

Wireless Weekly

Vol. 5
No. 10

CONTENTS

A New H.F. Circuit.

By A. D. COWPER, M.Sc.

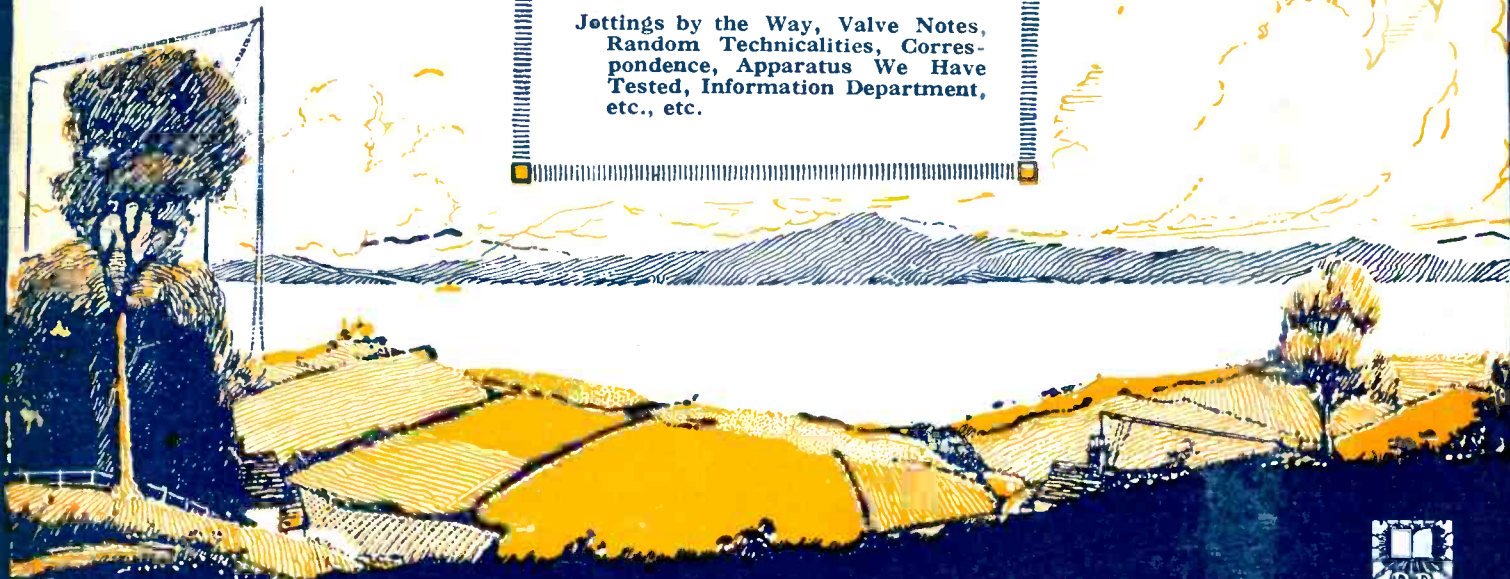
What is a Good Tuning Coil ?

Some Neutrodyne Notes.

A Low-Loss Coll.

Another Circuit on the Omni Receiver.

Jettings by the Way, Valve Notes, Random Technicalities, Correspondence, Apparatus We Have Tested, Information Department, etc., etc.



A Five Valve Super-Heterodyne Receiver

Full Constructional Details

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Wireless Weekly

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Christmas Greetings to Our Readers

EVERY week throughout the year we devote this page of *Wireless Weekly* to an expression of opinion on all aspects of the wireless art, science, and industry. This week we hasten to wish all our readers, on behalf of the Radio Press and its staff, the happiest Christmas that they could desire. Wireless enthusiasts are all of one family. The common bond of broadcasting binds together the dweller in the crowded town and the dweller on some remote hilltop, many miles from his nearest neighbour. The pealing of the Christmas bells, the roll of the organ in some great cathedral, the message of goodwill from some famous personage, can permeate in a flash to points hitherto attained by the speediest messenger only after many hours of travel. Heinrich Hertz, working in the 'eighties with ether-wave apparatus in his laboratory, little realised that in a comparatively few years such a wonderful art would grow out of the work he was then doing.

No novelist has yet seized upon the true romance of wireless to weave stories which will grip us, as do those of Charles Dickens, of whom we are bound to think when the spirit of Christmas is upon us. Even H. G. Wells, in the highest flight of his constructive imagination, had never pro-

phesied that millions of people would sit by their firesides on Christmas Day listening to the same message from a central station.

From the practical point of view, the popularity of wireless

speakers on Christmas morning, when the only set available to work them was a single-slider crystal receiver. Equally, the owner of a multi-valve set capable of receiving broadcasting from the ends of the earth may be pardoned some annoyance upon opening a Christmas parcel containing but a modest "single-valver." Then again, we have the horrible possibility of a man receiving three two-valve amplifiers and trying them in series.

A Happy Christmas, too, to the hard-worked officials of the British Broadcasting Company—to the engineers, who see the unromantic side, to the station directors ever vigilant, to the band of enthusiastic aunts and uncles, who, whatever their personal worries may be, must keep bright and cheerful before the microphone when giving their messages to the little ones.

Last, but by no means least, a Happy Christmas—dare we say a Happy D-Xmas?—to the small but energetic band of experimenters who, having, with tiny amounts of energy, penetrated the ether to Australia and New Zealand, are now sighing for new worlds to conquer. We must not forget how much broadcasting owes to the experimenter, and the splendid pioneer work he has done.

CONTENTS

	Page
What is a Good Tuning Coil ? ..	346
Jottings by the Way ..	349
A Neat Indoor Aerial ..	351
A Reinartz Circuit on the Omni Receiver ..	352
Valve Notes ..	354
A Low-loss Coil ..	356
Random Technicalities ..	358
Some Neutrodyne Notes ..	360
A New High-frequency Amplification Circuit ..	362
A Useful Four-way Switch ..	366
A Novel Switching Device ..	367
Building a 5-Valve Super Heterodyne Receiver ..	368
A Simple Loose Coupler ..	373
Mounting Variable Condensers ..	374
Correspondence ..	375
Apparatus We Have Tested ..	378
Information Department ..	381

has eased the minds of many people who hitherto had doubts what to give for Christmas gifts. There are many jokes about the duplication of wedding presents, and we fear there will be many more on the similar duplication of crystal sets and loud-speakers. It would be highly embarrassing to receive, say, six large loud-

A Happy Christmas to All

What is a Good Tuning Coil?

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

One of the most important components in any receiver is the tuning coil, and yet little attention is usually given to what constitutes a good coil.

SOME twelve months ago I gave great offence to a most elegant salesman in a wireless shop, which shall be nameless, by declining to accept a reel of what he alleged (and certainly the bobbin was so marked) to be No. 24 double cotton covered wire. He fetched a wire gauge for my undoing, but, alas, it proved to be No. 25, incorrectly labelled. I wonder how many of my readers who are fairly recent comers to wireless have made themselves so familiar with the various sizes and coverings of wire as to be able to distinguish one gauge from another by eye? Very few, I fear, because in these days of the almost universal use of bought plug-in coils it is quite a common thing to meet a wireless enthusiast who has never wound a coil of even the simplest description.

Good and Bad Coils

The situation is, I suppose, inevitable, for coil-winding seems a laborious and thankless task when ready-made coils can be bought quite cheaply, and the advantages of home-made coils are not at once obvious. It seems a pity, however, that the knowledge of the details of coil construction possessed by the earlier experimenters should be lost in this way, for the simple reason that there are bad coils as well as good ones on the market, and it behoves everyone who uses plug-in coils to make sure that he is not spoiling his reception by employing inefficient inductances. No set can work properly with poor coils, and good ones will often make an astonishing difference to results.

Discrimination

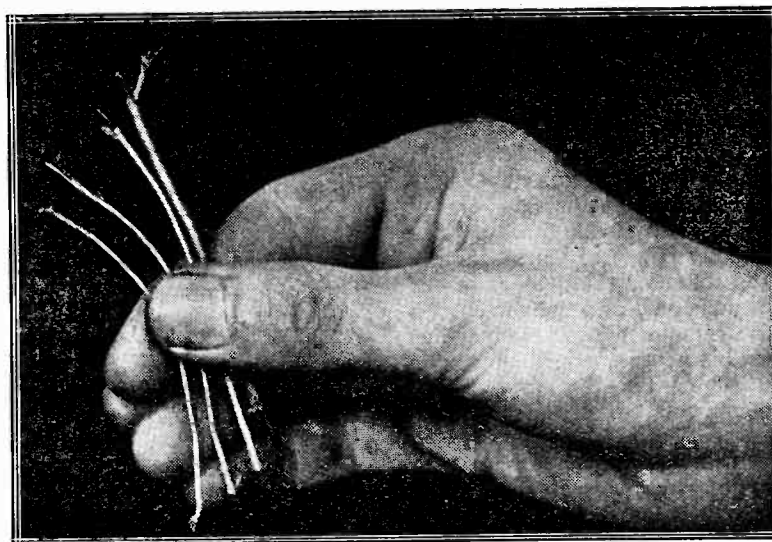
It is the purpose of this article to explain just what constitutes a good tuning coil in order that the reader may acquire the power

to discriminate between coils which will aid, and those which will hinder him in his efforts to secure good reception.

Self-capacity

Every coil must possess to a greater or lesser extent a defect which is known as "self-capacity," and the greater part of the energies of the coil designer are commonly devoted to its reduction. Every winding must pos-

sess a certain capacity, but in a good tuning inductance it must be kept low, as we shall see in a moment. First, what is meant by "self-capacity" when speaking of coils? Every winding must possess capacity as well as inductance, for the reason that each turn of wire and its neighbour must act as the two plates of a condenser, and the resultant of all these distributed capacities is called the self-capacity of the coil.



A few samples of double cotton-covered wire. Reading from left to right, Nos. 24, 22, 20 and 16 gauges are shown here.

will signals be. It is found that to produce the maximum potential difference the inductance in circuit must be as large as possible, while the capacity must be small, and hence we see that the useless self-capacity of the coil must be kept as low as possible, so that the only capacity in circuit may be that which is used for tuning purposes—namely, that of the variable condenser.

Wavelength Range

A further objection to high self-capacity in a coil used for

has inductance only, because

tuning purposes is that it reduces the range of wavelengths over which the coil will tune in conjunction with a variable condenser of given capacity. For example, a coil of a given inductance may tune from 320 metres to 570 metres if its distributed capacity is low, but a coil of the same inductance and a high self-capacity of windings may serve only for waves between 430 and 600 metres, the same variable condenser being used in each case.

Determining Self-capacity

Finally, self-capacity and one of the other serious defects of a tuning coil, namely, high-frequency resistance, are closely connected, and high capacity means serious H.F. resistance.

The capacity of a winding is a very difficult thing to measure, but fortunately it is easy to decide, in most cases, whether a winding is of high or low capacity merely by inspection. A typical high-capacity winding is that which consists of a number of layers, each wound straight on top of the one beneath without any spacing other than that produced by the insulating covering of the wire. In such a winding each turn (except those upon the outside) has four others lying close against it, whereas in a single layer coil there would, of course, be only two.

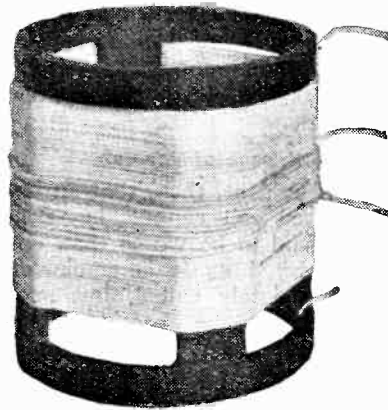
Multi-layer Coils

Further, capacity between turns is rendered more harmful in the case of the many-layered coil by the fact that the difference of potential is relatively great, and these turns may lie close together. This leads us to one of the most important rules of coil construction: Turns which lie close to each other in the winding should have as small a difference of potential between them as possible. This means that, whatever system of winding is employed, turns which lie close together should not be separated *electrically* by a large number of intervening turns. In other words, after any given turn has been wound on only a few turns should follow before the turn which is to lie beside or close to the first one is put on.

Potential Difference

The difference of potential between any two turns, it should be remembered, is more or less proportional to the number of turns intervening in the winding. Thus, between turn number one and turn number three there will be only a small difference of potential, and these turns may lie close together without ill effects, but between turn one and turn thirty there will be a relatively high-potential difference, and they must be kept well apart.

It follows from this that in any type of multi-layer winding—for example, a honeycomb coil—the depth should be great



This photograph shows the low-loss windings used in the ABC wave trap (Radio Press Envelope, No. 6).

and the width as little as conveniently possible. Therefore, the narrow and deep coil should be chosen in preference to the wide and shallow one. The only exception to this rule is the coil wound "edgewise," but so far as I am aware no coil of this type is yet on the market, good though it is.

Spacing the Turns

The main point to note in a multi-layer coil when considering its self-capacity is the *spacing* between the turns. A good coil is a more or less open structure, every turn being spaced out from its neighbours, or at least from any turn between which and itself there is a serious difference of potential. This spacing out may be achieved by the actual interlacing of the wire, as in the duo-lateral ("Igranic") coil, by a special spacing turn, as in the

lattice ("Burndept") type, or an arrangement of mechanical spacers may be used, as is done in the Gambrell coil. The point is that spacing there *must* be; no coil which is a solid mass of wire, having considerable depth and breadth, can be efficient as a tuning inductance.

Impregnating Against Damp

The material between the turns of the coil will naturally affect its capacity considerably, since such material forms the dielectric of the innumerable small condensers provided by neighbouring turns. Besides introducing dielectric losses, such material must increase the capacity of the winding, and therefore the ideal coil is one in which the turns are air spaced. Some good makes approach this ideal, but care must be exercised in forming an opinion upon any coil which has been impregnated against damp with wax, varnish, or other insulating material. If such material is present in any quantity the capacity will be increased unduly, and hence one should look carefully for any excess of wax or varnish.

High-frequency Resistance

The high-frequency resistance of a winding is not by any means the same thing as its ordinary direct current resistance, and it is here that so many professionally made coils show up unfavourably. In actual use, the following phenomena will be observed when a coil of unduly large H.F. resistance is employed: Tuning will be abnormally flat, and it may be impossible to cut out the local station, signals will be somewhat weak, and will fall off rapidly as reaction is weakened, so that one is compelled to work always on the verge of self-oscillation, with its attendant mush and parasitic noise generally.

Thickness of Wire

One of the main factors governing the H.F. resistance of a coil is the thickness of the wire with which it is wound, and it is here that the ability to estimate gauges by eye is so valuable when buying a coil. In

the case of the large coils required for long wavelengths it is necessary to use fairly fine wire to keep the bulk of the coil within reasonable limits, but upon the ordinary broadcasting band it is reasonable to expect that wire of adequate thickness will be used.

Efficiency on the Short Waves

Commercial considerations often lead to the use of quite fine gauges even for short-wave coils, but the consensus of expert opinion is to the effect that losses resulting from the H.F. resistance of the coil become unduly great if anything finer than about No. 24 gauge is used. Hence, coils for the shorter waves wound with quite fine wire must be regarded with suspicion by all who desire the maximum of efficiency.

Method of Winding

The actual system of winding influences the resistance of the coil to high-frequency currents to a considerable extent, but the only general rule which can be given is that a system of winding which is open and well spaced out is likely to produce a coil of low resistance. The gauge of wire is the only really obvious guide to the resistance, but it must be realised clearly that it is not the only deciding factor.

The Ideal Coil

One sometimes sees it stated that the ideal coil is one wound with exceedingly thick wire, say No. 14 gauge, but I am more than a little doubtful whether the qualifications which must be added to make such a statement correct do not invalidate it altogether under practical conditions. It must be remembered that the capacity of a winding depends to some extent upon the actual diameter of the wire, since each turn and its neighbour represent the plates of a condenser, and the size of the plates is obviously a factor in the result. Unless the spacing between turns is increased, very thick wire must lead to an increase of capacity, and hence it seems that such wire is only permissible where some special system of winding is used, such as a single layer with the turns spaced apart. Such coils are necessarily very bulky.

Dielectric Losses

A source of energy loss in tuning coils, which does not often receive the attention which it deserves, is that which takes place in any insulating materials which may be placed in the electrostatic field. For example, if the coil is impregnated with wax or varnish to protect it from damp, there will be between the turns a mass of dielectric material in which losses are inevitable. This, of course, is the reason for the oft-repeated advice to use *dilute* varnish, and apply it sparingly, so that the quantity of insulating material embodied in the finished coil may be as small as possible. It does not follow, however, that coils should not be impregnated at all. There are other serious losses consequent upon dampness which render the question a difficult one to decide.

Excess of Varnish

It is evident, then, that an impregnated coil cannot be definitely said to be worse than one "left dry," as it is somewhat inappropriately called, but such a coil should be examined carefully, and if an excessive quantity of wax or varnish seems to have been used it should be rejected.

It is evident that solid dielectric material (any insulator except air, that is) between the turns of a coil will lead to losses, but it

must not be forgotten that losses may also occur in the former on which the coil is wound, the plug upon which it is mounted, and so on. Preference should therefore go to the coil in which the minimum of dielectric material is actually included in the static field. In practice this means that the former should be as thin as possible, and if a self-supporting winding can be used in which no former is needed, so much the better.

Wire Covering

The covering of the wire used for winding a coil has a considerable bearing upon efficiency, and in general it may be said that the thicker the covering the better. Enamelled wire is unsuitable for anything except single-layer coils, and even for these is not very desirable. Double cotton covering is usually accepted as the best for all windings except those in which mechanical separators are used to produce a very wide spacing between turns. In such coils silk covering may be permissible, but since it is thinner than cotton, and more prone to absorb moisture when unprotected, it is not desirable in other types.

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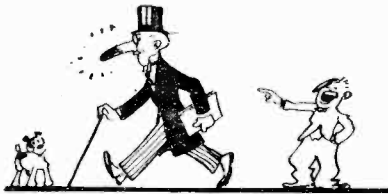
Our photograph shows the Tibetans, who recently broadcast from 2LO, with their weird instruments.



JOTTINGS BY THE WAY By Wireless Wayfarer

A Merry Christmas

PERMIT me, on behalf of myself and in the name of the Little Puddleton Wireless Club, to wish you all the merriest of Christmases. I have no doubt that you will spend most of your time at the wireless set, but you should, I think, in fairness to yourself and to others, spare a few moments during the day and in the evening to take part in the usual festivities. A touch of gaiety quite in keeping with the season is added if the wireless enthusiast dons a paper cap, or a vast red nose before sitting down to fiddle with his gadgets. If headphones are used these should be worn *under* the cap. Be very careful in your



Oblivious of the fact that he was adorned with it

movements whilst wearing an artificial proboscis. Last year Professor Goop marked the occasion by donning one of these on Christmas Day, and being, as you know, rather short sighted, he did in valve after valve whilst peering at his controls. During the afternoon the Professor, entirely oblivious of the fact that he was adorned with it, took it out for a walk through the streets of the town.

A Tall Hat

As he was wearing also the tall hat and frock coat which he reserves for great occasions and ceremonies, the effect was most striking. Be gay, therefore, on Christmas Day; throw your cares

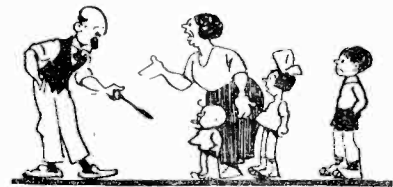
to the wind; enter light-heartedly into the fun when you can tear yourself from the wireless set, but be careful not to overdo things as the Professor did.

To Beginners

Christmas is the season of the year when the wireless beginner takes the field in enormous numbers. For about a week before the festive day wireless shops are thronged with fathers, tall, short, thin, stout, and medium, with assorted mammas and with hordes of the younger members of families. All are intent upon buying wireless sets or parts wherewith to make them, and all intent to have them in full working order on Christmas Day. Papa, thinking of the income-tax demand note which will usher in the glad New Year, is usually all for a crystal set. Mamma, on the other hand, earnestly desires to have "one of those nice ones with little lamps because they look so pretty." The young back up mamma and go one better. They want the biggest possible set and the loudest of loud-speakers. If a noisy noise annoys an oyster it certainly does not have that effect upon the young human being of either sex. Over the choice of the set the battle rages loud and long, and eventually the skill of the salesman,



coupled with the flattery, threats and entreaties of his family, induces papa to purchase one costing six times as much as he had budgeted for, and he sighs deeply as he hands over the "Fishers" in exchange for it. But what after all does it matter? He is learning the first great lesson, though he does not realise it at the time. All fully fledged wireless men spend the greater part of their income on gadgets, and comparatively few of us know what it is to have a bank balance. Mamma, who thus pushes her worse half into extravagance, will have cause bitterly to regret her action in about six months' time. Then she will go to him saying, "Tommy and Mary must really have some new boots. May



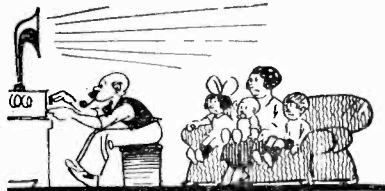
"Tommy and Mary must have some new boots"

I have a cheque, please?" To which he will answer: "I am sorry, but it is absolutely essential that I should buy some square law condensers, so they must manage with the old boots for a bit longer."

