H.F. or L.F. work. The former has an impedance of 75,000 ohms and a magnification factor of 35, while the latter has an amplification factor of 9 with an impedance of 17,000 ohms.

THE RICE-KELLOGG LOUD SPEAKER

—concluded from page 176

in parallel require a transformer ratio of 14 : 1.

The secondary winding must be a thick one and suitably sectionalised, as shown in the sketch, which incidentally gives the dimensions of the "stalloy" stampings. The sectionalising ensures small leakage between the primary and the secondary windings.

Of course, this loud speaker should be used with a resistance amplifier or something equally good, and blasting must be avoided at all costs.

I mentioned at the beginning that there is a diaphragm resonance. This shows itself as a high-pitched effect—strong "s" sounds, etc.—and is usually rather disagreeable. A 2 to 5 mfd. condenser across the winding of the loud speaker, or a condenser of ·01 to ·05 mfd. across the transformer primary, will put the matter all right.

The size of the baffle plate is a matter for experiment—the larger the better, of course, but a compromise can be found at about 2 ft. square.

WHAT'S NEW

—*continued from page* 199

distributing the output to any number of rooms in convenient fashion, has been devised and is now being marketed by Messrs. Garnett, Whiteley & Co., Ltd., the makers of the well-known "Lotus" components. This scheme, which is illustrated in the accompanying photograph (see page 199), consists of a special relay which is placed near the receiving set, a number of wall jacks (one for each room to which it is desired to distribute the output), and a plug for each room connection.

As an example, let us imagine that the set itself is situated in a study and that it is desired to use loud speakers in the dining-room, drawing-room, a bedroom, and the kitchen. "Lotus" wall jacks are placed in each of the rooms and each of the loud speakers is provided with a "Lotus" plug. The relay, which is placed in the study immediately by the set, has eight terminals, two for connection to the L.T. terminals of the set, two for the accumulator and four for the distributing wires.

At this point it may be said that the outfit includes a supply of four-strand cable for joining up the various rooms to the relay. When all of the plugs are out of the jacks the set is turned off, but immediately the first plug is inserted in the jack (say, in the dining-room) the set is turned on and the loud speaker operates.

If now it is desired to connect a loud speaker in one of the other rooms,

One of the "Wearite" Binocular Coils, a report on which appeared in our April issue.

the plug connected with the second loud speaker is inserted in its jack and this loud speaker, too, comes into operation without interfering with the other. Loud speakers can be operating in all of the rooms simultaneously or in any one of them, the set being automatically switched on immediately the first plug is inserted and switched off immediately the last plug is withdrawn. The whole outfit is very well made and finished, and can be recommended with full confidence to all readers.

For Accumulator Testing

Messrs. A. H. Hunt, Ltd., of Croydon, have sent us a specimen of the Ala hydrometer, that tested being known as the Ala "B". A claim of 100 per cent accuracy is made for the instrument in question, which has several noteworthy features. For example, how many hydrometers can be used to test the specific gravity of the small H.T. accumulator cells now so popular? The Ala "B" will do this quite satisfactorily, as it is provided with a very small tube which can be inserted into the tiny orifice with which the H.T. accumulator cells are fitted. The amount of liquid required to give a reading is quite small and the float itself is clearly marked. Another point of importance is that the base is made square, so that there is no fear of the hydrometer rolling off the table. The price (3s.) brings it within the reach of all.

A Useful Battery Component

The steadily increasing use of super-power valves for the output stage of

(*Continued on page* 210.)

WHAT'S NEW

—continued from page 208

a receiver has made the high-tension problem more acute than ever. Only the largest and specially designed types of dry H.T. battery will give an adequate current supply for such valves, for which reason rechargeable H.T. batteries of the wet type are growing more popular. Many experimenters are turning with interest to the small Leclanché cells as a source of H.T. current. The Leclanché cell is one of the oldest primary batteries, for it has been in general use for ringing electric bells and supplying current to telephone systems for very many years. Excellent small cells, forming units for H.T. batteries, are now available at a very reasonable price.

When a Leclanché battery is exhausted it can be recharged by emptying out the liquid—a solution of ammonium chloride—and replacing it by fresh. After a number of recharges have been given it will be found that the zinc has been consumed and new zinc electrodes will be required. The Wet H.T. Battery Company has recently sent us samples of their latest type of zinc for such batteries, these being of a good heavy gauge, well shaped, each fitted with a tongue to facilitate connection with the carbon of the next cell. The price (1s. a dozen) is most reasonable.