What Joy!

Anyhow, that new set is going to give paterfamilias any amount of innocent enjoyment. His family are utterly mistaken if they imagine that they are going to have much of a share of it. On Christmas Day he will be quite unselfish about it, endeavouring only to let them all hear how wonderful it is. From his loud-speaker or telephones, as the case may be, he will produce a

very fine imitation of the battle cries of warring tom-cats, and these will be supplemented by similar contributions from all the other beginners in the neighbourhood. Christmas is the season of the year when the welkin, whatever the welkin may be, gets its most severe rending. He will, of course, assure the assembled company that none of the yells heard are caused by his set, and it is not unlikely that he will write indignantly to the papers to protest against the appalling way in which the ether is mangled by selfish people who ruin the enjoyment of others by misusing their sets. Possibly, even on Christmas Day, he will begin to show one of the earliest symptoms of real radiomania. This consists in what I call the home-made "lucky dip" programme. What happens is this. He tunes in 2LO, whose orchestra is playing some particularly jolly piece. The family sit enraptured as they listen to it. At the end of about fifteen seconds he moves to the controls, twiddles one and tweaks

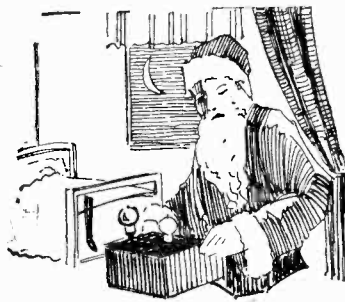


... He tunes in 2LO ...

another. He beams. "That," he says, "is Cardiff." This station, again, is doing something which appeals to all who are listening. But are they allowed to hear it? They are not. Just as they are getting really interested he twiddles again and gives them Manchester. This is followed at intervals of a few seconds by snatches of Birmingham, Newcastle, Aberdeen, Glasgow, Belfast, Bournemouth, Brussels, P.T.T., Le Petit Parisien, Madrid, Breslau, and so on and so on. Having got so far he changes the coils and gives them usually a duet between Chelmsford and Radio Paris. This is followed by the Eiffel Tower time signal, and then it is time to go to bed.

Family Trouble

You, if you are an old hand, know in your heart of hearts that



this is precisely what you do on most evenings of the week.

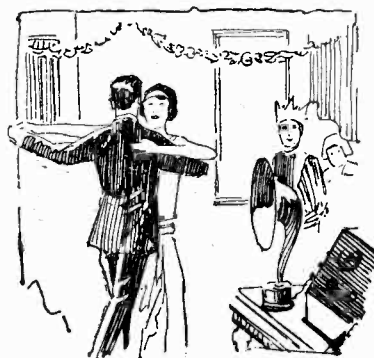
Many a family has been broken up by a prolonged course of lucky dipping, and there are signs that matters are growing worse and worse.

Breaking Records

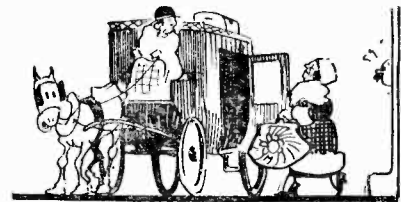
Recently, I notice, all kinds of people have been writing to the papers to claim that they can tune in the greatest number of stations in the shortest possible time. The record up to date is held, I believe, by one skilled lucky dipper who brought in twenty stations in eighty seconds. If he continued this during the evening for a couple of hours this would bring his total up to 1,800, which, I think, is sufficient to induce even the mildest of wives to leave on the next morning for a prolonged visit to her mother.

Useful Hints

In erecting the aerial the great thing is to obtain height. There is no need to be foolishly extravagant by purchasing a stout mast. By splicing a broom handle to a clothes prop a fairly tall mast can be produced, and you can go higher and higher by adding selections from your stock of garden implements. If the thing bends a bit, do not worry; nothing is more hideous than a straight line, whilst a graceful



curve adds considerably to the beauty of the aerial mast. The best place in which to make the hole in which the mast will stand is always in the middle either of the tennis lawn or of the asparagus bed. I do not know why this should be, but one or other of these spots is invariably specially marked out as the ideal site. Do not worry about this, for you can always join a tennis club when the summer comes round again, whilst asparagus is purchasable at any greengrocer's at reasonable rates. The task which usually proves most difficult is the attachment of the house end of the aerial wire. Chimneys are very closely associated with our Christmas celebrations. Santa Claus pops down them, and paterfamilias shins up them. The best way on to the roof is usually *via* the skylight. Before adopting this method of egress from your abode it is as well to run the foot rule over it and the inch tape over yourself. When Poddleby



... to leave next morning for a prolonged visit to her mother ...

was a beginner many years ago he omitted to take these precautions and spent the greater part of Christmas Day firmly jammed in the skylight. Whilst the local builder was engaged in extracting him his family fed him with slices of turkey and portions of Christmas pudding passed up on the end of a fishing-rod. I gather from what Poddleby has told me that this is not the ideal way of spending one's Christmas. And then there is the question of the earth. You may take it from me that the flower-pot in which your azalea blooms is not ideal for the purpose. The best thing is to dig a large hole somewhere in the garden and to bury the baby's bath in it. The child will have to go unwashed for a few days, but he will not mind this, and if he is quite happy why should you worry?

WIRELESS WAYFARER.

A Neat Indoor Aerial

A SUGGESTION for a neat indoor aerial is described in the following article. As is known, indoor aeri- als are seldom as efficient as a good outdoor one, but, nevertheless, if constructed on the right lines, good results can be obtained on even modest receivers. The design shown in Fig. 1 is a suggestion as a possible arrangement, and the first items to be constructed are the two end pieces which are fixed to the walls. One of these is shown together with the principal dimensions in Fig. 2, and may be made of hard wood thoroughly dried. Two such pieces will be required, the only difference between the two being that the one shown in the diagram is equipped with a down lead terminal, and in the other piece, this terminal is not required. First prepare two wooden pieces 6 in. by 6 in. by $\frac{1}{2}$ in. Drill in one piece four holes, each 2 ft. apart, to receive ebonite panel bushes. In the other piece drill four similar holes, with the addition of a centre hole which also receives an ebonite panel bush, through which the down lead terminal is secured. Next fix an iron wall bracket to each end of each piece, as shown.

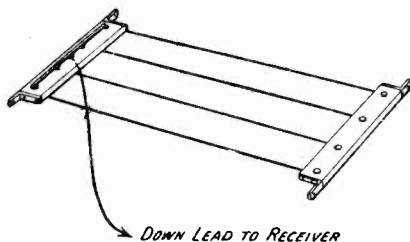


Fig. 1.—The neat arrangement of the indoor aerial is here shown.

These may be bought or made from soft iron bent to shape and drilled. Now assemble ten ebonite panel bushes in one piece, and eight in the other, and secure by means of large pillar terminals and nuts. To complete, solder a piece of $\frac{1}{16}$ in. sq. tinned copper wire, 6 ft. 1 in. long, across the piece to which the five terminals are secured, as indicated in Fig. 2. The other wall piece does not require this

connection. The complete aerial is shown in Fig. 1. Wires are secured to each of the four terminals, which are 2 ft. apart on the piece which is provided with the down lead terminal to which

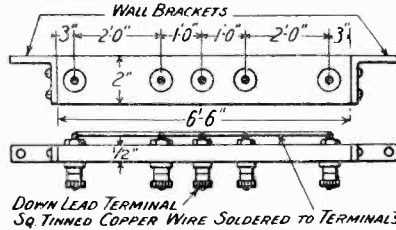


Fig. 2.—Constructional details of the "spreaders."

a further lead is secured. This piece is then secured to the wall by means of the iron brackets, the terminals being on the underside. Secure the other piece on the opposite wall of the room in a corresponding manner, and position. Connect each of the four wires to corresponding terminals on this piece by drawing them tightly across the room and

cutting each piece off to the required length.

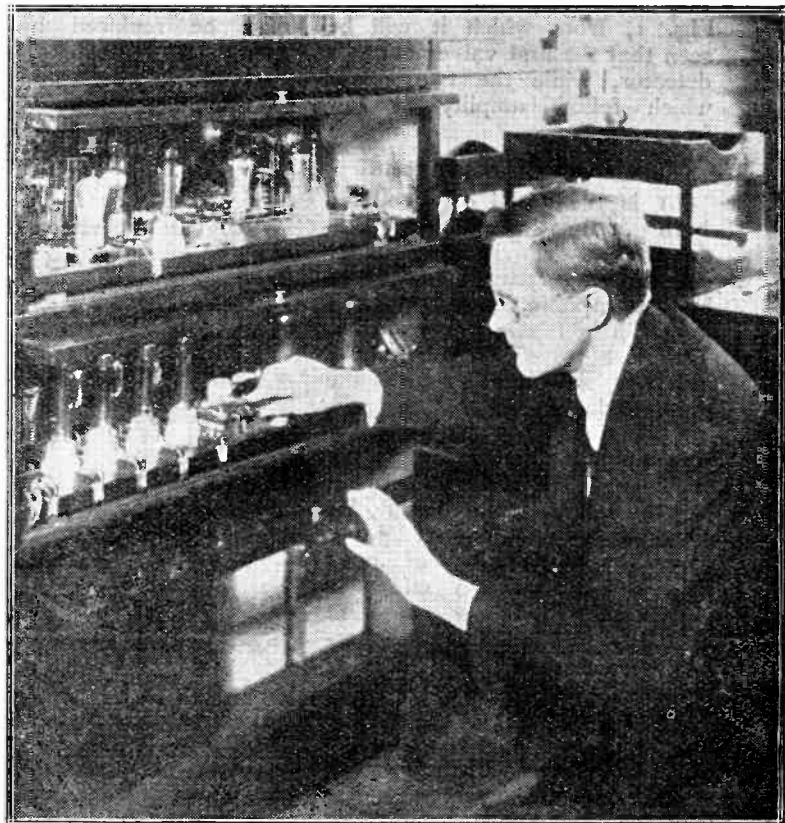
Madame Tetrazzini to Broadcast on Christmas Day

The Italian agent of Burndept, Limited, calls attention to a very interesting programme which will be broadcast from the Rome Station of the Unione Radiofonica Italiana on Christmas Day.

Madame Luisa Tetrazzini, the famous prima donna, assisted by Signor Ugo Donarelli, will sing the following duets:—

The Mad Scene, from "Hamlet" (Verdi), and La Ci Darem La Mano, from "Don Giovanni" (Mozart).

For the benefit of British listeners, Madame Tetrazzini will sing in English as well as in Italian, the items including "The Last Rose of Summer" and "Somewhere a Voice is Calling." This concert will commence at 8.30 p.m. (G.M.T.) on 425 metres.



The above photograph shows Mr. D. Ranger, of the Radio Corporation of America, who is mainly responsible for the development of the new apparatus used in the transmission of photographs by wireless.

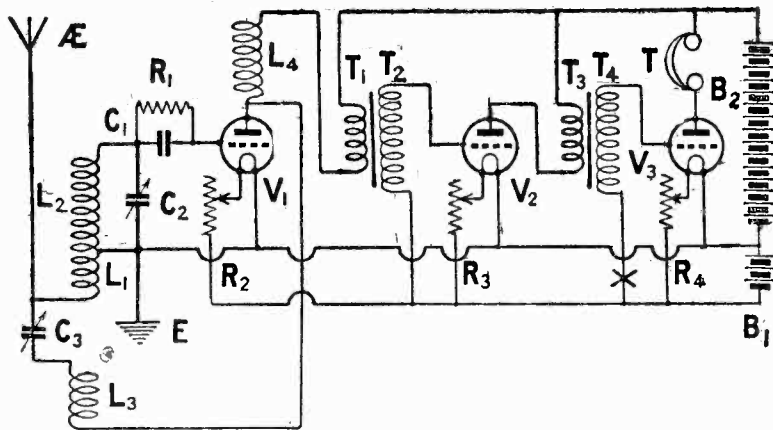


Fig. 1.—The Reinartz circuit as arranged upon the Omni Receiver.

A 3-Valve . . .
. . . Reinartz
Circuit on the
Omni Receiver

RECEIVERS employing Reinartz tuners are not used very extensively in this country, although they possess certain distinct advantages over the more usual receiver using standard tuning arrangements. In the Christmas number of *Modern Wireless* Mr. Percy W. Harris described "A New Reinartz Receiver," in which several improvements have been made over the older types. The circuit employed is given in Fig. 1, from which it will be seen that the first valve acts as a detector, while the two valves which follow amplify at low frequency.

The Circuit Arrangement

L₁ is the aerial coil, coupled both magnetically and conductively to the grid or secondary coil L₂, the latter being tuned by the variable condenser C₂ of .0005 μF maximum capacity. The first valve V₁ detects the incoming signals by virtue of the grid condenser C₁ of .0003 μF, and the leak R₁ of approximately two megohms resistance.

The high-frequency component in the anode circuit of V₁ traverses the reaction coil L₃ and variable condenser C₃ of .0005 μF, and a reaction effect is obtained. Obviously, reaction would not be obtained if no current flowed in L₃ and C₃, and it is quite possible for this to be the case if the coil L₄ is omitted. This coil, with the primary and the transformer, acts as a choke to H.F. currents, and is consequently of large size. The low-frequency currents in the

anode circuit of V₁ are communicated *via* the L.F. transformer T₁ T₂ to the grid and filament of the second valve V₂. In the anode circuit of this valve is the primary winding T₃ of a second L.F. transformer T₃ T₄. The voltage variations induced in the secondary winding T₄ are applied to the grid and filament of V₃. The resultant greatly amplified currents in the anode circuit of this valve are transformed into sound by the telephones T, which may be replaced by a loud-speaker, if desired.

It may be beneficial to insert at the point marked X a small dry battery, to apply additional negative bias to the grid of the last valve.

Wiring the Circuit on the Omni

The following is a list of connections for wiring up the circuit on the terminal board:—

51—25	6—7
17—41	15—24
17—52	56—16
33—19	8—31
18—33	23—24
26—41	32—40
27—12	52—40
19—35	4—9
27—43	1—2
4—53	10—25
54—22	48—55
21—24	29—48
30—14	

Coil Sizes

The grid circuit coil is to be plugged into the front moving socket of the three-coil holder on the side of the cabinet, the aerial coil in the fixed centre socket, and the reaction coil in the re-

maining socket at the rear. The choke coil L₄ is to be inserted in the left-hand fixed socket on the front of the panel.

The correct size for the aerial coil will be independent of the size of the aerial employed. In general, a No. 25 will prove suitable for the broadcast wavelengths. The grid coil may be a No. 50 coil, while for reaction either a No. 50 or No. 75 should be used. As indicated previously the choke coil is of large size, a No. 200, 250, or 300 being suitable.

Operating the Set

Having inserted the coils and valves and connected the batteries, phones, aerial and earth to the correct terminals, tuning may be commenced. The aerial and grid coils should be closely coupled, and the reaction coil placed as far away as possible from the aerial coil. It should be noted that the aerial and grid coils are connected, and the connections to these coils should therefore be experimented with.

Tuning should now be carried out by rotation of the variable condenser C₂. Having tuned-in the nearest station in this manner, the reaction coil should be moved towards the aerial coil, retuning at the same time on C₂. If the receiver does not oscillate, even when the two coils are coupled as closely as possible, the connections to the reaction coil should be reversed by disconnecting the leads 2—1 and 4—9, and joining 4—1 and 9—2. The dial of the variable condenser C₃ should now be placed at 90

The Reinartz Circuit is one which is recognised as giving a fine control of reaction. Users of the Omni Receiver will at once appreciate this point.

deg. and the reaction coil adjusted until the receiver just oscillates. Fine and smooth reaction control will now be obtained by variation of C₃.

Grid Bias

In the event of there being any distortion, even though reaction is carefully controlled, the trouble will probably be caused by the

* * *

SIR,—We have pleasure in advising that our flagship, s.s. *Leviathan*, transmitting on 316 metres, was picked up by a Dublin amateur, Mr. Cherrick, of 36, Grosvenor Street, Rathmines, when she was 550 miles from Land's End on your Transatlantic V.

As you are probably aware, s.s. *Leviathan* has inaugurated a broadcasting service on her voyages east and west bound. Her station was installed as an experiment to find out whether a moving station could give perfect reception for amateurs, and has, judging by the number of reports that are reaching us, attained complete success.

Mr. Cherrick advises us that at 12.45 a.m., December 11, he picked up her call sign, WSN, in the neighbourhood of 316 metres, and after standing by for two bells, was recalled for weather reports and selection of jazz music, together with a complete description of the transmitting set as installed, which is too detailed to report herein. Mr. Cherrick was using three valves, namely, two H.F. and detector, and obtained perfect reception. On switching on the two L.F. valves he was able to obtain full loud-speaker strength with perfect clearness, the articulation being perfect.

We have pleasure in adding that Mr. Cherrick also received seven American stations within the hour

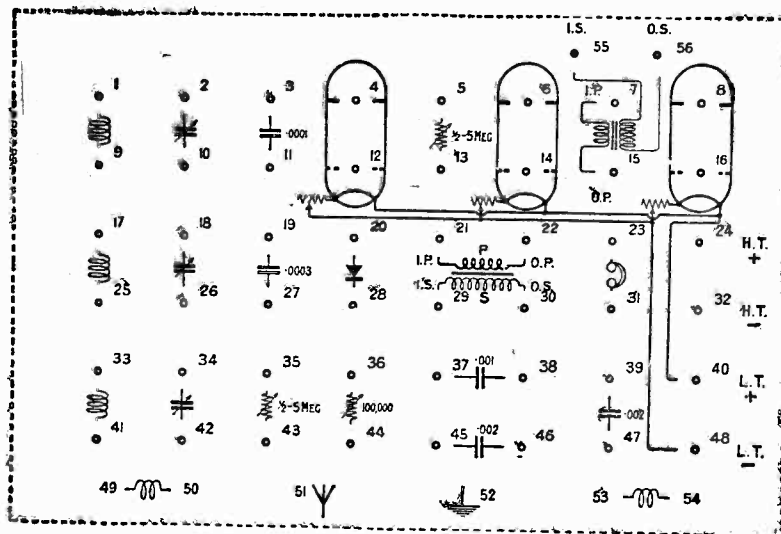


Fig. 2.—The terminal board.

last valve, and the introduction of grid bias will do much to improve the quality of music and speech. As an experiment, an ordinary flash-lamp battery may be employed, though, of course, a battery of variable voltage is

preferable. The method of application is quite simple. Disconnect 55—48 and connect the grid battery between those two terminals. The plus terminal is joined to 48 and the minus terminal to 55.

S.S. "Leviathan" Broadcasting

after WSN closed down, and was able to do without the L.F. amplification. The set, we understand, was built exactly to specification, except that different Mansbridge condenser values were used.

In concluding, we have to compliment you on the design of your "Transatlantic Five," which has before been brought to our notice when s.s. *Leviathan* first broadcast, also your H.F. ST100, which received her on the loud-speaker 1,482 miles out on her last voyage.—Yours faithfully,

UNITED STATES LINES.
H. M. LEARMONT.

using an indoor aerial consisting of four 11-ft. wires of 26 d.c.c. across the ceiling nailed to the wall at each end.

On Sunday, 14th, at 1.40 a.m., I received KDKA on the one valve as well as I can receive 2LO on any average night on both indoor and outdoor aerials. I intend to add the second valve after Christmas.

Concluding, may I congratulate you on designing so simple and efficient a short wave receiver, and also wish the Radio Press a Merry Christmas and a very prosperous New Year?—Yours faithfully,
ATMOSPHERIC.

Folkestone.

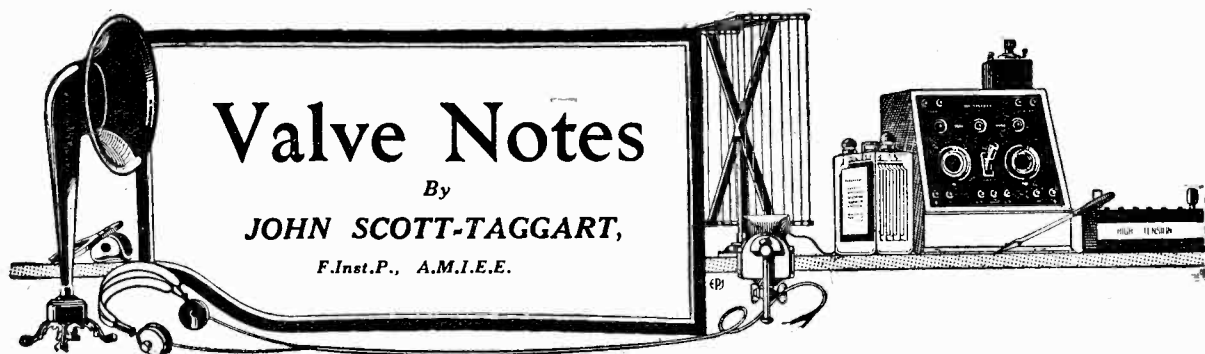
A Low Loss Tuner for Short Waves
(W.W., Nov. 19th.)

SIR,—It may interest you to hear some of my results with the low loss tuner. I finished this without the note magnifier on December 4 at 10 p.m., and at 11.45 p.m. I was listening to KDKA at fairly good 'phone strength. On Wednesday, 10th, I heard KDKA call up very clearly at 10.35 p.m. On Friday, 12th, I heard KDKA very clearly,

OUR NEXT ISSUE:
FULL CONSTRUCTIONAL
DETAILS OF A NOVEL
THREE-VALVE RECEIVER.

SOME HIGH-TENSION
PROBLEMS

By Percy W. Harris.



Super-Heterodyne

READERS will be interested to see shortly an article which I have asked Mr. W. R. H. Tingey to write on the subject of a super-heterodyne set

damping effect on any circuit in its anode circuit.

Let us look for a moment at the Fig. 1 arrangement, which shows the end part of a type of receiver commonly employed. It

primary winding is in the anode circuit of the first valve and the secondary winding is in the grid circuit of the second valve, but it is not always appreciated by the novice that a tuned anode circuit is really also the tuned grid circuit of the next valve.

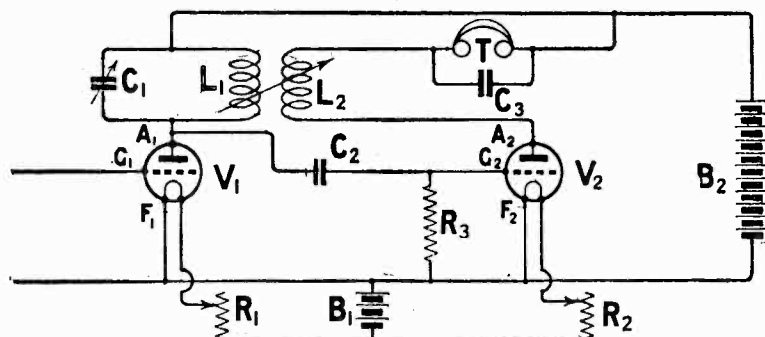


Fig. 1.—A common circuit drawn to illustrate the relationship of C1 L1 to the grid circuit of V2.

which he has designed and which gives excellent results. In the actual set is embodied the method of using a transformer for the source of oscillations and having an ebonite tube surrounding this transformer, a number of turns of wire being wound on this outer tube. This method of feeding the local oscillations into the grid circuit of the detector valve of the supersonic heterodyne receiver is very successful and forms part of Mr. Tingey's set.

Damping Effect of Valves

Many troubles of self-oscillation in valve receivers are due to a variation in the damping effect of valves used as amplifiers or detectors. Curiously enough, I have never seen the slightest mention of this effect elsewhere, although in actual practice it is extremely important.

The fact of the matter is, that even though a valve may be acting as an amplifier or a detector, this does not alter its

will be seen that a tuned anode circuit L1 C1 is included in the anode circuit of the valve V1, and that reaction is introduced by means of the inductance coil L2 from the anode circuit of the detector valve V2. The high-frequency potentials applied to G1 will be amplified by the valve

Instability

When using a circuit of the Fig. 1 type, the grid G1 and the filament being connected across the usual aerial circuit, it sometimes happens that a variation of the filament current going to F1 will alter the whole stability of the set. This, in the first place, may be due to an alteration of the amplification effect of the first valve, thereby varying the natural reaction taking place through a capacity effect between the aerial circuit and the circuit L1 C1, or it may be due to an increased tendency of the second valve to oscillate. If we connect up the circuit of Fig. 1 by itself without any aerial, we will see that we have a simple grid circuit L1 C1 connected virtually across the grid and filament of the

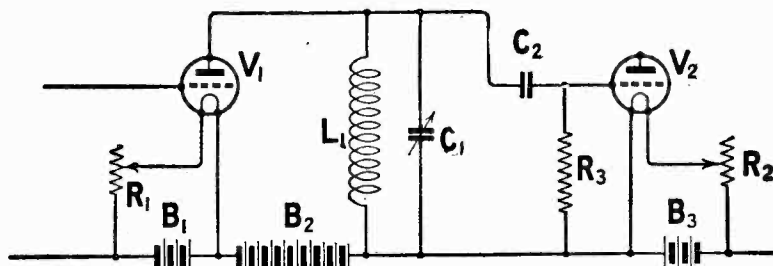


Fig. 2.—The Fig. 1 circuit redrawn in simplified form.

V1, the amplified oscillations appearing in the circuit L1 C1. This circuit, although an anode circuit, is also the grid circuit of the second valve. When a 2-winding transformer is employed, the beginner realises that the

second valve. It is true that the high-tension battery is in the way, but this does not affect the position as regards high-frequency currents; it might just as well be replaced by an ordinary piece of wire. It is, of course,

necessary for the anode circuit of the second valve.

A Useless Valve

In the arrangement of Fig. 1 exactly as it stands, the valve V_1 , therefore, is merely a useless object. Whether it is there or not, oscillations may be produced by the valve V_2 by coupling L_2 sufficiently tightly to L_1 , but the amount of reaction required to make the valve V_2 oscillate depends upon the presence of the valve V_1 , and it also depends upon the filament current passing through F_1 . The valve V_1 is virtually shunted across the circuit $L_1 C_1$, and affects its damping; the heavier the flow of current through V_1 , the greater the damping effect on the circuit $L_1 C_1$, and to make the valve V_2 oscillate, more reaction will be required.

A Simplified Arrangement

We really have now the circuit shown in Fig. 2, the grid circuit being represented by $L_1 C_1$. Batteries, of course, have been duplicated to make the circuit simpler, but the fact remains that the anode circuit of the valve V_1 is really shunted across the circuit $L_1 C_1$, and therefore will help to determine the damping in this circuit.

The fact stands out that an amplifying valve (or the first detector valve, in the case of a supersonic heterodyne receiver) affects the damping of the circuits associated with its anode circuit, and does not merely carry out its ordinary intended function. The Fig. 1 circuit is of no real practical value, because no aerial circuit is attached, and the valve V_1 is not acting as an amplifier. If, however, we attach the aerial circuit at the beginning, the valve V_1 will amplify the incoming signals and will be doing really useful work, but the mere fact that the valve is doing useful work does not alter its other property of affecting the damping of the circuit in its anode circuit.

A Practical Point

This point has great practical significance, because when using a circuit of the Fig. 1 type with an aerial attached, it will often happen that the reaction between L_2 and L_1 has been very carefully adjusted to give the maximum signal strength. If now the fila-

ment current of the first valve is decreased, it is quite possible that the second valve will oscillate, and the reason is not far to seek. The less the filament current, the less the current passing through the valve V_1 and the less the damping in the circuit $L_1 C_1$. The reaction coil L_2 has been adjusted almost to wipe out the damping in the circuit $L_1 C_1$, but when this damping is suddenly decreased by reducing the filament current of F_1 , the reaction effect introduced by L_2 is far more than sufficient to counterbalance the losses in $L_1 C_1$, and the second valve V_2 proceeds to oscillate. In a circuit of the Fig. 1 type, there-

adjust the reaction between L_2 and L_1 very carefully and then turn off the first filament; the second valve will immediately proceed to oscillate.

Supersonic Heterodyne Trouble

In Fig. 3, which shows a simple supersonic heterodyne receiver in which the local oscillator is represented by G , the long-wave, or rather intermediate frequency amplifier, may easily oscillate and give a great deal of trouble. This may happen if the detector valve is run at too low a filament brilliancy. In Fig. 3 V_1 is the first detector, and the output circuits of V_1 , namely, L_3, L_4 , are designed for

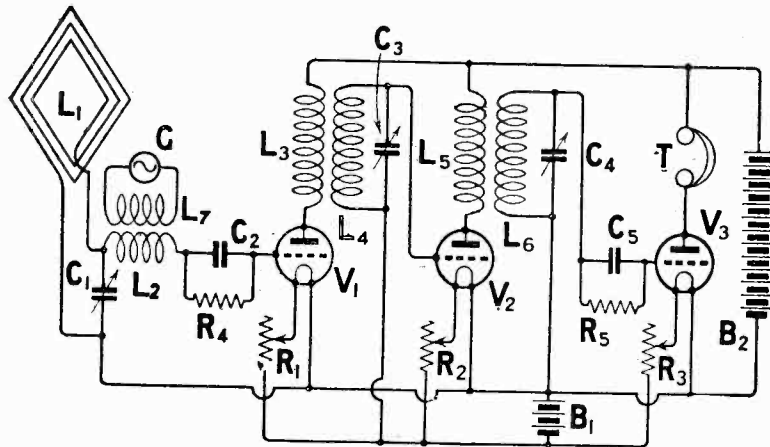


Fig. 3.—A simple supersonic receiver in which the intermediate frequency amplifier may easily oscillate.

fore, with aerial circuit attached, an adjustment of the filament of the first valve does not merely alter the operation of that valve as an amplifier, but it tends to alter the whole stability of the circuit, and does not merely alter the stability of the first valve, but also of the second.

Overcoming the Difficulty

This instability can usually be overcome by increasing the filament current of the first valve so as to increase its damping effect on the circuit $L_1 C_1$, but unless this is done within reasonable limits the filament F_1 will be overrun and its life will be shortened. It is obviously better, if it is absolutely essential, to introduce damping otherwise than by increasing the filament current.

If you wish to test out what I have just said, you have only to connect up the Fig. 1 circuit and

the long wavelengths, e.g., 6,000 to 10,000 metres. The output of the second valve V_2 carries the amplified long waves, which are then passed on to the second detector valve V_3 . An examination of this circuit will show that the valve V_2 will tend to oscillate through natural capacity coupling, since the grid circuit $L_4 C_3$ is tuned and since the anode circuit, which may really be considered as a combination of L_5 and the circuit $L_6 C_4$ are both tuned. Under these conditions a valve will readily oscillate.

Energy Absorption

In the Fig. 3 arrangement, however, although it may not at first be obvious, the valve V_1 is acting as a damper on the valve V_2 , because the coil L_3 is in the anode circuit of the first valve and L_3 is coupled to the induct-

(Concluded on page 380.)

An Easily Made Low-Loss Coil

By JOHN W. BARBER.

The trend of modern coil design is towards the reduction of dielectric material in the field, in some such manner as that described in this article.

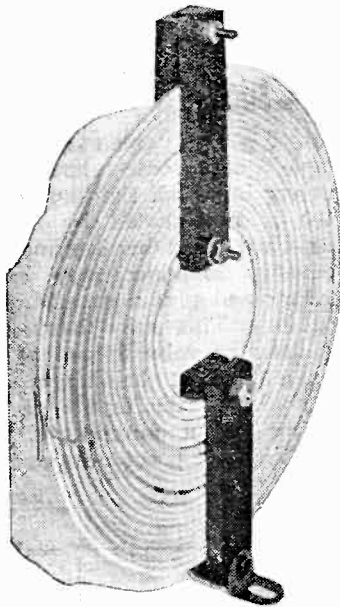


Fig. 1.—A photograph of the coil showing method in which it may be secured.

THE interest in short-wave work has brought the problem of "low loss" coils before the experimenter. Many designs have been put forward, all with some degree of success. Perhaps the most notable of the recent types of low loss coil is what is generally known as the Harris X coil, designed by Mr. Percy W. Harris, and used by him in several sets, which readers have made and found very efficient.

Dielectric

The chief point to note in a low loss coil is that there shall be as little dielectric in the field of the coil as possible; in other words, the coil should be as nearly as possible self-supporting, and on no account should such materials as shellac, varnish, or paraffin wax be used to "fix" the turns.

The above-mentioned coil suggested to the present writer a method by which it may be wound without the ebonite former, and it is the object of this article to describe the method of winding and securing the new coil.

Pancake Coil

The idea, which may be gathered from the photograph and drawing of the coil, is to develop the winding in a pancake form, merely supporting it in two

diametrically opposite positions. The first point to be decided is the number of turns required, as this will decide the number of layers.

Wavelength Range

The coil shown was intended for reception of 90-150 metre stations, when used in the secondary circuit, and contains twenty turns.

For such a coil four pieces of ebonite, 3 in. long, $\frac{1}{2}$ in. wide, and $\frac{1}{4}$ in. thick, will be required, having holes drilled near each end as shown (Fig. 2). Four bolts $\frac{3}{4}$ in. long, with nuts, will also be required, and some thin washers. Two pieces of ebonite are then fastened together at one end, with

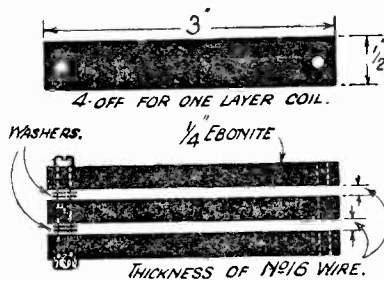


Fig. 2.—Constructional details of the ebonite supports.

just sufficient washers between to enable the wire (No. 16 gauge d.c.c.) to pass into the slot thus formed. The other two pieces of ebonite are then fastened together in the same way.

Construction

A turn of the wire is then taken round some object of about $1\frac{1}{2}$ in. diameter, and the turn secured with cotton. The two ebonite clips are then slipped on and the wire is fed on by rotating the coil, holding the latter tightly between the fingers to prevent slipping. If a helper can be obtained to hold the hank of

No. 16 wire and to revolve the same as winding is in progress, so much the better.

When the necessary number of turns has been put on a second bolt is slipped through the outer end of each ebonite clip, without any washers in between, and the whole tightened up.

This completes the coil, which is very simple to wind, although a little care is called for.

Multi-Layer Coil

If more than one layer is required, two pieces of ebonite, over and above the original number specified, will be needed for each layer after the first, drilled to correspond with the other pieces. The first layer is wound, as already described, but thin nuts must be put on, and shorter bolts in the outside holes must be temporarily used in order to allow the wire to pass into the second slot, which is formed by securing the third piece of ebonite on top of the second, as shown in the lower half of Fig. 2.

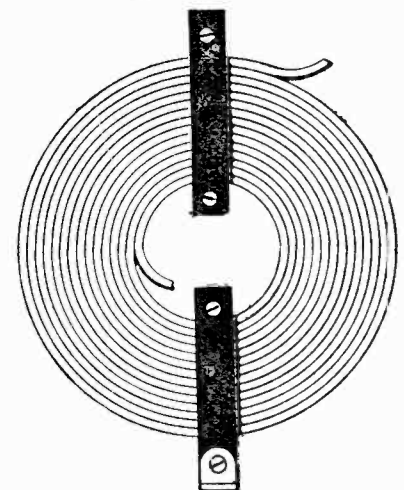


Fig. 3.—Illustrating how the coil is wound.

Securing the Coil

The end of the wire from the first coil is bent down to the centre of the coil and then wound round into the second slots, thus forming the second layer of the coil.

When the second layer is completed the temporary short bolts are removed and the longer bolts substituted, thus securing the whole coil. An improvement which somewhat simplifies the construction of a two-layer coil is to drill a clearance hole through one piece of ebonite in each clip, while a tapped hole is made in the other. When the first layer is completed, the bolt is screwed into the

clip thus securing the first layer, while after the second layer is put on the bolt may be screwed right home, tightening the whole up.

Mounting the Coil

The coil may be fastened to a base board by means of a "Meccano" angle bracket, which is held under the head of one of the outside securing bolts, a screw passing through the slot in the other arm of the bracket into the base board. The completed coil is much more rigid than one might imagine at first sight, and when screwed to a base as above is quite secure.

□ □ □

A GOOD finish may be given to cabinets in the following manner. After the cabinet has been perfectly finished with sandpaper, prepare some plaster of paris by mixing with water to a paste. Rub this well into the wood across the grain. This acts as a grain filler. In many cabinets sold, especially oak ones, this operation has been over-

Finishing Wood Cabinets

looked. When the plaster is quite dry, sandpaper the box again. It will be seen that the grain is filled, giving a perfectly smooth finish and at the same time enhancing the natural beauty of the lines which the grain of the wood takes. Now

treat the box by quickly applying a coat of spirit stain with a soft brush or rag. When perfectly dry, give the box a coat of beeswax dissolved in turpentine. This mixture should take the form of paste similar to floor polish. Pure beeswax should be procured. The object of this operation is to prevent the wood absorbing the spirit varnish, which is to be next applied. This should be done quickly with a camel-hair brush. The brush should not be applied over the same ground more than once if possible. The spirit varnish may give a better finish if thinned down slightly with a little methylated spirit.

H. B. W.

Keeping Terminals Bright

A SIMPLE method of inducing terminals to retain their original lustre is to give them a thin coat of spirit or shellac varnish, care being taken not to apply the varnish on the contact faces of the terminals. The varnish is best applied with a small camel-hair brush, the brush being cleaned in methylated spirits when finished with.

D. O.



Our photograph shows the aerial at the Post Office station at Devizes, call-sign GKU, which communicates direct with Switzerland in addition to ships at sea.

Representatives Wanted

RADIO PRESS, LIMITED, desire to appoint a number of Resident Sales Representatives, one in the vicinity of each main broadcasting station. Applications are invited from young men of business ability and initiative, possessing some knowledge of wireless. Applications should be made by letter, stating age, previous experience and salary required, addressed to Sales Manager, Radio Press, Limited, Bush House, Strand, W.C.2.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

Some Notes of general interest to the Home Constructor and Experimenter.

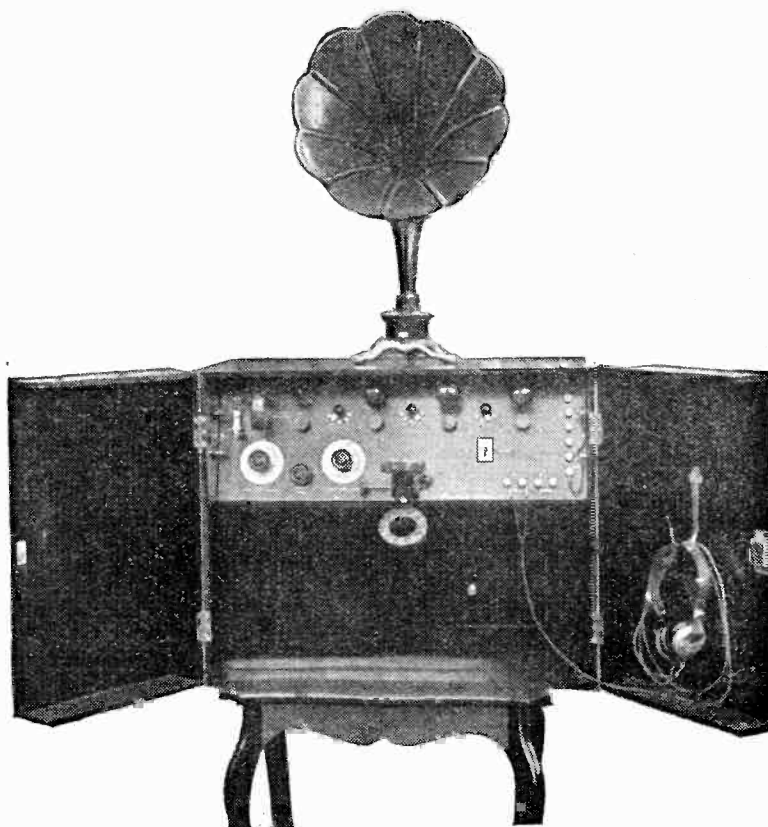
I OFTEN think that a very amusing article could be written on the various types of experimenters. They are all very interesting, and as I have a very large post bag, I receive at least two or three letters from each kind every morning. There is, for example, the man who seems to make every set described, and who, for some inexplicable reason, seems to want some important point in the design altered for his especial benefit. If I publish a design with two stages of transformer coupled amplification, he immediately writes for a diagram showing one transformer and one resistance coupling. If I follow this up next month with a design showing a transformer and a resistance coupling, he immediately wants both transformers again. If, after much burning of midnight oil, I manage to evolve a set on a panel measuring, say, 24 in. by 10 in., our friend will write and suggest that we give him a new wiring diagram on a panel measuring 15 in. by 15 in., and "while you are at it, will you please introduce switches to cut in or out any or all of the valves?"

Then we have our dear old friend the "Constant Reader." We all love "constant reader," whose constancy invariably consists in reading two complete issues and none before that, for he is always asking questions on matters which have been fully dealt with not more than two or three months before the time of writing.