"Fancy" Ebonite

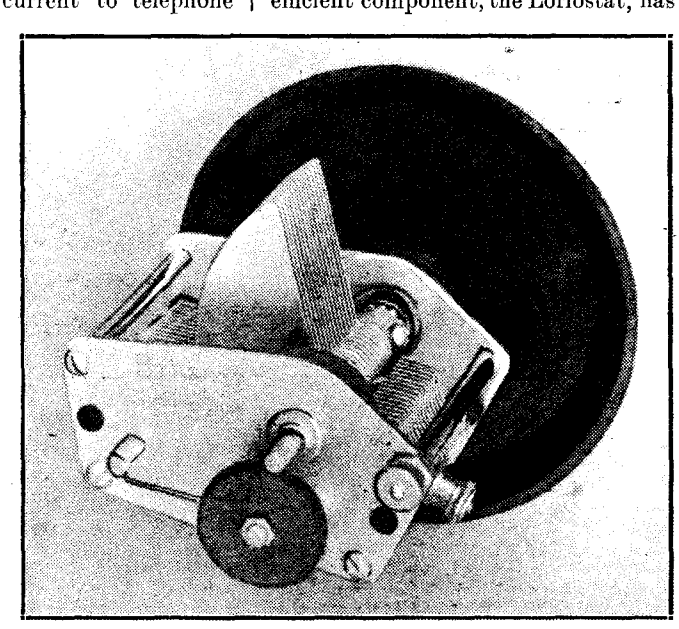
From Messrs. McLeod & McLeod we have received samples of their new lines of sheet ebonite known as N.A.D. Wavy. This has been submitted to resistance and high-frequency tests, and has given a satisfactory account of itself. One specimen of the ebonite has a kind of crystallised appearance somewhat similar to the "crackle" finish given to some loud speakers, and offers a rather pleasing variation to the conventional matt or highly polished finish. The other sample shows a "wavy" surface. The material cuts and drills satisfactorily, and although not possessing all the properties of the highest-grade ebonite sheet, should prove perfectly satisfactory for wireless receiver panels.

The Loriostat

A very ingenious, well-made, and efficient component, the Loriostat, has recently been submitted to this laboratory for test. It consists of a multiple variable baseboard unit, made up of three variable-resistance filament controls on one base. It is also obtainable for one-, two-, four-, five- or six-stage units. The general appearance can be well judged from the photograph on page 211. Two polished ebonite end-pieces carry three polished ebonite rods, on which are wound the resistance wires of suitable gauge—in the component under review the three resistors are each of 30 ohms.

Above each of these rods is placed a square-section plated bar on which runs a slider. At one end these rods are joined to a common strip bearing a terminal, and at the other end each rod terminates in a soldering lug. The whole component is so mounted that it can be screwed down rigidly to a baseboard, the finish being

(Continued on page 211.)



The Brandes S.L.F. Variable Condenser. An interesting example of the modern geared-down component.

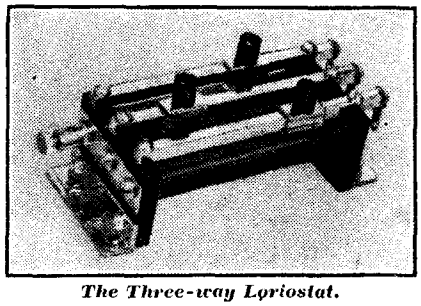
WHAT'S NEW

—concluded from page 210

particularly handsome. The three-way Loriostat sells at 5s. 6d., and is made in 6-, 15-, or 30-ohm values. This is a thoroughly well-made component and can be recommended to all readers of the WIRELESS CONSTRUCTOR.

A Good Screwdriver

Messrs. Atalanta, Ltd., have submitted the Atalanta screwdriver. It is very well made and particularly suited for wireless use. Three box spanners are provided with the wireless model of the screwdriver. These slip over the end and fit on the flat of the blade, thus enabling the user to gain access to awkward parts of a set where nuts have to be tightened.



The Three-way Loriostat.

A "MATCHLESS" EMERGENCY VALVE HOLDER

NOT very long ago the writer wanted a valve holder in a hurry. Circumstances demanded that a note-magnifier be made without delay, and though all other components, including the valve, were available, the valve holder was missing. What, then, could be done?

It is a poor reader of the WIRELESS CONSTRUCTOR who cannot get over a little trouble like this, and, seizing the spare valve, together with four short lengths of No. 30 D.C.C. wire, one length of the wire was bared for an inch or so, and wound for a few turns round each valve leg. The valve was pushed, legs downwards, into the top of a safety match-box, after first removing the matches, and the four wires were threaded through pin-holes; four being made on the top of the box adjacent to the four valve legs, and four through the bottom of the box. In a few minutes the valve holder was made.