Two other "regulars" are the man who hastens to congratulate you on what you have done, as he has done it also himself at least two years before (and so can verify what you say), and the man who never seems to get the simplest set right. I don't mind the first kind, but the second is a constant source of

worry. He will write you three pages of foolscap explaining that he has followed your article carefully in every detail, and has used the best quality components throughout. He has tested everything, all the local experts have been called in; he is quite sure

vital changes in the design and the alleged "high-grade components" were very frequently shoddy and nameless parts of the lowest possible quality. In addition, there were generally at least half a dozen glaring faults immediately obvious on turning



The handsome "Four Valve Family Receiver" made by Mr. Anspach from Radio Press Envelope No. 2.

you are wrong, and he considers that you have caused him to waste five or ten pounds' worth of apparatus. When I began to write constructional articles and when my morning post was of such a size that I could give personal answers to everyone, I used to conduct quite a deal of correspondence with such people and, in many cases, arranged to have the set sent to my house. I soon found that two out of three of these people had made

over the panel. I remember in particular one ST100 set supposed to be made to my design in which basket coils had been used. These coils were wound with thin enamelled wire on metal hatpins which had been cut off short. Naturally, about every other turn was short-circuited on to the hatpins. The intervalve transformers had cost under 10s. each, the filament resistances were of the variety that when on the alleged "off" position,

would frequently throw the full accumulator voltage on to the valves, with dire results, while the whole of the underside of the panel was so thickly smeared with soldering flux and dirt that it took me about an hour to clean it up. The disposition of the parts on the panel, the method of wiring, and even the terminal arrangements, were different, and incidentally, not a single component in the whole outfit was one which I had ever used in a constructional article of any kind. (Having a sense of responsibility to the public I would not have used any of them at any time.)

The reason I asked that this set should be sent to me was that the man stated that it had been made exactly to my design and would not work after having been tested by a number of experts. Nowadays, of course, we have a

□ □ □

THE ST100

SIR,—Just a word of appreciation of your wonderful ST100 circuit. I made this set up some time ago and have had more than satisfaction out of it. I have received all the B.B.C. stations at good 'phone strength (Belfast excepted, so far) and also many Continental stations.

On Wednesday, December 3, I fixed a Vernier condenser across the anode condenser and started knob turning just before 12 midnight. Imagine my surprise to hear a real live Yankee voice giving out market quotations. I hung on like a leech and got it almost crystal clear and found it was WBZ calling. The following is the programme received up to one minute past one, when I packed up, although it was still coming through with perfect clarity and good strength.

WBZ, Wednesday, December 3—Thursday, December 4.

12 midnight.—Market quotations.

12.4.—Lady giving bed-time story about "Old Man Kiobe."

12.12.—Above lady introduces a Mr. Burgess, who spoke to the kiddies until 12.24 on the subject of whales, their habits, weight (130 tons), length (103 ft.), etc. (This was clear enough to be able to take down verbatim had I known shorthand.)

12.32.—Orchestra (perfect).

12.52.—Baritone, accompanied by Mrs. Helen Fowler (intermittent fading).

13.1.—Same baritone singing "Aria," by Handel, accompanied by Mrs. Helen Fowler.

I tried at midnight on Thursday, December 4, and again picked it up with ease.

special Service Department which devotes itself to helping readers out of such difficulties.

If I were awarding prizes for "nerve" I think this week's prize would go to an unknown lady who rang me up one night recently and asked me to tell her what was wrong with her set. She did not know the name of it, or the circuit; she admitted that it had not been made from any of my own designs, and she had no technical knowledge of the subject whatever. The facts were that the set had suddenly failed, and she was particularly anxious that her friends who had come in should hear the music.

Fortunately, however, the majority of letters I receive are of quite a different nature. I value them greatly for the reports of results they bring, and give me a great deal of helpful information. It is always a great

pleasure for a constructional writer to receive reports on sets made from his designs, and the more detailed the reports the more helpful they are. My only regret is that I cannot reply to all these letters individually. Editorial duties take up the whole of the day; research work and the designing and making of sets and the writing of articles upon them, takes most of the evening.

* * *

It is the custom in some newspapers to end up a page such as this with a little anecdote. How do you like this one?

CUSTOMER: "I want a good interval transformer. It must be one of those new ones with extremely low self capacity."

ASSISTANT: "Yes, sir. Anything else?"

CUSTOMER: "Oh, yes! I want a .002 μ F condenser to shunt across the primary."

Readers' Results with Radio Press Envelope Sets

On Saturday night, December 6, I picked it up soon after twelve, and heard the announcer say he was standing off until 7.30 (American time). Not knowing quite what time that would be, I went to bed.

The components used in the set were exactly as stated in your Radio Press Envelope No. 1.

To be able to pick up WBZ with ease on the only three nights I have yet tried and get it at good 'phone strength speaks wonders for this ST100 set.—Yours faithfully,

C. W. BLAKE.

London, N.22.

THE SIMPLICITY 3-VALVE RECEIVER

SIR,—I have just completed a "Simplicity" 3-valve set from instructions in your Radio Press Envelope No. 3, by G. P. Kendall, B.Sc., and you will no doubt be interested to hear the results of my first tests, which were made on the night of December 4.

I first tuned in London and connected up my Sterling "Audivox" loud-speaker, obtaining quite a good volume of sound. I then thought I would make some long-distance tests, and found I could tune in all B.B.C. main stations, Paris and Berlin. Although I am eight miles from 2LO, I was able to get all stations except Cardiff and Manchester without interference from London, and not using a wave

trap. Using larger coils, Chelmsford was as loud as 2LO, and I was able to pick up Radio-Paris, but could not cut out Chelmsford.

After the London station closed down I tuned in Madrid on 392 metres, and it came through with surprising strength. At 11.30 p.m. I turned the condenser about 12 degrees below the Madrid position, and was surprised to hear a voice saying WGY, New York. While making adjustments to improve signal strength I lost it, but after ten minutes picked it up again. There was a play in progress, and I listened to this until 2.45 a.m., when the station closed down, the announcer saying: "This concludes the transmission from WGY and WJY relayed from WIP. We are now closing down until 11.40. Please stand by till 11.40."

The coils used were 40-turn aerial, 75 reaction. They are self-made honeycomb coils. The variable condenser is built up from bought parts, and the anode coil also self-wound. The results have exceeded all my expectations, and I think it is an ideal set for a beginner, as it is so simple to tune.

I am at present using the ST100 with additional H.F. valve described by Mr. John Scott-Taggart in the June issue of *Modern Wireless* with splendid results.—Yours faithfully,

W. PALLANT.

West Ham, E.15.

Some Neutrodyne Notes

By JOHN UNDERDOWN.

Some interesting practical details, experimentally obtained, are here given in view of the prevailing interest in this excellent method of stabilising.

THIS type of stabilisation of high-frequency valves is becoming increasingly popular in this country where lightly-damped selective long-range sets are concerned.

Where range is the main objective of the experimenter, it becomes increasingly necessary to get maximum amplification from high-frequency valves, and

possible. Another method of stabilising is to provide series or parallel stabilising resistances in either grid or anode circuit. This tends to flatten the tuning, and to a certain extent reduces the build-up of signal-strength.

Reason for the Neutrodyne

The failings of the two above methods are responsible for the

the valve. One method is illustrated in Fig. 1. This is a practical circuit in which $L_1 L_2$ is a loosely-coupled circuit followed by a high-frequency amplifier V_1 and a detector valve V_2 . $L_4 C_4$ is the tuned anode circuit of V_1 , and the coil L_3 coupled to it is the neutrodyne coil. The function of this latter coil and its small attendant condenser C_3 is to apply equal and opposite voltages to those set up across the grid to plate internal capacity of the valve V_1 , and thus neutralise the latter unwanted capacity. By suitably choosing the direction of winding of L_3 , a phase reversal is effected and balance obtained by adjusting the very small variable condenser C_3 .

The Use of H.F. Transformers

Once this balance is obtained, it should hold constant for the band of wavelengths over which the anode coil L_4 will tune with its condenser C_4 . In this circuit it has been found in practice that the windings of certain makes of high-frequency transformers act admirably, one winding as the tuned anode coil and

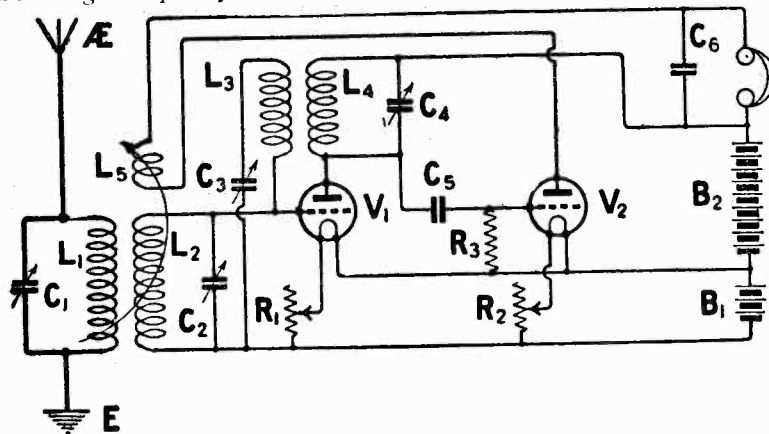


Fig. 1.—A selective neutrodyne arrangement which can be recommended for long range work.

also a high degree of selectivity so that the desired distant transmission is not swamped by a closer and more powerful station. A loosely-coupled circuit at once suggests itself, but with this and even one high-frequency valve, the set, if of efficient design, at once becomes so unstable as to be unmanageable. A number of methods of gaining stability at the expense of maximum amplification may be used, as, for example, the potentiometer method, whereby the valve is worked at a sufficiently positive potential to obviate the bugbear of self-oscillation. This introduces a certain amount of grid current, which for maximum amplification and purity of reproduction should be avoided if

introduction of the neutrodyne method of stabilisation, which strikes at the root of the inherent

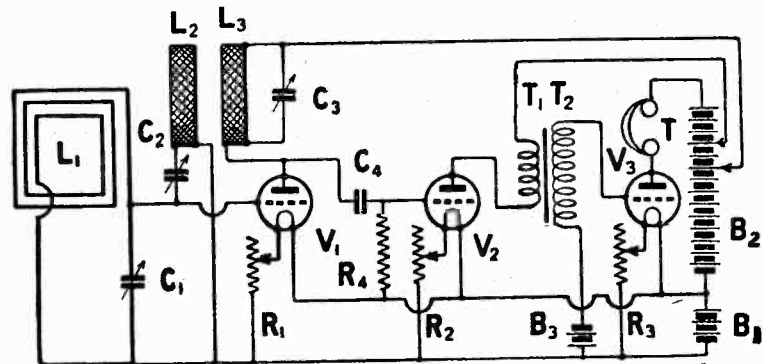


Fig. 2.—The neutrodyne method is particularly effective with a frame aerial as shown.

cause of self-oscillation in high-frequency amplifiers, namely, the plate to grid internal capacity of

the other as the neutrodyne coil. The connections can only be found by trial and error, but this

is quite simple. One winding is chosen as the anode coil and the other used for the neutrodyne circuit. With the aerial completely disconnected and no coil inserted, and the reaction coil L_5 short-circuited, the condenser C_3 is adjusted with C_2 set at some intermediate position, say 20 deg., whilst C_2 is slowly rotated. The grid of V_1 should be tapped, and oscillation will announce its presence by loud "plonks" in the 'phones over certain degrees on the scale of C_2 . With a certain adjustment of C_3 it should be impossible to obtain oscillation with any setting of C_2 . If this condition is not attained, reverse the connection to the neutrodyne coil L_3 , when a point at which complete stability is reached should be obtained.

Magnetic Reaction

Once this condition is satisfied it is usually better to leave C_3 set and to introduce deliberate magnetic reaction by means of a small coil L_5 in the plate circuit of the detector valve V_2 , coupled to the secondary coil in a three-coil holder. In practice this circuit has been found to be remarkably efficient and selective, it being possible to work with extremely loose coupling, with a consequent gain in the latter desirable condition.

The Broadcast Wavelengths

The transformers used should preferably be of the slotted type, where primary and secondary windings are not wound in the same slot. A rather curious effect is noticeable in that the ordinary 300 to 600-metre type, with a .0003 μ F condenser across the secondary, will only tune down to about 350 metres, using one high-frequency stage, whilst with two stages I have found it difficult to get down to the London station wavelength to obtain definite tuning on either side of the wavelength desired. A number of enterprising manufacturers are, however, now placing specially low-minimum types on the market, suited to this class of circuit. The neutrodyne condensers, primarily designed for use with plug-in coils, might with advantage be made with a somewhat higher maximum capacity for use with plug-in transformers in this circuit, various ordinary 2-plate

vernier-type condensers will serve admirably.

American Broadcasting

With the arrangement of Fig. 1, American broadcasting may easily be received under favourable conditions, and I have at times received this on a good aerial at strength quite equal to that of the distant British stations.

Frame Aerials

The principle is particularly adapted to the use of frame aerial reception for directional working, where it is desired to eliminate interference, or where any other type of aerial is not possible. In this case reaction is most conveniently obtained by slightly upsetting the adjustment of the neutrodyne condenser and eliminating any reaction coil. A circuit with which I have been particularly successful is seen in Fig. 2. L_1 in this case was a very useful portable frame aerial of commercial make, hexagonal in shape and about four feet across the diagonals, tuned by a variable condenser C_1 of .00025 μ F. Instead of the H.F. transformer, as in Fig. 1, two coils of low self-capacity were used as neutrodyne and anode coils. These were plugged in side by side with about $\frac{1}{8}$ in. separating them, the coupling being fixed at this value. C_2 is a standard neutrodyne condenser, whilst C_3 is of .00025 μ F.

Loud-Speaker Results

With this arrangement excellent

results were obtained, London at 12 miles giving quite good loud-speaker strength for an average room, whilst on the 'phones a number of distant stations, among them several German, were of excellent strength. Coils of low self-capacity are advised here. With a set made by a friend, a curious result was obtained by using coils of high self-capacity due to the method of winding and impregnation used.

Coils

This set, though wired exactly as mine, was found not to be constant in adjustment. If the neutrodyne circuit was set as previously explained as with the Fig. 1 circuit, this setting did not give stability over the whole range of the coil L_3 with its condenser C_3 . If for the example the set was neutralised with the anode condenser C_3 at, say, 20 deg., complete stability would be obtained except for a small band of a few degrees higher on the scale of C_1 . From this it was deduced that probably the coils were the offenders, and on substituting others of known low self-capacity, this was proved to be the case, since perfect stability was obtained when the change was made. Finally it was found that the coupling between L_2 and L_3 had to be reduced to about 45 deg. before one setting of C_2 stabilised the set over the whole range of L_3 , using these latter coils.



Our photograph shows the members of the Camden Town Wireless Society with Capt. Ian Fraser, M.P., in the centre chair.

A New High-Frequency Amplification Circuit

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

THE highly-specialised type of receiver described here was developed by the writer for the specific purpose of receiving very long-distance telephony through the usual Morse jamming and atmospherics, etc., with reasonable certainty and, under average circumstances, at loud-speaker strength. The best available aerial was to be used in conjunction with it. It is not a regular broadcast receiver, and those who have had no other than crystal experience would be ill-advised to attempt this for their first valve receiver.

Selectivity

For such reception, two principles must be borne in mind: First, extreme selectivity, so as

to cut out, as it were, a very narrow slice of the resounding ether for closer examination (just as a biologist's microtome cuts a very narrow section of a specimen for examination in detail under the microscope), and thereby avoiding that jamming by Morse and general mush, etc., which is, to a large extent, the limiting factor in distant reception; and, second, to obtain the highest available degree of high-frequency amplification without lowering the standard of selectivity or introducing "valveospherics" to an unbearable extent. An efficient silent audio-frequency amplification up to loud-speaker strength is also required; this must have as few valves as possible, i.e., a high

amplification per stage, as few other than the engineers of the broadcasting authorities are in a situation to use valves lavishly, and still retain the essential silent background.

Loose Coupling

The first condition is not difficult to comply with, if properly-designed low-resistance circuits are used, and the principle of *fixed* very loose coupling (by the use of only two turns actually close-coupled with the aerial circuit at the earth end of the A.T.I. included in the secondary circuit) applied with very satisfactory results in an extremely selective tuning unit, described by the writer in *Wireless Weekly* about a year ago, and recently revived elsewhere. But with none of the various high-frequency amplifying circuits and coupling devices with which the writer has experimented, or has been able to devise, is a really *high* degree of amplification attained (apart from the effects of reaction introduced by tuned anode circuits, which

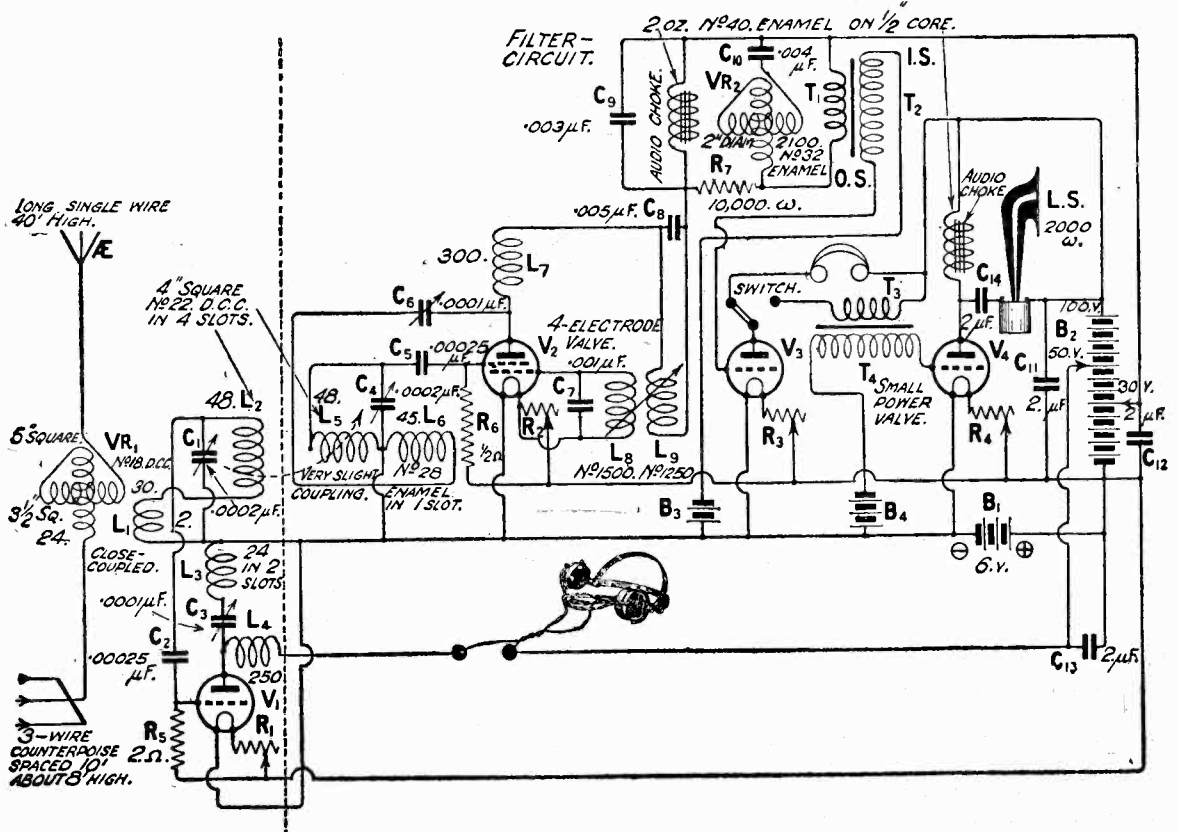


Fig. 1.—Circuit diagram of Mr. Cowper's arrangement, all values being shown.

effects would in any case be utilised in an efficient receiver), even in the first stage, as shown by actual measurement of signal-voltages obtained.

Super-regeneration

However, by utilising the principle of super-regeneration the problem can be solved, whilst retaining a fair degree of selectivity here. The popularity of the Armstrong "Super" was brief, largely on account of the extravagant claims made by those who first introduced it to public notice, and the unstable and fickle form of the earlier circuits published. Actually, it has its applications of real utility: this is one example, where extreme H.F. amplification of a feeble signal is required, with but little complication in the way of tuning difficulties, and with the minimum number of valves. The type used here is a version which utilises a four-electrode valve, the particular circuit having been described recently by the writer for use with short waves. As an external collector of signal-energy is to be used, the most extreme amplification is not sought, so that the quenching-frequency oscillation is set at a very high audio-rate, in place of the more usual 8,000-10,000 cycles which is generally demanded for stability. The four-electrode valve circuit is so very stable, when once set up, that this becomes possible. An effective filter-circuit of the usual "acceptor" type, isolated to some extent by a 10,000-ohm resistance, guards against any appreciable disturbance or distress that might be caused by the high-pitched whistle. This is barely audible in the loud-speaker, and quite merged in any signals which may be received, in the instrument constructed by the writer.

Reaction

With extremely loose coupling to the A.T.I. of a loose-coupled single-valve receiver using finely-controlled Reinartz type of reaction, such a four-electrode valve super-regenerative amplifier actually gives a high degree of amplification with the use of only

In this article Mr. Cowper describes a receiver which he developed for the reception of long distance telephony at loud-speaker strength, with the added attraction of extreme selectivity.

one additional tuning control—and that not so fine that searching (over the narrow belt isolated by the aerial-tuning device and receiver) is rendered impracticable on account of the natural rather flat tuning of any super-regenerative receiver. The tuning-inductances are put practically at right angles to one another, so slight is the coupling required to hand on enough energy for the super-regenerative operation to respond effectively, most of the coupling being of the "casual" description. This point would lead the writer to condemn the circuit as unscientific and unreproducible, but for the fact that the exact amount of casual coupling is not critical, and the actual coupling is, in practice, adjusted by experiment, once for all in the first try-out of the receiver.

Practical Details

The modus operandi is then briefly as follows. A high, low-resistance aerial is used, actually all of 100 feet long and some 40

wound round the stator of this variometer, at the "earth" end, and provide the entire coupling to the latter receiver, the inductances being arranged far apart and at an angle of minimum magnetic coupling. By the use of finely-controlled Reinartz type of reaction in this receiver, and a tuning-inductance of low-loss, i.e., of a fair gauge of wire and air-spaced coils (Harris "frame-aerial" type), this secondary circuit is made of extreme selectivity. This combination gives the narrow slice of the wave-length belt for further examination by the other part of the receiver. The required signal is tuned in on this single-valve receiver, after setting the secondary to the desired wave-length by the wave-meter as usual, and adjusting the aerial variometer to resonance by finding the position of maximum reaction-demand for bare oscillation; then reaction is reduced to a safe amount, and the second part of the receiver is brought

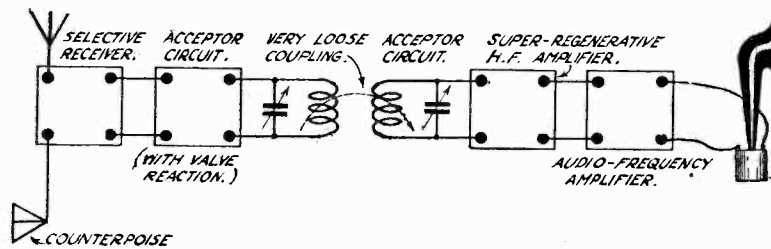


Fig. 2.—An elementary illustration showing the principle of the circuit.

feet high in the author's trials, with a counterpoise earth (of "Electron" wire) shielding any rough ground, bushes, etc., which probably give high-resistance "earth" paths, stretched under it. A large low-loss air-core variometer of thick wire tunes this aerial so sharply that actually a fine-adjustment handle is called for. Two turns of wire included in the grid-tuning circuit of a single-valve receiver are

into play. Any distant signal that is going to give intelligible telephony will be, at least, just audible as a faint heterodyne squeal in the first pair of phones at this preliminary stage, but in general will disappear entirely when reaction is safely relaxed.

Howling

The super-regenerative portion is then set in operation, and tuned to resonance with the secondary circuit, using either

pair of phones; and its reaction device adjusted to a point just below the customary howling-point in "supers" where super-regeneration is at its maximum. The signs of resonance are unmistakable. It may be necessary still further to reduce the reaction on the first valve at this point, if howling starts too easily.

Searching

Then search is carried on across the narrow belt thus isolated, with the super, until the signals come up steadily. On switching in the extra audio-frequency stage, loud-speaking results should be obtained from any reasonable signals. With 9 in. extension handles on the two main tuning condenser handles, extra fine-adjustment condensers in addition to the 0.0002 μ F variables indicated are not called for, and hand-effects are entirely obviated. The wave-length range is from about 300 to 550 metres, with the dimensions as shown, and with small tuning condensers the scale is nearly linear. In practice, all really fine tuning is done on the one handle: the secondary tuning condenser.

Constructional Data

As any experimenter who is sufficiently competent to be at all likely to get much satisfaction from such a complex circuit will undoubtedly have his own ideas as to arrangement and detailed construction, only the bare necessary technical constructional data are given here. The receiver was actually arranged on a large polished base-board 1 ft. by 3 ft., the filament resistance and vertical panel 5 in. by 12 in. carrying the four controlling condensers being at the front edge, the four valve-holders with grid-condensers, etc., along the middle, and the oscillator coils, oscillator filter-circuit, L.F. transformers, blocking-condensers, and terminal-strips along the back edge.

Radio-choke

The one radio-choke was a No. 250 plug-in coil standing in the middle of the board, the other a narrow slab-coil mounted on the reaction-condenser itself. There was a space at the L.F. end, behind the panel where the frame-aerial coils stood, mutually at right angles. The A.T.I. variometer was mounted in a separate

box, as also was the filter for the loud-speaker, though the switching gear was on the board.

Wiring

Wiring was done mainly with square bus-bar, and arranged to minimise casual couplings. The oscillator coils were a No. 1,500 and No. 1,250 Igranic, mounted in a Grafton Electric Co.'s two-coil holder, fixed in a tripod of Meccano strip to carry the heavy coils. These were coupled at about $\frac{1}{4}$ in. between faces and with centres $1\frac{1}{2}$ in. eccentric, for best results with the particular valve used, a four-electrode valve obtained from Messrs. Leslie Dixon & Co. The fixed condensers were the plug-in Grafton type; grid-leaks Grafton and Dubilier; all variable condensers

the low-loss and low-minimum Jackson Bros., with ebonite end-plates. The filter-circuit variometer consisted simply of two home-made lattice-type coils of a total of 2,100 turns, 2 in. outside diameter, mounted so as to slide across one another for rough tuning. The 3-electrode valves used were a Penton low-consumption for the first, a D.E.5B. for the third, and a B.T.H.B.7 for the last stage of L.F., where some power is developed. The loud-speaker was a Grafton. The first L.F. transformer was a Pye No. 1; the second a nameless low-ratio one of doubtful antecedents, but of excellent performance here. A finely-tapped H.T. battery is essential with this super-circuit. Until this latter has been got to a



No doubt many of our readers will have heard the broadcasting by the ss. "Leviathan." Our photograph shows some of her apparatus, with the chief operator in attendance.

stage of efficiency where the local broadcast can be picked up on a "capacity" aerial at moderate loud-speaker strength on the two middle valves alone, at 35 to 40 miles in a place not unduly screened, it is useless to proceed further with the elaborate circuit, as a 3-valve straight O-V-2 receiver would give better results.

Results

Exigencies of time and space prevented the completion and real try-out of this receiver before 3.45 a.m. of November 28, though in a preliminary trial of an earlier version, where a stage of H.F. amplification by the writer's "neutral grid" method was attempted before the super stage, a transmission from Hamburg at about 2 a.m. was picked up at good strength on short earth-lead alone with three valves.

American Stations

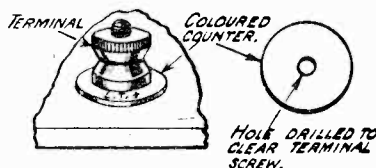
At 3.50 a.m. on the 28th, with the final receiver, KDKA's wave (326 m.) came in, and at 3.54 WBZ's (Springfield, Mass., 337 m.) was heard; both too slight to stop then to resolve them; at 3.58 music was coming from the loud-speaker in merry style, from WEBH (Chicago, 370 m.); at 4 a.m. precisely WGY (Schenectady, 380 m.) was being analysed when Madrid (about 390 m.) came in with a bang with a loud band, and announced the end of the Transatlantic test for that morning. During the next hour Continental stations between 400 and 435 m. were heard readily, though there was much heterodyne interference between them around 410-420 m.; and a persistent call on 430 m. "C.Q. de S.A." in slow C.W. gave trouble. PTT on about 465 m. came in at excellent L.S. strength, with a selection from "Carmen" at 4.30; and from 4.37 to 5 a.m. Zurich on 500 m. gave good entertainment on the loud-speaker with piano and concertina. At precisely 5 a.m. a muffled voice in the middle of a bad heterodyne around 425 m. gave—"station calling, ?H (or some other letter) AC—" and "good night." (Rome, Berlin, and two other German stations, as well as CKAC, Montreal, 425 m., and Calgary, CFAC, 430 m., are all around here.) This was

with the high aerial in Essex. The same evening, on the low 70 foot test aerial, of poor efficiency, Aberdeen (with all the rest of the main B.B.C. stations) came in with great steadiness; and the Nottingham relay station at the end of the evening on the loud-speaker. Even in the welter of

flat-tuned Morse on 450 metres Leipzig (452 m.) was recognizable, and loud-speaker results were obtained on the big aerial from one of the two relay stations, Plymouth and Hull, now nominally on the same wavelength, 335 m., in spite of the heterodyne squeal between them.

Terminal Tags

TERMINAL tags may be easily made from cardboard or celluloid counters which may be purchased cheaply from



any dealer. The counters chosen should be larger in diameter than the external diameter of the terminals. Those sold in assorted colours would be useful for recognising at a glance the negative and positive terminals, etc. All that is necessary is to drill a hole to clear the terminal screw in the centre of each counter, and secure the counters between the panel and the ter-

minal, as shown in the diagram, the lettering being printed round the counter in Indian ink.

City of London Phono-graph and Radio Society

At our meeting on November 27 we were particularly fortunate in having a lecture and demonstration by Mr. Percy W. Harris, who brought along his "Puriflex" receiver. Mr. Harris stated he was very glad to have an opportunity of demonstrating this receiver to a Society whose members were all critical students of sound reproduction.

The merits of the "Puriflex" which embodies resistance-coupling were fully explained, and a crowded meeting showed their appreciation of the circuit by the applause and hearty vote of thanks which they accorded to Mr. Harris. In responding, the latter paid tribute to the Allison loud-speaker, which was provided by the designer, our Vice-President.

MUSICAL COMEDY NIGHT



Reading left to right Messrs. Kingsley Lark, L. Stanton Jefferies, Frank Cochrane and Rex. Burchell who broadcast recently from 2LO.

A Useful Four-Way Switch

A USEFUL four-way rotating switch which may be put to several uses, may be easily constructed as described in this article. A diagram of the complete switch is shown in Fig. 1. The material required for construction will be as follows:—One piece of ebonite, 3 in. sq. by 3/16 in. thick, for the panel, or, if the switch is mounted on the panel of an existing receiver, this will not be required. One piece of ebonite, 2 in. in diameter by 1/4 in. thick, one small ebonite knob, some strip brass, 2 B.A. rod, four 6 B.A. countersunk screws and nuts. First construct the panel as shown in Fig. 2. Twelve holes are drilled equally spaced on the circumference of a 1 1/2 in.

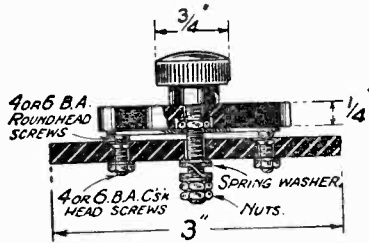


Fig. 1.—The arrangement of the complete switch.

circle. These holes should clear the size of B.A. screws used, which should be either 4 or 6 B.A. They should also be carefully countersunk to allow the head of the screw, when inserted, to be about 1/64 in. below the surface of the panel. The centre hole is drilled to clear 2 B.A. rod.

Constructional Details

Next make the circular switch piece as shown in Fig. 3. Cut out a piece of 1/4-in. ebonite, 2 in. square, and round off with a series of saw cuts, finishing on sandpaper, or if a fret-saw is available, the circular disc may be cut out more easily. Drill four holes spaced equally on the circumference of a 1 1/2-in. radius circle, and tap to suit 4 or 6 B.A. screws. Recess the centre hole on one side to the depth of 1/8 in., the diameter being large enough to receive a 2 B.A. lock nut. Assemble the switch in the following manner:—Cut off a short length of 2 B.A. rod, and pass through the centre hole in

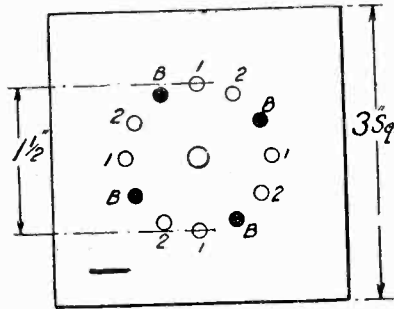


Fig. 2.—Shows the dimensions and marking out of the panel.

the ebonite circular disc. On that side of the disc, which is not recessed, secure a small 2 B.A. bushed ebonite knob. Secure firmly by means of a nut which is screwed on to the other side of the 2 B.A. into the recessed portion of the centre hole. Cut two brass strips, as

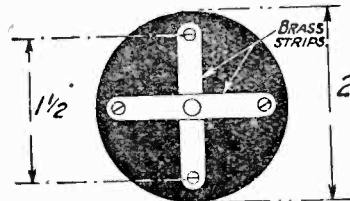


Fig. 3.—Details of the circular switch piece.

indicated in Fig. 3. These may be 1/2 in. wide by 2 in. long, each having three holes drilled, two of the holes having 1 1/2 in. centres and clearing 4 or 6 B.A. screws, and the centre hole clearing 2 B.A. rod. Secure these to the ebonite disc, as shown, by means of the B.A. round-head screws.

Adjustment

Next equip the panel by assembling

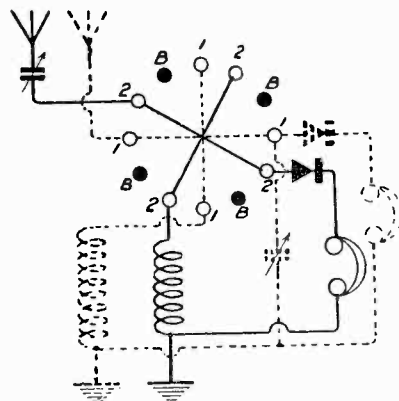


Fig. 4.—A circuit diagram for using the switch in comparing two circuits.

thereon the twelve countersunk B.A. screws and nuts. Adjust completed disc on the panel by passing the 2 B.A. rod through the centre hole and securing on the underside of the panel by means of a washer, spring washer, washer, nut and lock nut. These should be screwed down to a sufficient tension to produce a firm contact between the round screw-heads and the countersunk screw-heads. This completes the construction of the switch, which may be utilised in several ways. One suggestion is shown in Fig. 4. In this case it is employed to compare instantaneously the respective merits of two different circuits, each provided with a different detector. The full lines indicate a circuit having a vari-

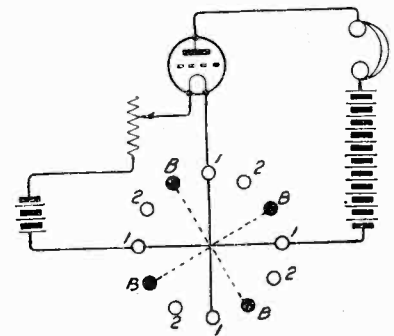


Fig. 5.—Using the unit as a battery switch.

able condenser in series with the aerial, the points of connection being on studs numbered 2. The dotted lines indicate a circuit having a variable condenser in parallel with the aerial tuning inductance, the points of connection being on studs numbered 1. These two circuits may either be tested for comparison of results, or employed for immediate change-over from short- to long-wave reception. The four studs marked B act as blanks for complete disconnection. Several detectors or crystals may be instantaneously compared by means of this switch, or different types of inductances, or the merits of two similar components of equal value, such as condensers. A method of employing the unit as a battery switch is shown in Fig. 5. In this case the filament positive, the L.T. positive, and the H.T. negative are connected to studs numbered 1 in the order shown.

D. O.

A Novel Switching Device

A NEW switching device is shown in the accompanying diagrams. In Fig. 1 the complete switch is shown. The construction is quite simple, all that is required being some ebonite strip, $\frac{3}{8}$ in. wide by $\frac{3}{16}$ in. or $\frac{1}{4}$ in. thick, some springy strip brass, four small

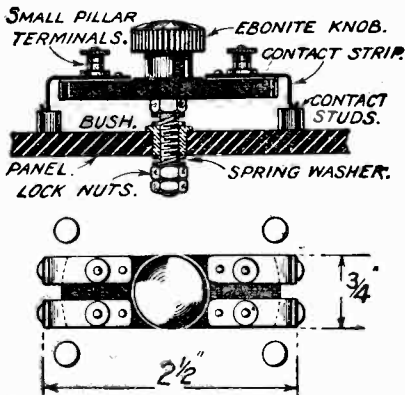


Fig. 1.—Illustrating the make-up of the switch.

pillar terminals, and eight contact studs. First cut a piece of ebonite, as shown in Fig. 2, the ends being finished to $1\frac{1}{8}$ in. radius. Four holes are drilled to clear the screws of the small pillar terminals and four further holes to clear small rivets or 6 B.A. screws. A centre hole is drilled to clear a 2 B.A. spindle. Next cut four pieces of springy strip brass to the dimensions shown in Fig. 3. Drill one hole in each to clear the small pillar terminals and the other hole to

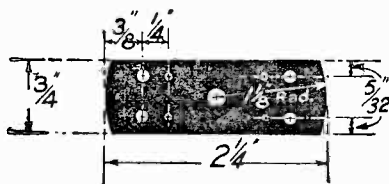


Fig. 2.—Constructional details of the ebonite bridge.

clear a rivet, or 6 B.A. screw, as before. Bend the four brass pieces in the manner shown, and assemble to the ebonite piece by means of the terminals and screws. Now assemble the contact studs to the panel on a $1\frac{1}{4}$ in. radius, spaced $\frac{3}{8}$ in. apart, and drill a centre hole in the panel to make a tight fit for a 2 B.A. clearing bush. A short length of 2 B.A. rod is passed

through the centre hole of the ebonite piece of the switch and secured by means of a small ebonite knob on one side, and a lock nut on the other. Pass the other end of the 2 B.A. rod through the bush in the panel, having first interposed a spring washer. Place a further spring washer over the rod on the underside of the panel, and secure by means of a nut and lock nut, screwing the nuts down until a suitable pressure is brought to bear between the brass pieces and the contact studs. In Fig. 4, various methods of using the switch are shown. Example 1 shows the switch terminal linked

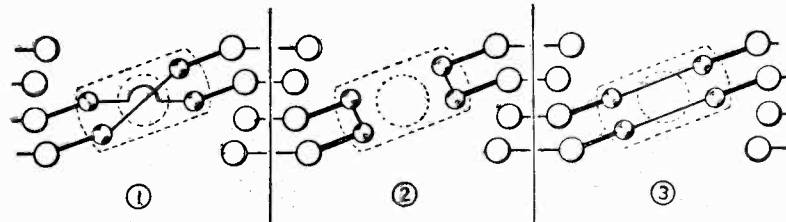


Fig. 4.—Three possible connections with the switch.

crosswise by means of short flexible leads. Example 2 shows independent connections on each

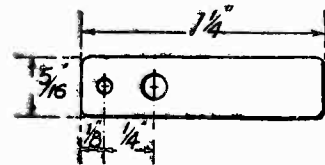


Fig. 3.—The brass contact runners.

side of the switch, and Example 3 shows the terminals connected across. It will be seen at a glance to what a myriad of purposes a switch, such as has been described, may be put, and the idea constructed as an independent unit would provide an endless source of uses for the experimenter who is continuously trying out new circuits.

H. B.

How to Make Your Aerial Joints

THE joint here illustrated is useful for attaching stranded wire aerials or guy-ropes to their insulators, etc. Although quite simple to make it is extremely strong, and gives the job a neat professional appearance.

The end of the wire is untwisted for three or four inches and threaded through the insulator.

One strand is then separated from the rest, see Fig. 1, and

continued close to the first, and so on until all the strands have been used.



Fig. 2.—The finished joint will be neat in appearance.

The finished joint is shown in Fig. 2.

R. J. B.

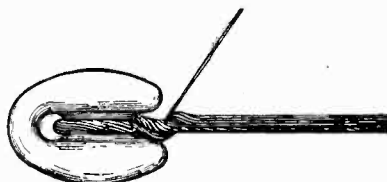


Fig. 1.—Showing how the single strand is separated.

commencing near the insulator is wound tightly round the rest with coils touching. A second strand is then selected and the winding

**A SIX VALVE
RECEIVER WITH
THREE STAGES OF
NEUTRODYNED
HIGH FREQUENCY**

By Percy W. Harris.

See the Christmas Number of
"THE
WIRELESS CONSTRUCTOR"
Now on Sale.

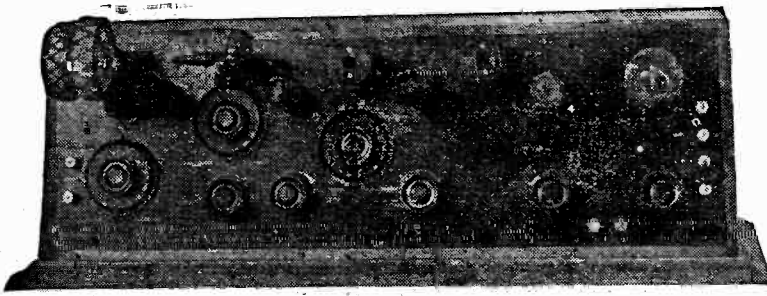


Fig. 1.—The compact and handsome appearance of the receiver is shown in this photograph.