OUR NEWS BULLETIN

Some of the More Interesting Happenings in the Radio World this Month

By Short Waves to Sydney

So good were the short-wave transmissions from P C J J, the Dutch experimental broadcasting station at Eindhoven, that they have successfully been re-broadcast in Australasia.

Recently tests have been carried out from 7 p.m. till 11 p.m. on Wednesdays, Thursdays, and Fridays, the wave-length used being 30·2 metres. When picked up and re-broadcast by 2 B L, Sydney, Australia, both the quality and strength were reported to be absolutely first class.

Rosenhuegel

The Rosenhuegel station—already well received in this country when conditions are good—is to have its power trebled during the summer. Probably the Austrian station will have to close down for several weeks in September to refit, but when it returns to its radio audience it will be as powerful as any broadcasting station in Europe.

Half-a-Mile Aerial System

Now that the "Beam" wireless service is going strong, some interesting details of the equipment have been published. The Grimsby transmitter for India has two wave-lengths, 16 and 35 metres, one for day and the other for night work. For this service Grimsby has five masts 287 ft. high, each with a 90 ft. crossbar at the top to carry the aerial and reflector wires. The masts are in line 650 ft. apart, so that the aerial system from one end tail-anchor block to the other is well over half a mile long.

Another Short-Wave One

To the lusty voices of American W G Y and K D K A is now added another recruit, broadcasting on short waves in addition to its band in the regular broadcasting spectrum. This is W L W, the Crosley station at Cincinnati, Ohio, whose 5-kw. transmissions are frequently heard in this country on 422 metres. The W L W programme is now also being broadcast on 52·02 metres, using 250 watts power.

Sweden's Super Station

Have you tried for Motala, the new Swedish station? It is a hard worker, being on the air practically all day on Sundays, and every evening during the week. Its programmes, which are remarkably steady and clear, are relays of the Stockholm transmissions. They are sent out from Motala on 1,305 metres.

A Home-Made Basket Aerial

With reference to the article entitled "A Home-Made Basket Aerial" in the February issue, readers are informed that certain aerials of this general type are the subject matter of patents.

A Low-Power Record

A Southport experimenter (G 5 K L) has been breaking all the low-power records by talking to a pal in Nova Scotia on a wave-length of 45 metres, using a power of less than one watt! Many an ordinary receiving set takes more power than this *for H.T. alone!*

It is to be hoped that this remarkable low-power, low wave-length achievement will induce other experimenters to emulate it. In the meantime, *mon chapeau* comes off to G 5 K L and his opposite number in Nova Scotia.

World's Highest Wireless Set

Stations which are situated high, high, high up in the hills will have to look to their laurels when the French get their wireless balloon going. This ingenious gadget is intended to investigate the Heaviside layer, and will consist of an automatic wireless transmitter, placed under a balloon, and capable of carrying on at an altitude of *ten miles!*

The idea is that a comparison between the balloon's signals and those of a synchronised ground station would throw much light upon the Heaviside layer.

Is Radio Power-Transmission Coming?

Are we on the eve of important developments in distributing power by radio? There were two very

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significant pronouncements upon the subject last month, one in this country and one in America. Over here Senatore Marconi himself admitted that he felt optimistic about the chances in the near future, whilst Dr. E. F. Alexanderson—America's radio scientist—was equally hopeful. It looks as though wireless wonders will never cease!

Would You Believe It?

A youthful reader—who shall be nameless—writes to tell me that recently on several occasions he has been able to draw "quite fat sparks" from his aerial lead (which has a condenser in series). He seems to think this is very praiseworthy and notable, but as a matter of fact it is both silly and dangerous. During thundery weather a good aerial is more a safeguard than a danger, if it is properly earthed and *left alone*. To go playing about with electrical charges upon it is as much a mug's game as the investigation of gunpowder with a lighted candle!

The "Radiano Three"

Many readers have asked if the Gambrell Y Coils are O.K. for the "Radiano Three" receiver, which was described in the WIRELESS CONSTRUCTOR for last March.

These coils have been approved by the Editor as being quite suitable.

Before Winter Comes

I expect you saw in the papers the statement by Mr. Vyvyan, Engineer-in-Chief of the Marconi Co., regarding the possibilities of Beam telephony. "This summer," he said, "Canada and England will be on the 'phone; by the end of the summer Australia, South Africa, and India should be similarly connected with the Home country."

I must confess that I did not quite realise the tremendous significance of such a statement until I heard for myself a transatlantic telephone talk the other week.

Transatlantic Trunks

Happening to be in the room when his telephone bell tinkled for Transatlantic Trunks, I overheard Mr. Percy W. Harris gossiping over the Atlantic.