THE receiver which I regard as the most suitable for the beginner is described below. Only five valves are used, whereas the ideal supersonic heterodyne receiver would have about nine or ten. The results, however, with this set are excellent, and the receiver works well with a frame aerial already described.

At about 10 miles from London 2LO comes in on a loud-speaker perfectly, while many foreign stations have also been received on a loud-speaker. Cardiff, Manchester, Birmingham, Glasgow, Belfast, Madrid and other B.B.C. stations have been received, either on the 'phones or at moderate loud-speaker strength. Continental amateurs have also been received on wavelengths down to 100 metres, but a full report of results has not yet been prepared, owing to shortage of time.

There are one or two important points regarding the working of the set which I propose to give in the next issue. Meanwhile, I would say that there is no difficulty in working the set, and the construction is as simple as any other receiver.

The Circuit

In this circuit the first valve acts as the first detector, a frame aerial being employed in the usual way. In between the frame aerial circuit and the grid is the coupling coil L2, to which is coupled, in a fixed manner, the plug-in coil L3, which forms part of the single-oscillator circuit L3L4C3. The Hartley circuit oscillator is employed in this set, the variable condenser C3 of .0005 μ F maximum capa-

city being connected across the grid and anode of the oscillator valve V5. There is a single-oscillating circuit, and both inductance coils are parts of this circuit. The high-tension battery is shunted by a fixed condenser of .5 μ F capacity.

The oscillator induces the currents into the grid circuit of the detector valve V1, and, by suitably adjusting the condenser C3, supersonic beats are produced which are rectified by the valve V1 and produce, in the output circuit, currents corresponding to a wavelength which may be of the order of 7,000 or 8,000 metres. I have not actually measured this wavelength, but it is obtained by using a long-wave transformer of the 3,000- to 7,000-metre range of wavelengths, this range being given

Building a 5- Heterodyne

By JOHN SCOTT-TAGG

This most interesting article, forms Part X of our series in Theory

with a .0003 μ F condenser. The condenser C5 has a maximum capacity of .001 μ F, the transformer L5L6 being of the size specified. The output of the long-wave amplifier V2 contains an

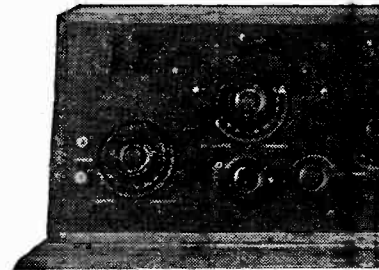


Fig. 3.—A photograph showing upon

exactly similar transformer, the secondary of which is shunted by a fixed condenser of .0005 μ F

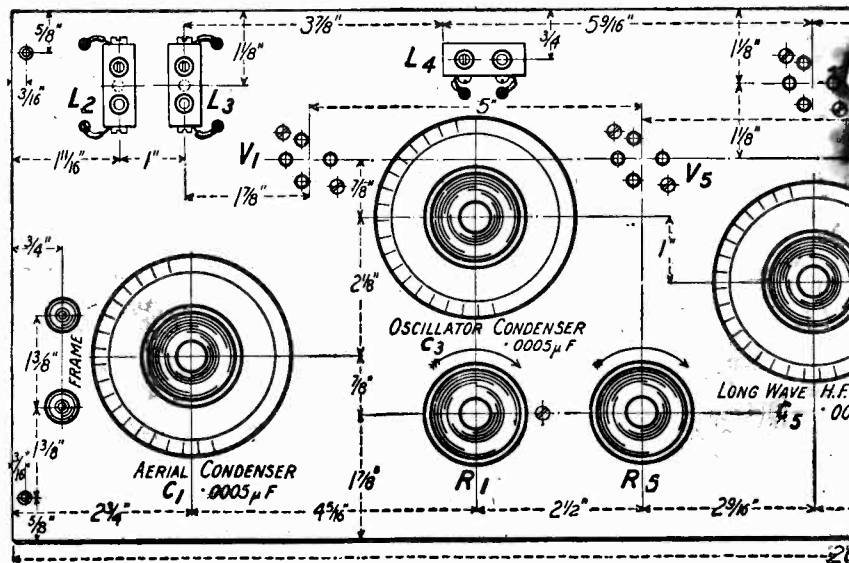


Fig. 2.—A working drawing of the panel. Full size blueprints

Valve Super-Receiver

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

giving full constructional details, *Personic Heterodyne Reception Practice.*"

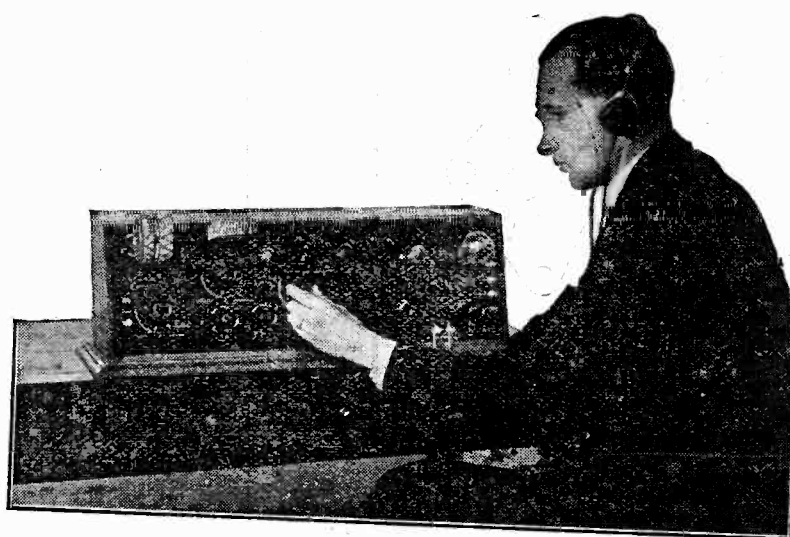
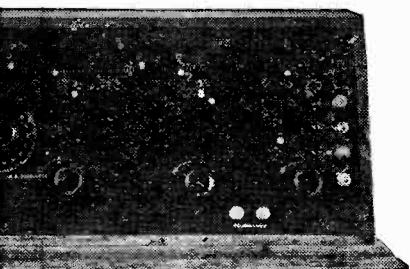


Fig. 4.—The Author may be here seen operating the receiver.



the disposition of the components the panel.

by introducing only one variable condenser in the long-wave side, the other one being fixed. It is

extremely important that the variable condenser should be adjusted so that the wavelength of the circuit to which it is attached is exactly the same as that of the circuit L8C6. It might be suggested that fixed condensers could be used in both cases, but the objection to this is that it is difficult to obtain fixed condensers of exactly equal capacity and just as difficult to get transformers equally alike. Unfortunately, discrepancies on these long-wave transformers are greater than on

the short-wave transformers, due, no doubt, to the fact that these latter are being made more accurately, due to the demand for matched specimens, for such sets as Mr. Harris' "Transatlantic" Receiver.

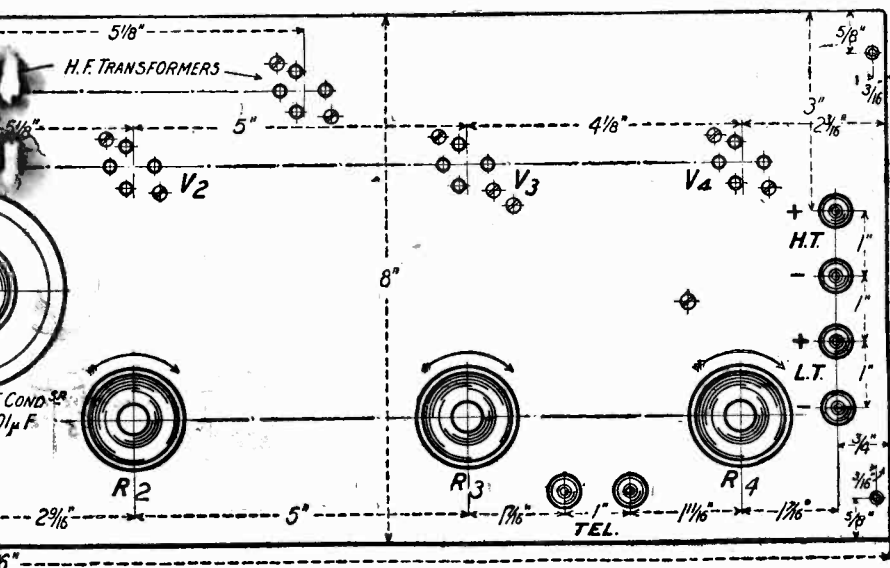
There are three condenser controls in the whole receiver, and once the condenser C5 has been fixed, there is no need to alter it again, the controls being consequently reduced to two.

Constructing the Receiver

The photographs show the handsome appearance of the completed instrument and no difficulties need be anticipated in its construction, the design having been so thought out that easy accessibility to the components is allowed for soldering. The constructor therefore will find the instrument perfectly straightforward to build, with the assurance that its clear lay-out in no way impairs its efficiency.

Components Required

For the benefit of readers who wish to make an exact copy of the original instrument, manufacturers' names are included in the following list of components. Providing components of good quality are selected, however, it should be understood that the actual make is immaterial.



of this figure may be purchased upon quoting Blueprint No 88a.

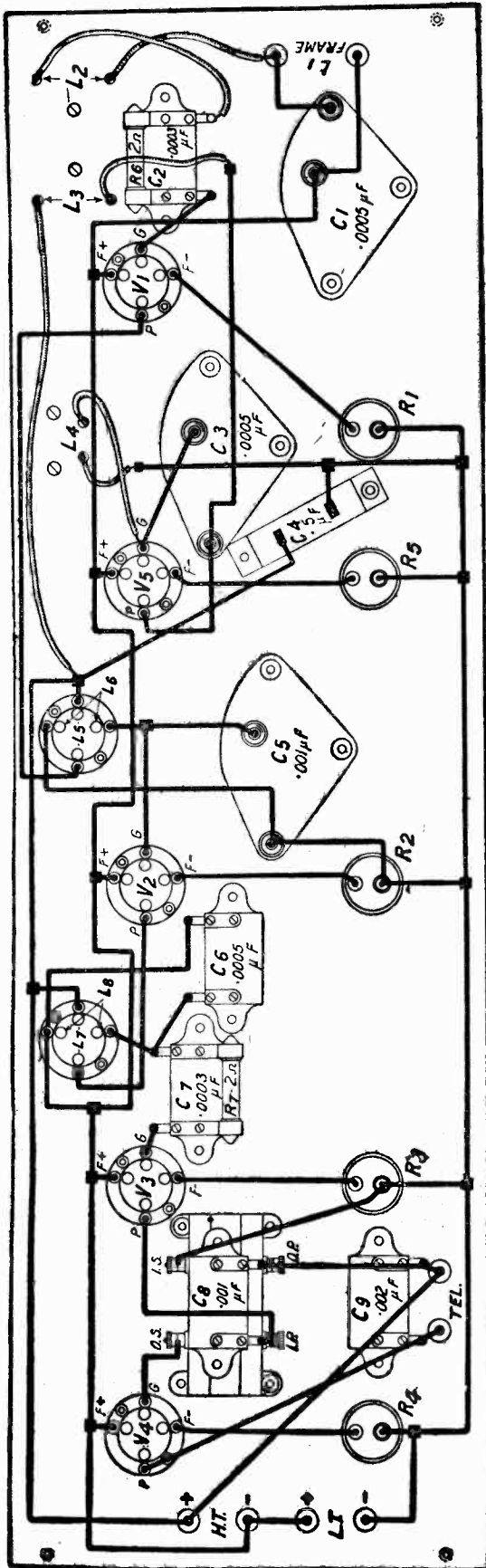


Fig. 5.—A practical wiring diagram of the receiver. Blueprint No. 88b.

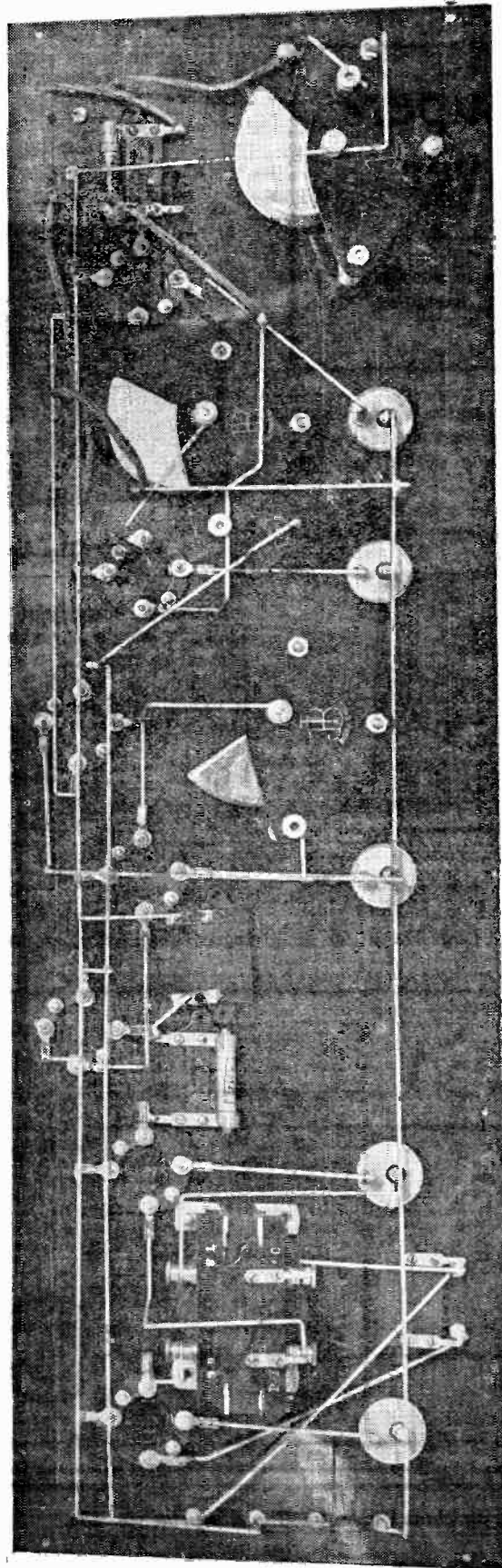


Fig. 6.—A photograph of the actual wiring of the receiver, which may be compared with the practical wiring diagram shown above.

The components used are:—
 Radion mahoganite panel, 26 in. by 8 in. by 3/16 in. (American Hard Rubber Co., Ltd.).

Cabinet of suitable size for above panel.

One .001 μF square law condenser (Jackson Bros.).

Two .0005 μF square law condensers (Jackson Bros.).

Two 3,000-7,000 metres H.F. transformers (McMichael, Ltd.).

Seven type C valve holders (H.T.C. Electrical Co.).

One Ormond L.F. transformer (Ormond Engineering Co.).

Five "Microstat" filament rheostats (Wates Bros.).

One .5 μF T.C.C. condenser.

Three single-coil sockets (Goswell Eng. Co., Ltd.).

Two .0003 μF fixed condensers (Dubilier).

One .001 μF fixed condenser (Dubilier).

which shows clearly the positions of the necessary holes. It is a good plan to have all the components at hand, if possible, when drilling the panel, so that correct sizes for the various holes may be easily determined. Time is often wasted by drilling too small a hole, which has subsequently to be enlarged, and, of course, too large a hole is distinctly unsatisfactory.

Mounting the Components

This is essentially a simple operation, requiring only a little patience. The .5 μF condenser is secured in position by a 6 B.A. screw and nut passing through the panel. The remaining fixed condensers are to be held in position by the stiff wiring, and are consequently not included at this stage. Most of the assembling may be carried out with the

Wiring

Fig. 5 is the wiring diagram, and it should be possible to complete the wiring of the receiver with its aid. Should any point of difficulty arise, however, it is only necessary to refer to the photographs giving views of the back of the panel, to settle the question.

Stiff wire is employed on account of its strength and neat appearance. Resistance, of course, is also cut down to a considerable extent by its use.

The connections to the coil sockets are made by means of flexible leads, Figs. 2 and 5 making this point quite clear. The fixed condensers are conveniently secured in the manner shown in Fig. 5, good soldered joints being necessary, of course. It should not be inferred from this that good joints are not

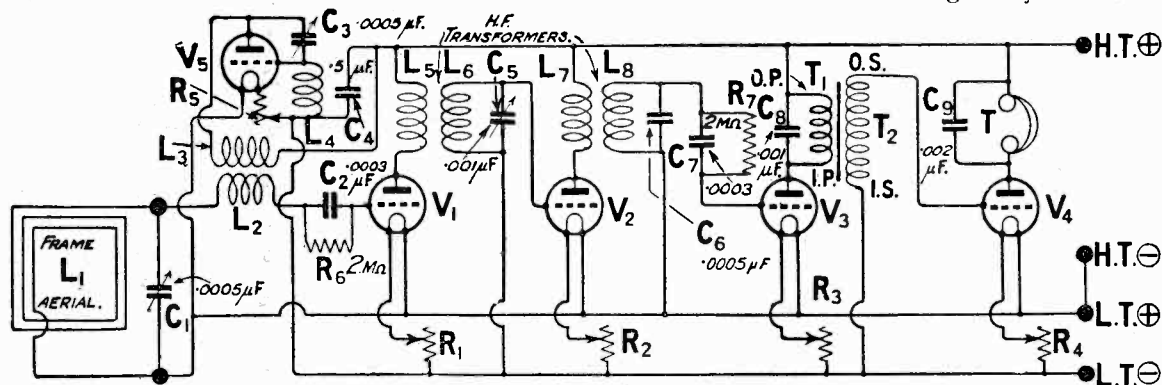


Fig. 7.—A theoretical circuit diagram of the receiver.

One .002 μF fixed condenser (Dubilier).

One .0005 μF fixed condenser (Dubilier).

Two 2 - megohm gridleaks (Dubilier).

Eight W.O.-type terminals.

Square wire for wiring-up.

Packet of Radio Press panel transfers.

Drilling the Panel

The insulating panel should be of superior quality, for the use of cheap, unguaranteed ebonite often results in puzzling faults which are incorrectly attributed to other causes. If ebonite of the latter type is employed, however, the possibilities of surface leakage should be minimised by rubbing well each side with fine emery cloth. A presentable surface may be restored by rubbing with a rag damped with turpentine.

Drilling is carried out with the aid of the diagram in Fig. 2,

aid of the wiring and drilling diagrams, while the photographs will also prove of considerable help. Full directions for the successful application of the Radio Press panel transfers are given with every packet.

The valve holders are designed for mounting at the back of the panel, but are, if anything, easier to fix than the more usual holder for front-of-panel mounting. Six holes require to be drilled in the panel for each holder, four of these being in the usual positions to admit insertion of the legs of the valve. The remaining two holes are for the screws which secure the holder in position.

Rheostats which permit the use of either bright or dull emitter valves have been fitted to the set, but if it is intended only to use valves of one pattern, rheostats suitable for the valves chosen may be used if desired.

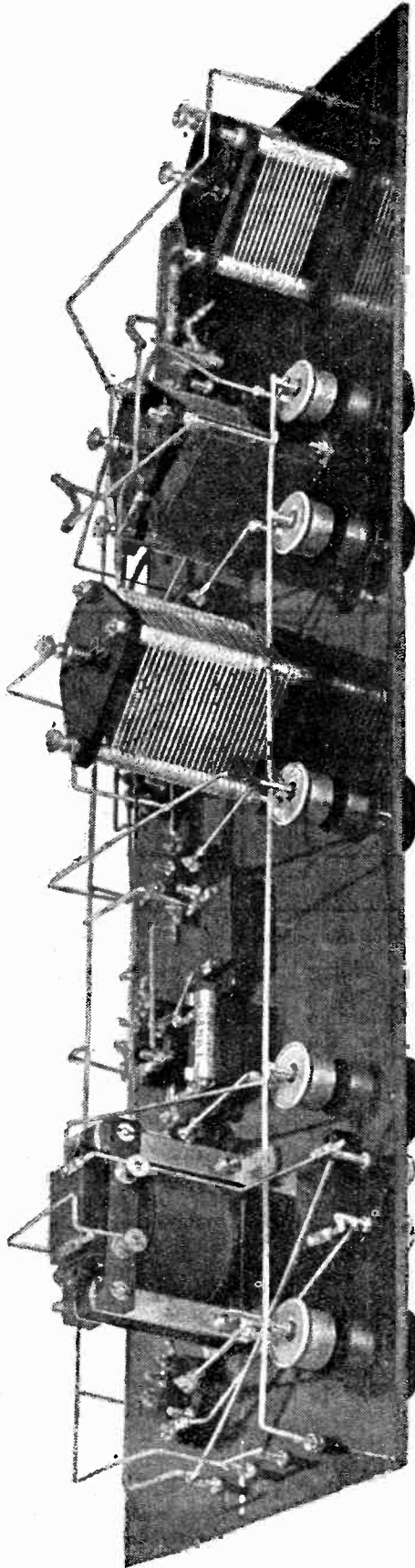
required everywhere, for several faults arise from poor soldered connections.

The Cabinet

In the majority of cases the constructor will prefer to purchase the cabinet ready-made, many dealers being willing to construct these to any size specified. In the present instance a plain cabinet of the sloping-front type has been used, and the reader may judge of its suitability from the point of view of appearance.

Results, of course, are not affected by the shape of the cabinet. The reader may, therefore, make his own choice in this matter.

Next week will be given full details of how to operate this receiver.



The near side is the bottom edge seen in Fig. 1.

Fig. 8.—The wiring of the receiver may be followed from this photograph

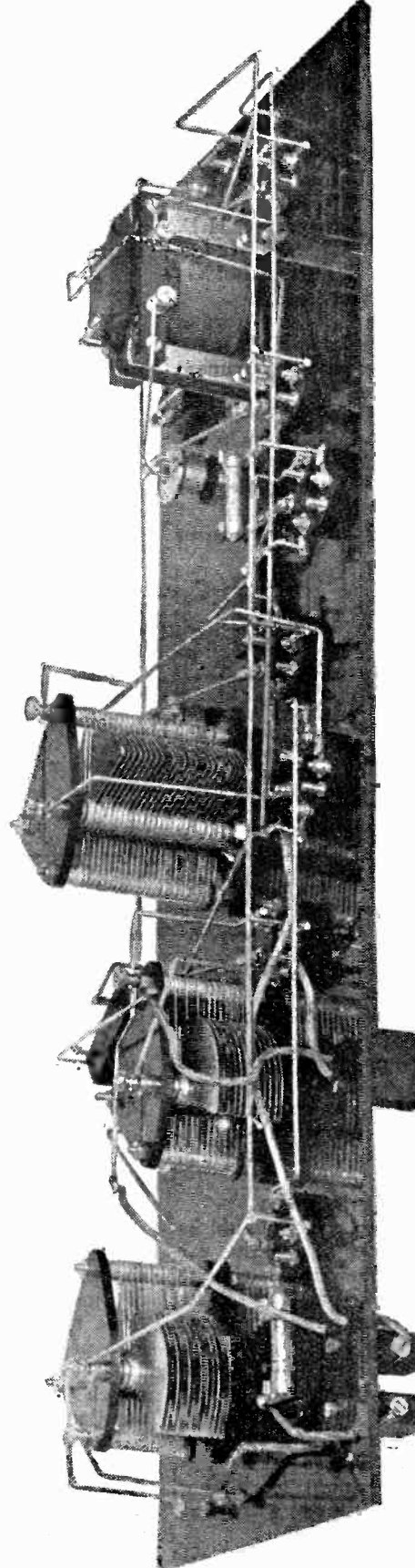


Fig. 9.—Another view of the receiver showing the wiring. This photograph is taken on the opposite side to that seen above.

A Simple Loose Coupler

ALTHOUGH at the present time very many experimenters use tuning coils of the honeycomb or basket type, from the point of view of efficiency on wavelengths from 300 to 3,000 metres the single layer type of coil has much to recommend it. If the following instructions are observed, the experimenter will have a tuner which will enable him not only to tune out a great many of the spark stations which from time to time interfere on the broadcast wavelengths, but will also allow him to tune-in 5XX, the Continental stations such as the Paris concerts, and the Eiffel Tower time signals. A general view of the tuner is given in the diagram. First of all we shall require a base board of hard wood 25 by 9 in. and 1 in. thick. Wood of this thickness is used throughout, as anything thinner is rather prone to warp if exposed to heat or damp.

Supports

Three wooden supports will be necessary, two of them to hold the larger former or primary coil and the third for supporting the 1/4-in. brass rods along which the smaller former or secondary coil slides.

General dimensions are given in the diagram.

These show the primary coil to be 5 in. in diameter; it will be necessary, therefore, to bore a hole 5 in. in diameter in the wood supports for its former. This hole can be cut by scribing two circles, one 4 3/8 in. and the other 5 in. in diameter, and on the smaller drilling a series of 1/2-in. holes right round the circumference, each hole just cutting into the next. The rough circle thus cut can be trimmed up and enlarged to size by means of a coarse-cut half-round file or rasp.

If possible, ebonite should be used for the formers, but should expense rule this out, a very good substitute can be made from thin Bristol board rolled round, several layers being used, to form a tube of the required diameter. In order to give the former good insulating qualities the Bristol board must be var-

nished with thin shellac while rolling and finally baked in an oven to dry and harden it. When taken out of the oven it should be allowed to cool, and then wound for a length of 10 in. with No. 24 gauge d.c.c. copper wire. If the tube is 12 in. long this will allow it to fit right into the supports to which it can be glued. For convenience of winding the final mounting on to the base must be left for the last operation of all.

The Secondary Coil

To make the smaller or secondary coil two discs are required, one of wood and one of ebonite 3 1/2 in. in diameter and 1/2 in. thick, with two 1/4-in. holes 1 in. apart in each to allow the brass guide rods to pass through.

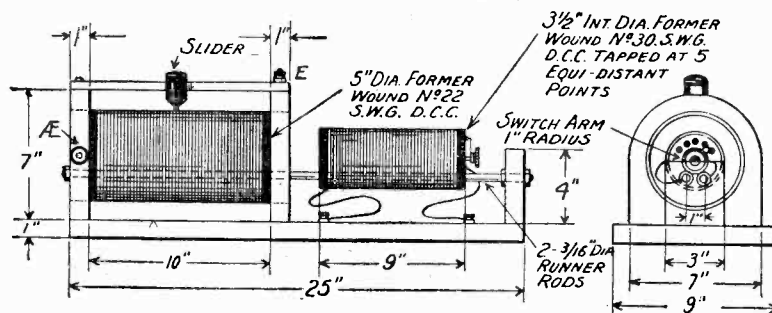


Fig. 1.—Constructional details of the loose-coupler

These holes should be made as near the bottom of the discs as possible. The two discs form the end supports for the former, which should be of a Bristol board tube 8 1/2 in. long and 3 1/2 in. inside diameter. The tube can be built up on the wooden discs, to which it should be securely glued.

Turns of Wire

This former should now be wound full of No. 26 gauge d.c.c. wire. Tappings are taken at five equidistant points, the wires being brought to the studs of a selector switch, the arm of which has a radius of 1 in. This switch is mounted on the ebonite end-piece, which is fitted to the outer end of the coil.

When the secondary coil is finished the brass rods, which should be 26 in. long, are passed through the holes in the end-pieces of the coil and through

both end supports, so that 1/2 in. projects at each end. Both ends should be previously tapped 1/4 in. Whitworth so that the rods may be clamped up tight. One pair of ends of a length of double flex are connected to the starting end of the windings and to the arm of the switch. The other pair of ends run to two terminals on the outer support. The flex should be long enough to allow the secondary to make its full travel.

The Slider

It now remains to fix the slider on the primary coil, which is done by mounting a 1/4-in. square section brass rod as shown in Fig. 1 provided with a slider of the usual pattern. This latter is not worth making, as it can be purchased for a few pence. To bare the wire for the sliding contact a piece of glass paper should be held underneath the slider and rubbed up and down the coil until

the insulation is removed. One end of the primary winding and a lead soldered to the square rod are taken to two terminals, mounted on ebonite, secured to the side of the base as shown in the diagram.

R. W. H.

BROADCASTING NEWS

It is reported that up to October 4 this year 15,000 people have subscribed to the Radio-Vienna broadcasting service.

The U.S. Department of Commerce has issued an official list showing that 535 radio broadcasting stations were operating in the United States under government license on November 1, 1924.

Mounting Variable Condensers

If you use variable condensers provided with a "one-hole" fixing, the task of mounting them on the panel of your set is usually a simple one, for all that you have to do is to drill a $\frac{3}{8}$ -inch hole, pass the screwed bush through it, and tighten down the large nut provided. The only difficulty rises when your panel is more than $\frac{1}{4}$ inch thick, for nearly all standard types of one-hole fixing are made for ebonite of this thickness. In this case the best thing is to drill and tap two holes in the upper end-piece, and to fix with a couple of screws driven through from the top of the panel. By doing this you are making use of the fixing which is used with most condensers of high quality, and the problem which presents itself is how to make holes in the panel which will correspond exactly with those in the end-piece of the condenser.

Using a Template

Here is a very simple way which will make the task quite an easy one. Obtain a piece of transparent paper, and make in it a hole which will just pass over the spindle and its bush. Press the paper down on to the top end-piece, and with the point of the scriber mark the centres of the fixing screw-holes which are clearly visible. Then remove the paper and use it as a template, placing the large central hole immediately over the $\frac{3}{8}$ -inch hole drilled in the panel—the fact that the paper is transparent makes this an easy task; prick into the ebonite with the scriber to mark the centres of the screw-holes

that must be drilled. Now take the centre punch and punch-mark the centres. It will be found quite easy to do this, since the point of the punch can be felt to slip into the little depression made by the point of the scriber. Should paper of the right sort not be available, an old celluloid camera film will answer excellently, or you may use thin

opaque paper, feeling for the holes in the top plate of the condenser with the finger tip, and then marking them as before.

The same tip of using a transparent substance with which to make a marking-out template will be found useful for fixing other components besides variable condensers. I make a rule of always keeping some pieces of transparent paper in a drawer of the workshop, for they prove very useful for all kinds of fitting work.

Crystal Detector Stability

With certain types of crystals the adjustment of the contact made by the catwhisker is very critical, and the best results are frequently obtained when the metal point is exerting only the lightest possible pressure on the surface of the crystal. This, unfortunately, means that the slightest jar may move the point slightly to one side or the other and throw out the adjustment which has been made after a great deal of trouble.

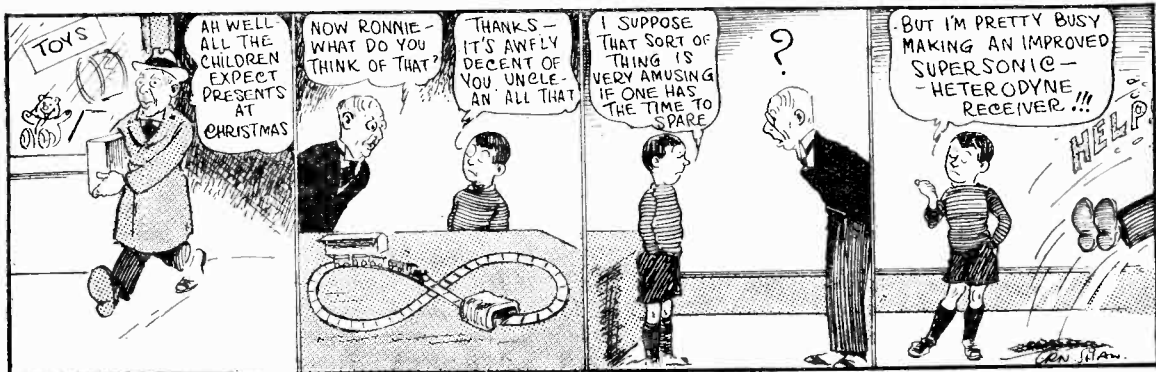
A very simple way of obtaining greater stability with crystals which require a light contact is as follows. After the crystal has been fixed in its cup, take a piece of fine muslin about the size of a halfpenny. Stretch this over the crystal and fasten it by stitches to the mounting screws of the crystal cup. If screws are not used for mounting the crystal, a rather larger piece of muslin should be used, and thread should be passed through its edge. It can then be placed over the crystal, the thread being drawn tight round the stem of

the cup. The point of the catwhisker penetrates the muslin without any difficulty, and it is held quite firmly in the desired spot by the meshes of the material. In this simple manner it is possible to maintain a fine adjustment with the lightest possible contact for many days. The muslin has also the advantage of protecting the crystal to a great extent from dust and grease.

R. W. H.

JANUARY "MODERN WIRELESS"

Full constructional details of how to build five different sets, including a Seven Valve T.A.T. Receiver.





Correspondence

FRENCH VALVES

SIR,—With reference to the letter from the Mullard Radio Valve Co., Ltd., in your issue of December 3, I should like to point out that I never said or implied in my article that there was an "amazing" difference in the prices of French and English valves. My actual words were: "There are numerous French valves on sale in England, and the variance in prices is amazing," referring to the variance in prices of *French* valves.

I should certainly never have stated that the difference in prices of French and English valves was "amazing" because I agree with your correspondent that the difference is not in any way due to manufacturers' prices.—Yours faithfully,

J. W. DAVIES.

IS THIS A RECORD?

SIR,—You will be interested to know that on the voyage out here from U.K. I picked up very good speech and music from both Chelmsford and Bournemouth Broadcasting Stations on a crystal detector at distances well over 1,000 miles. This was scarcely a fluke, as signals came in well at distances over 800 miles for a period of ten days. At 1,100 miles Bournemouth could still be heard fairly well, and Chelmsford was heard clearly up to 1,450 miles (on December 1), though at this distance reception was spoilt by the usual strong atmospheric experienced in the South.

The aerial used was a single wire type and the receiver inductively coupled with a carborundum crystal using potentiometer.

Is this a record for crystal reception? I shall be glad to hear from you regarding this, as I have not heard of any B.B.C. station being received on a crystal over 1,000 miles.—Yours faithfully,

CECIL E. PEARSON.

s.s. *Queensbury*, Port Said.

[We should be pleased to have readers' views on this. We believe it to be a record.—Ed.]

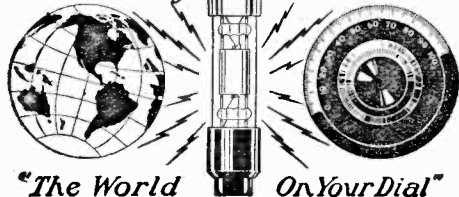
20D

SIR,—I take the liberty of writing you with regard to the last paragraph of "Random Technicalities" in the December 17 issue of *Wireless Weekly*.

I note with considerable surprise that Mr. Simmond's station is quoted as an illustration of the inability of a powerful amateur

Myers Valves

Practically Unbreakable



"The World On Your Dial"

A practical suggestion

In the receiver designed by Mr. John W. Barber "A Long Distance Single Valve Receiver," described in the December issue of "Modern Wireless," it will be observed that arrangements are made for the set to accommodate both the four-pin valve and the MYERS. The special mounting peculiar to the MYERS is an essential factor towards its remarkable achievements in long range reception. Try the MYERS as suggested practically and your next receiver will be built to incorporate MYERS valves only.

improve, improve, improve

Day by day experiment carried to exhaustion has added many little refinements to the MYERS. Its construction from the day they were first obtainable has undergone a change here and there—briefly the MYERS you bought one year ago, unsurpassed as it was, is to-day second only to the product of the present day. The long range reception which amateurs have achieved with MYERS is the potential reward of every Receiver fitted with MYERS—in a word "Radio on Wings."

NEW TYPE MYERS VALVES

the long range and the long life valve are obtainable from our agents or direct from us.

- LONDON.—Dull Emitter Valve Co., 83, Pelham St., Kensington, S.W.7.
- MANCHESTER.—R. Davies & Sons, Wireless Depot, Bilsberry Street.
- NEWCASTLE.—Charles Bailey, 26, Cloth Market.
- LIVERPOOL.—Apex Electrical Supply, 59, Old Hall Street.
- GLASGOW.—Milligan's Wireless Co., Ltd., 50, Sauchiehall Street.
- YORKSHIRE.—Wadsworth Sellers & Co., Standard Buildings, Leeds.
- BRISTOL.—Bristol Wireless Co., Radio House, Queens Road.
- TAUNTON.—A. Montague Cooper, 29, East Street.
- WINCHESTER.—Watson & Childs, 7, City Road, Winchester.

Myers Valves

PRACTICALLY UNBREAKABLE

CUNNINGHAM & MORRISON
WINDSOR HOUSE, VICTORIA STREET,
LONDON, S.W.1. Phone Victoria 827.

station to be heard at more than average strength throughout this country, and, at the same time, be audible at enormous distances.

In this part of Scotland, in point of strength, 2OD's are, without exception, the most powerful amateur signals received, the note being particularly pure.

On Saturday, December 6, from 6 p.m. to 6.30 p.m., when 2OD was working Australian 3BQ, Mr. Simmond's signals were so loud that I had to "tone them down," as they were making the 'phone diaphragms buzz. 2KF was very strong at the same time. The set in use consisted of a detector valve and one-note magnifier.

I must confess, however, to complete mystification with regard to the phenomenon of what one might call "intermediate loss of signal strength," and would like to give instance of an extreme example which I have noted frequently.

The French station of St. Marie de la Mer in the Gulf of Lyons, although its normal range is rated at about 200 miles, comes in here at such great strength as to cause the almost complete exclusion of GPK (Portpatrick), which is only a matter of 50 miles from my station, while St. Marie de la Mer is about 1,050 miles as the crow flies. This, of course, is crystal

reception, and can be vouched for.—
Yours faithfully,

J. WYLLIE.

Newlands, Glasgow.

WIRELESS PANEL TRANSFERS

SIR,—Referring to your wireless panel transfers, I think you will find the following method of applying them much better than the one using a hot pad described on the envelope:—

Select the label desired and cut it out with a pair of scissors and carefully separate the transfer from the stiff paper backing. By means of a camel hair brush put a little pool of methylated spirit on the ebonite where the transfer is to go. Then take the transfer and lay it in the pool of spirit. Adjust it to the exact position required and press down with a clean cloth or handkerchief stretched over the finger tip, moving the cloth to a fresh place once or twice so that all the surplus spirit may be absorbed. Allow the transfer to dry for ten minutes, or any longer time, and then wet with water, when the tissue paper will come away, leaving the wording on the panel.

The hot pad method is not always successful in the hands of a novice, owing sometimes to the pad not being hot enough or to the trans-

fer slipping when the pad is applied. Furthermore, it is practically necessary to label the panel directly after drilling the holes and before putting any of the components on or wiring up, owing to the difficulty of getting the hot pad between terminals and other components. The consequence is that whilst making the set the lettering is likely to get scratched and spoilt. By using the methylated spirit method the set may be entirely finished before labelling and the lettering can be easily adjusted with perfect accuracy.—Yours faithfully,

S. C. PUDDY.

London, N.

A TWO-VALVE CABINET RECEIVER

SIR,—It may interest you to know that I made up the two-valve receiver described by Mr. Stanley G. Rattee in your June number of *Modern Wireless*, and how pleased I am with the results it gives. I tuned in all the B.B.C. stations, using for wavelengths between 300 and 400 metres a No. 50 coil in the aerial and 75 for reaction, and for the higher wavelengths a No. 75 in aerial and 100 in reaction. I am situated three miles from Birmingham and I can get excellent signals on 5IT. The L.S. on two valves is

RICHARDSON'S NON-DIRECTIONAL PERFEX AERIAL
PATENT NO. 216457 ALSO PROTECTED ABROAD.
 —previously known as the "Vertex"—marks a great advance in aerial construction. During the last 18 months it has been adopted after actual comparison by leading amateurs all over the country in preference to the old-fashioned P.M.G. type aerial. The PERFEX Aerial will improve your reception in every way, irrespective of the type of wire you have in your present aerial.

THE PERFEX OUTDOOR AERIAL
 shown on the left will increase range, volume, purity and selectivity, and obviate interference from passing electric trams or trains. With one mast only, its compact form enables it to be erected anywhere, irrespective of space. Complete with download ready for attaching to mast ... **£3 : 15 : 0**



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Complete with download and fittings for suspension **£4 : 5 : 0**

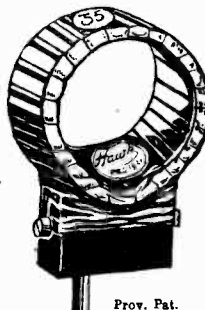
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100	1820	815	3/10
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Sole Manufacturers:

The Hawk Coil Co., 39, PENRHYN RD., Kingston-on-Thames

too loud, and I have to detune on one valve for just comfortable L.S. volume. My aerial is 75 ft. long and 40 ft. high. Some of my friends have a three-valve set, but it does not come up to this wonderful two-valve circuit, and now they have heard my set they are dismantling the three-valve and are going to build the two-valve, so ably described by Mr. Rattee.

Thanking you for such a wonderful circuit and wishing your magazine, *Modern Wireless*, of which I am a regular reader, every success.

—Yours faithfully,

J. W. ALLEN.

Birmingham.

ENVELOPE NO. 2

SIR,—I should be very pleased if you would allow me to add my congratulations to others on what I consider the finest of straight circuits yet designed—"The Family Four," by Mr. Percy W. Harris (Envelope No. 2). I enclose photograph* of finished set, and should like to say that although this is the fifth I have made, it is also the best. The results, I must say, have fully justified my using the best components. On the first Sunday after it was finished for testing I logged the following Continental

* Photograph is reproduced on page 358.

stations on the loud-speaker: Vienna (Radio Wien), Berlin, Helversum, Copenhagen, The Hague, Radio Paris and Radio Iberica, also several I could not identify. I have since received all the main B.B.C. stations on the loud-speaker, and on November 19 I heard on the telephones at 12.55 a.m. Schenectady calling. At 1.15 a.m. the next day I received s.s. *Leviathan* 750 miles from Cape Ushant on the loud-speaker, and at 1.47 a.m. I received WHAZ on the 'phones. All these came in very clearly with no atmospherics or interruptions.—Yours faithfully,

HARRY H. ANSPACH.