A 3,000-mile wet and watery waste intervened between him and

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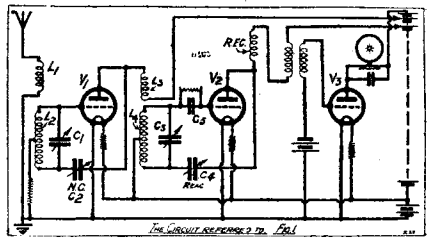
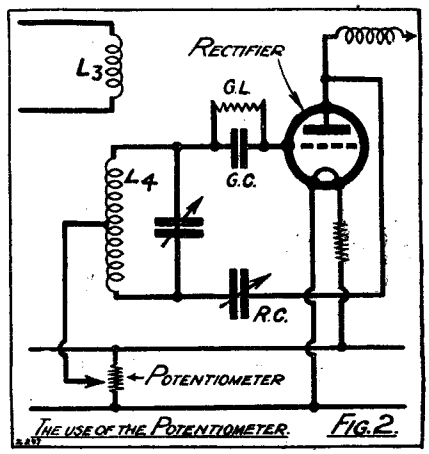
IMPROVING THE TAPPED SECONDARY CIRCUIT

A VERY popular circuit to-day is that seen in Fig. 1, in which use is made of centre-tapped coils to form the secondaries of the H.F. transformers. One of the few disadvantages that this circuit possesses is that as a rule the tuning of the grid circuit of V_1 is very much sharper than that of V_2. This is due mainly to the damping introduced by the grid current, which is necessary for gridleak and condenser rectification. Practical experience shows that few 4-volt or 6-volt valves are at their best as rectifiers when the grid return is made directly to L.T. positive as shown in the circuit diagram. Usually there is a distinct improvement in signal strength if the grid potential is made



rather less positive, and this is clearly all to the good from the point of view of selectivity, since the smaller the flow of grid current the less will be the damping introduced. Fig. 2 shows how an improvement can be effected by the use of a potentiometer wired across the L.T. leads. The centre-tapping of L_4 is now connected, not to L.T. positive, but to the slider of the potentimeter, which enables the grid potential to be adjusted to a nicety. The writer finds that with most valves the best general working conditions are obtained when the slider of the potentiometer is almost in the middle of its travel, slightly nearer the positive end than the negative. When the potentiometer has been fitted a little experimenting soon shows which position gives satisfactory signal strength combined with the best obtainable degree of selectivity.

There is another advantage of using a potentiometer in this way which



THE USE OF THE POTENTIOMETER. FIG. 2.

is not generally realised. Modern medium-impedance valves require a good deal of current from the plate battery at any time, but the amount passed may be considerable in the case of a rectifier whose grid is made very strongly positive by having its return connected to L.T.+. By reducing the amount of the positive grid potential the use of the potentiometer cuts down the flow of plate current. Its fitting is therefore a distinct economy, since it prolongs the life of the H.T. battery. Care should be taken to choose a potentiometer of reputable make, or, if an old one is used, to see that it is in good condition, for if the contact made by the slider is uneven it may give rise to a great deal of noisiness. With a jumpy potentiometer adjusting the grid potential may become rather a painful business.

AN IMPROVISED CHOKE

IT sometimes happens that one has on hand an L.F. transformer which, save for a burnt-out primary winding, is good in all other respects. Or, again, it may be desirable to add a stage of choke-coupled L.F. to an existing set, or one may wish to try this form of coupling for the first time, and no matter what the reason, the secondary winding of most L.F. transformers can be used as a substitute for a specially manufactured choke by connecting it up in the conventional manner.

In cases where the primary winding of a transformer is burnt out in a set while working, a few changes in the connections will quickly enable the set to be used again, either until the transformer is replaced, or it may be used permanently as a choke-coupled set. It should be remembered that the valve, in whose anode circuit the choke is connected, should preferably be of the resistance-capacity or special H.F. types for the best results.

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Mr. Loftin, the radio inventor, who was speaking from Washington, D.C.; but I've had more trouble in putting through a call to Clapham than was experienced in this trans-ocean talk. In fact, the whole transaction was perfectly smooth and silky—the kind of thing that Mr. Loftin's countrymen would style "the cat's pyjamas!"

Quick Work

What I particularly liked about it was the absence of any excitement. No shouting, no fuss, no bother, no roar of X's—nothing but Mr. Loftin's own clear and friendly voice discussing the latest developments of the Loftin-White circuit, as they were occurring to him. Talk about "straight from the horse's mouth"! Why, it was like a back-of-tonsil close-up!

The Rugby trans-ocean telephone service may not yet be perfect. But for sheer, downright, upstanding, right-across, all-along, top-to-bottom efficiency there's very little to beat it on this old ball of land and water that we call the Earth!

A Radio Amalgamation

The news that Radio Instruments (R.I., Ltd.) and the Varley Magnet Co. have joined forces is a welcome sign of trade activity.

So instead of *Ri-valry* we shall have R.I.-Varley—almost the same, but better for everybody!

SAVOYARD

SOME CURIOUS RHEOSTAT ARRANGEMENTS

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the resistance elements, so that if a coarse adjustment is obtained by slider No. 1, slider No. 2 may be used on the vernier portion of its element, and vice versa.

In the second and concluding article on this subject a number of arrangements will be shown, becoming gradually more complicated but at the same time having greater and greater range of application, and the reader will find it rather fascinating to work out different arrangements of resistances and the different applications of these.

(To be concluded.)

USING OLD PANELS

A good set is worthy of a good panel, and its smooth polished and unscratched surface will do more to enhance the appearance of the receiver than any other single factor, but for experimental sets which are to be "chopped and changed about" the appearance of the panel is not quite so important. In any case, old panels can be utilised quite effectively, and even given an excellent appearance, if a few simple precautions are taken.

Usually an old panel has a number of unneeded holes of varying sizes. To see what must be done to make your old panel presentable, clean it as well as possible (if it is a polished panel a hard rubbing with a piece of wash-leather on which a few drops of oil have been sprinkled will do wonders), and then lay out those components which are to appear on the panel.

Filling the Holes

If you use 4-inch condenser dials in accordance with modern practice you will probably find that the dials themselves will cover several of the older holes, and generally such a component as an on-and-off switch will fall in the same place as before. When you have found which holes need obscuring, lay the panel on a flat surface and fill up the unwanted holes with pieces of wood, screwed-up paper, or anything else suitable, being careful that the filling material does not come right to the surface of the panel, but is depressed slightly below it.

Now obtain from your stationer's a small box of "Glitterwax." This is a wax sold in sticks of several colours, of which you will need the black and sometimes the red. If you are "patching" a black panel, take a stick of the black wax, light a match, hold it under the stick, and drip the melted wax into the holes, until they are filled right up and overflowing. Do not worry about wax running on the panel around the hole, but see that you get plenty in the hole and a small amount above it. When you have filled up all the holes in this way, set the panel aside for half an hour, when the wax will have set quite hard.

Now take a sharp, flat knife (a table knife will do), and slide it along the surface of the panel, being careful not to scratch it. You will find the knife will slice off all superfluous wax neatly and cleanly, and the hole will be almost completely obscured. Now take a piece of wash-leather and rub all over the panel, and you will find that it will polish easily and that the old holes will be practically invisible.

Back of the Panel

If you desire, the back of the panel can be treated in the same way, but usually it is the front of the panel only which matters so far as appearances are concerned. For mahogany panels you can blend the red and black wax so as to get the right colour for each particular hole.

The same waxing method can be used to alter markings on terminal strips. For example, you may have a terminal strip which is engraved in an unsuitable way. To remove the markings take a sharp-pointed instrument, such as a scriber, or a large needle, and pick out the white filling material from the engraving. You will find this will come out quite easily. When this is done fill up the engraved lines with black wax as before, when you will find, after slicing away the superfluous wax and rubbing the strip, that the old marks are completely obscured.

A SAFEGUARD AGAINST SHORTS

If yours is a receiving set employing screened coils, or should the shields or the cores of your transformers be earthed, the risks of short-circuiting are considerable owing to the large areas of exposed metal which are connected to the accumulator. An accidental contact between an H.T. positive lead and one of these, though lasting only for a moment, may do pounds' worth of damage by burning out valve filaments.

One can greatly reduce the risk of short circuits by covering such exposed metal surfaces with an insulating layer. "All very well," says the reader, "but surely you don't expect me to wind them round with insulating tape or something of that kind?" Not a bit of it. All that is needed is a sixpenny tin of quick-drying stove enamel, or a bottle of shellac varnish, and a paint brush. Give all the surfaces referred to two good coats with either of these, and they will be pretty effectively insulated.

Do not forget, by the way, in the case of earthed transformers, to paint over the heads of the screws which hold them down to the baseboard, if these pass, as they nearly always do, through metal lugs in electrical contact with the frame or the shield. The enamelling tip is an exceedingly useful one for other purposes as well. Bare leads, for example, can be made quite safe in this way *after* the wiring of the receiving set has been done. Soldered connections to tags can be covered up in the same way. Be very careful, however, not to allow the enamel to run under terminals or over ebonite insulation.

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