Dartford.

THE ALL-CONCERT DE LUXE

SIR,—Having constructed the "All-Concert" and "All-Concert de Luxe" (Envelope No. 4), designed by Percy W. Harris, I thought it might interest you to know my results.

With the "All-Concert" one could obtain good results, but I certainly find the "de Luxe" a great improvement. Of course, all B.B.C. and Continental stations come in at good strength.

On Sunday, December 7, between 12 and 4 a.m., I received the following American stations: WBZ,

337 metres; KDKA, 326; WGY, 380, and WOR, 405 metres, signal strength quite strong in 'phones, and WGY audible on L.S. I think these results are exceptionally good.

—Yours faithfully,

G. W. E. RASHLEY.

Niton, Isle of Wight.

A TRANSFORMER COUPLED 3-VALVE RECEIVER

SIR,—I thought it may be of interest to you to hear of the excellent results I have obtained with "a transformer coupled three-valve receiver," described by Mr. Stanley Rattee in *Wireless Weekly* of November 12.

On the early morning of December 5, at about 3 o'clock, I made an attempt to receive America, and succeeded in tuning-in WBZ, Westinghouse Electric and Manufacturing Co., Springfield, Mass., hearing some excellent singing by the St. John's Choir, including Rubenstein's "Melody in F" at about 3.20. Atmospherics were rather bad at times, but on the whole it came through wonderfully clearly.

Wishing your excellent papers every success.—Yours faithfully,

PATRICK MACDOWELL.

S.W.7.

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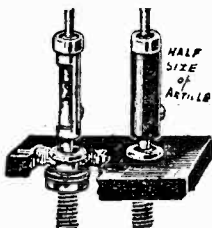
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BROWNIE	7/6
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HEADPHONES

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DRY BATTERIES

SIEMENS: 1.5 Volts. .50 Volts. .60 Volts.

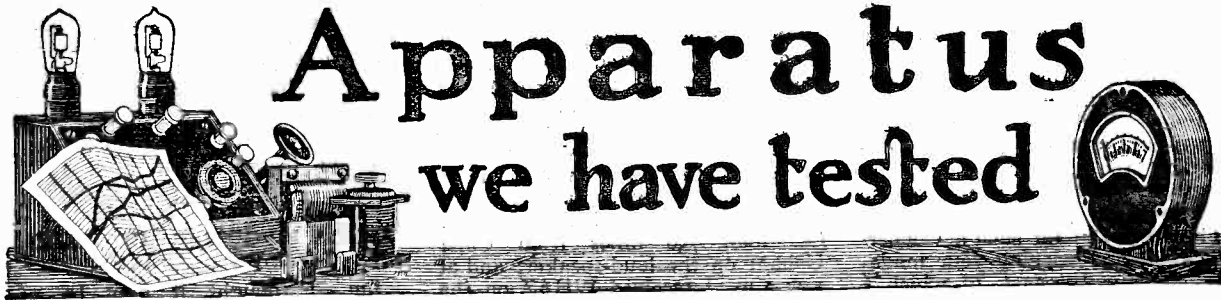
VALVE RECEIVERS

BY WESTERN ELECTRIC, BURNDEPT, MARCONI, R.I., B.T.H., etc. FROM £5-18-6.

ALL THOROUGHbred

ROBERTSONS

MOTORS Ltd., 156, Great Portland St., W.1.



Apparatus we have tested

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

Two-Valve Amplifier

A complete two-valve L.F. amplifier mounted in a handsome mahogany case 9½ in. by 5 in. by 5½ in., has been submitted by Messrs. Wates Bros., which, we understand, retails at what is an extremely moderate price for a complete and well-finished unit such as this undoubtedly is.

Externally, only the two valve-windows are visible from the front, and the two carbon-compression type of filament-resistance, together with a push-pull "off" switch for the filament circuit have their control-knobs at one end. A row of eight terminals projects from a terminal-strip at the rear, where the connecting wires are less conspicuous.

The front and top swing out on hinges, exposing the valve-sockets and all internal wiring and components. The two valve-holders are placed on the floor of the box, and two "Supra" intervalve transformers arranged to give small magnetic coupling, grid-bias cell, battery, fixed condensers and stabilising resistance are all accommodated around the sides. The wiring is particularly neat and business-like and of heavy bus-bar.

A very good point, and one neglected by some makers who should know better, is the provision of permanent grid-bias, to avoid distortion and moderate the drain on the H.T. battery. This is an ordinary 4-volt flash-lamp battery, the same bias being given to both

valves. It is noticeable that no ready provision is made for renewing this cell, the connections being securely soldered. Whilst the demand on this battery is quite negligible, the shelf-life of such a cell is not unlimited, and noise is bound to develop in time if it is not occasionally renewed.

The common device for stabilising a two-stage transformer-coupled amplifier and improving quality, is adopted in the form of a high resistance across the second transformer secondary.

On trial with ample H.T. and reliable valves able to handle the signal-energy developed, good amplification and loud-speaking resulted on the local broadcast at 35 miles,

*Hearty
Christmas Greetings*

to all our clients in
the Wireless Industry
and
Best Wishes for
Continued Prosperity
throughout
1925

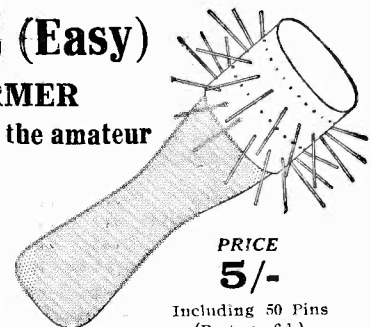
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The E-C (Easy)

COIL FORMER

Is indispensable to the amateur

Fully described and illustrated on page 28 of "Wireless Weekly," Oct. 22 issue.



PRICE
5/-

Including 50 Pins
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Obtainable from most Wireless Dealers.

For both Fine and Coarse Spacing

Cost Saved on First Coil Wound.

BEWARE OF INFERIOR IMITATIONS.

These Formers will wind every type of Plug-in Coil described in

"Tuning Coils and How to Wind Them"

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A FEW PROVINCIAL AGENCIES STILL OPEN.

on a poor aerial and following a simple detector-valve with reaction; the quality being also good, even though there was a slight tendency towards a raising of the average (so-called) "pitch," i.e., amplifying the higher audio-frequencies to a higher degree than the lowest. The degree of amplification also fell somewhat short of what is attainable with two stages of very efficient low-frequency amplification, though here the degree probably equalled, if not excelled, what is commonly accepted by the amateur constructor. There was no difficulty in the matter of low-frequency oscillation, or whistling, common in two-stage amplifiers operated under conditions which are incorrect.

For everyday use in conjunction with the loud-speaker and an existing detector-unit, this instrument can, in general, be recommended with confidence as being really excellent value for the price asked, and satisfactory in operation.

G.R.C. Audio-Former

Messrs. General Radio Co., Ltd., have sent for test samples of the latest production of their inter-valve L.F. transformer, the G.R.C. 83 Audio-Former.

This is a small, highly-finished instrument in a polished vertical cylindrical metal case, with wide

bottom flange drilled for fixing in the set, and terminal-plate on the top, with substantial accessible terminals clearly marked. It stands about 3½ in. high, and the barrel is about 1¼ in. in diameter. On test, the insulation resistance was excellent. In actual reception, the build-up of signals was fair, but there was a noticeable fall-off in the lower frequencies, so that the tone was a little thin—as is so frequently the case with small transformers. As indicated, the finish and workmanship of these instruments appear to be of a high order.

A Low-Priced Inter-Valve L.F. Transformer

We have received from J. Jarvis samples of an interesting L.F. transformer of extremely moderate price, but which, unlike most which come under this description, actually gives, on test, really quite a good performance for a small instrument.

The transformer is of the usual general type, with open laminated rectangular core and horizontal coil, the terminals being arranged in a very accessible position on an ebonite plate at the top, and clearly marked. The primary and secondary coils are separately former-wound, and can actually be replaced. Ample insulation is provided, and

the instruments endured a severe D.C. voltage test. The iron circuit is of unusually ample dimensions for a low-priced instrument, and no bolts pass through the laminations. The workmanship appeared to be good, and the finish quite adequate.

On trial in actual reception, in comparison with instruments costing from two to three times as much, as stated the performance of this instrument was very creditable, good amplification resulting with but little falling-off in the lower frequencies, and in a second-stage the results were also good. We are convinced that where it is not desired to purchase a high-priced instrument considerable satisfaction can be obtained from this excellently-designed low-priced transformer.

G.A.V. L.F. Transformer

Messrs. C. A. Vandervell & Co. have sent for test a sample of their new L.F. inter-valve transformer. This is a medium-sized instrument of rather unusual outward appearance, the coil being horizontal and the terminals arranged on strips of insulation at opposite ends, a metallic casing being provided which also carries the two lugs for fastening the instrument in the set. As a result, it is of small height, requiring only 2-in. clearance, on a base

TANGENT TUNING COILS and SELECTIVITY

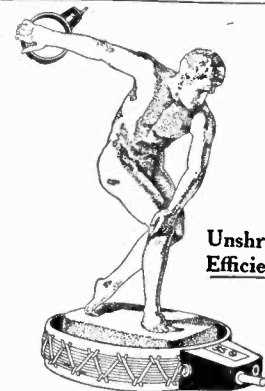
If you would choose your station and select your own programme without interference from other stations—

You will choose "Tangent" Coils because of their Selectivity. Their Low Self-Capacity ensures fine Selectivity.

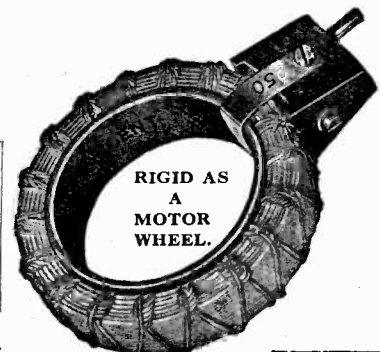
Incidentally there is no more efficient coil on the market. Our motto is—

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Your dealer stocks them, accept none other.



Unshrouded Efficiency.



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PRICES			
Coil No.	Price.	Coil No.	Price.
25	4/3	200	7/-
35	4/3	250	7/6
50	4/3	300	8/-
75	4/6	400	9/-
100	5/-	500	10/-
150	6/-		

Complete Set of 4 Coils (Nos. 25 to 75) 16/- the set.
Complete Set of 11 Coils (Nos. 25 to 500) 67/- the set.

about 3 in. by 2½ in., which may be a matter of great convenience in some types of receiver. The terminals are of reasonable size, and easily accessible.

On test, the insulation-resistance proved excellent. The performance in actual reception, at good loud-speaker strength, of broadcast music and speech, revealed the remarkable freedom from distortion and good build-up obtainable with L.F. transformers of modern design. On most critical test at various audio-frequencies, as well as in comparative tests with several other makes not of the cheap kind, this transformer came out with flying colours. No signs of resonance at particular frequencies were noticeable. There was no woodenness up to the very high notes of the piano; and the full richness of the low brass instruments of the band came out. At the same time, the actual build-up, as confirmed also by actual measurement of R.M.S. values of signal-voltage across the loud-speaker developed on a constant audio-signal, compared favourably with other instruments and with our standard. Whilst we should like to see the actual shape of the voltage-amplification curve at different frequencies, as determined by the N.P.L., to confirm these observations, we can thoroughly recommend this type of

transformer, if the sample submitted is any criterion, for the most fastidious.

The finish and workmanship appeared to be of high order.

Valve Notes.
Concluded from page 355.

ance L4 of the grid circuit of V2. We are introducing damping into the circuit L4 C3 by the energy absorbing circuit, which includes the inductance L3 and the valve V1. It may readily happen, therefore, that if the valve V1 is turned off, the long-wave amplifier will immediately proceed to oscillate, whereas if the filament of V1 is kept at reasonable brilliancy, self-oscillation of the long-wave side will not occur. If, then, peculiar effects are noticed by reducing the filament current of the first valve, it must be remembered that this adjustment has altered the conditions of the second valve as well, although at first sight it might be thought that the valve

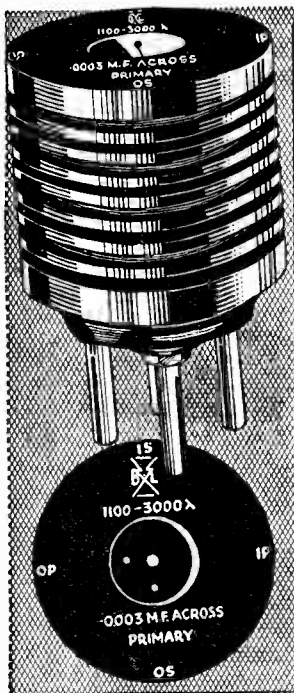
V1, being an ordinary detector without any reaction coil or anything of the sort, could be treated as an independent item. When the long-wave side oscillates, of course, hopeless squeals and howls will be heard because of the innumerable harmonics combining with the oscillations produced by the local oscillator.

□ □ □ □ □

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H.F. Transformers
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ALL RANGES
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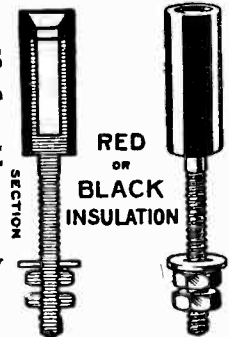
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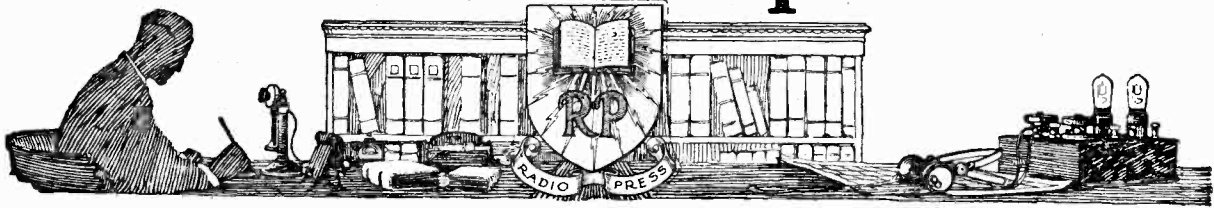
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Information Department



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G. Y. J. (LONDON) asks whether there is any serious risk of causing interference by means of a single valve set operating in an oscillating condition, so long as he adjusts his set that he hears no howl himself. His question is prompted by the fact that he has seen a description of a single valve receiver in which it was stated that the correct method of operating this set was to keep it in the oscillating condition.

It cannot be too emphatically stated that interference is most certainly caused by using any receiving set in this condition, so long as the reaction coil is coupled to any circuit from which energy can by any

conceivable means leak back into the aerial circuit. In a single-valve receiver, of course, conditions are practically at their worst for the causing of interference by radiation when in an oscillating condition, and the method of operating the set which is indicated represents one of the most pernicious forms of such interference. The effects of such a procedure are not felt over quite such wide ranges as those of the actual squealing and howling type, but their effects within their range of action are equally objectionable. Such a proceeding is responsible for many cases of what may be termed "artificial fading." Those who do a good deal of long-distance reception will be quite familiar with the

symptoms produced in their own sets by this procedure on the part of others, and will recognise the high-pitched whistle descending to the silent point, and then an almost complete blotting out of the desired signal. When a fairly strong signal is being received, the reduction of signal strength may not be very great, but the effect then is the certain appearance of very bad distortion in the received signals.

This is certainly not the correct method of procedure when operating a single-valve set, or any other in which reaction is employed. To get the best signals for oneself with a minimum of annoyance to others, such a set should always be adjusted to a point just short of oscillation.



Where Expert & Amateur agree

The test reports of experts in the technical journals, and the verbal and epistolary comments of amateurs all over the country, alike testify to the marked superiority of B.T.H. Valves. The three B.T.H. "general purpose" valves give better results in any position in the circuit than many valves designed and recommended for a single function only; while the three "power" valves are unequalled for L.F. amplification.

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GENERAL PURPOSE VALVES

Type R . . . 12/6 each
Filament Voltage 4 volts
Filament Current 0.7 amp
Maximum plate voltage 100 volts
Plate resistance 27,000 ohms

Type B3 . . . 2/1s. each
Filament Voltage 1.5 volts
Filament Current 0.85 amp
Maximum plate voltage . 80 volts
Plate resistance 27,000 ohms

*Type B5 . . . 2/5s. each
Filament Voltage 2.8-3 volts
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Type B4 . . . 3/5s. each
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Maximum plate voltage 120 volts
Plate resistance 6,000 ohms

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Filament Current 0.12 amp
Maximum plate voltage 120 volts
Plate resistance 9,000 ohms

*Type B7 . . . 3/7s. 6d. each
Filament Voltage 6 volts
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Maximum plate voltage 120 volts
Plate resistance 9,000 ohms

* For use with Dry Cells.



2175A

Advertisement of The British Thomson-Houston Co Ltd.

A. R. B. (PLYMOUTH) has recently seen a receiving set in which the grid leak is connected from the grid to the negative low-tension terminal, the filament resistance of the rectifying valve being in the negative lead, and asks which is the correct arrangement of the many possible ones.

For the grid condenser and leak method of rectification to be efficacious it is necessary that the grid of the valve should become positive during the positive half cycle of the oscillatory current, and if the leak is connected in the manner in which our correspondent refers to, this will not take place unless the positive swing produces a potential of more than the voltage drop across the filament resistance. In other words, this is not the correct method, and the leak should be connected to the positive end of the filament. Certain types of valves are occasionally found to give better results when the leak is connected to the negative end of the filament, but this is rather the exception.

J. T. U. (WEYBRIDGE) has seen statements in the Press to the effect that square bus-bar wire is not desirable for use in short wave receivers, the reason given being that radiation of extremely high

frequency currents takes place from the sharp corners and edges, and he asks our opinion.

Such a statement would appear to be made from an imperfect knowledge of the principles involved. As a matter of experimental fact, no such effects can be traced, and the advantages of the straight direct wiring, which is so easy to obtain by means of bus-bar wire, would seem to indicate that this is the material for the purpose.

G. F. E. (HUNSTANTON) possesses a telephony transmitter which he operates on the wavelength of 200 metres and asks us to explain a somewhat peculiar phenomenon connected with the use of a counterpoise earth. He finds that with a direct earth the aerial current is in the neighbourhood of $\frac{1}{2}$ amp. whereas when he changes over to his counterpoise, which is a rather unusually large one, the current rises to .8 amp. At the same time distant stations report no improvement in his signals.

It must be remembered that with a counterpoise, especially if it is of large size and fairly high above the ground, it is quite possible for the capacity of the aerial-earth system to be very materially in-

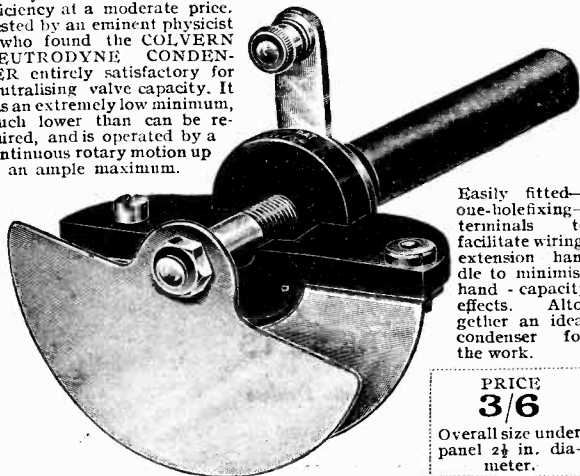
creased, and an increase in aerial current may quite possibly follow, but since the counterpoise is some 10 ft. off the ground and the aerial is not one of very great height, the effective height of the latter has been reduced, and the actual radiation may also be reduced. This is an obvious explanation which can be made without actual inspection, but there are a lot of other possibilities which may be contributing to the effect, or, indeed, may be almost the sole cause. We fear that an actual inspection would be needed to locate the sole cause.

B. R. Q. (LIVERPOOL) desires to construct a wavemeter to cover the wave range 1,000 to 10,000 metres, and enquires as to the suitability of the Buzzer type.

We do not advise our correspondent to attempt to construct an instrument along the lines which he indicates, since the use of a buzzer as the source of energy in a long-wave wavemeter is not as a rule effective, unless very special precautions are taken. The ordinary buzzer wavemeter circuit for the longer wavelengths gives only extremely flat tuning, so that anything resembling accurate readings is impossible, and we would strongly advise that the heterodyne type of wavemeter be adopted.

The COLVERN NEUTRODYNE CONDENSER

Similar in design to the COLVERN General Purpose Vernier, which is already well known—the COLVERN NEUTRODYNE represents utmost efficiency at a moderate price. Tested by an eminent physicist—who found the COLVERN NEUTRODYNE CONDENSER entirely satisfactory for neutralising valve capacity. It has an extremely low minimum, much lower than can be required, and is operated by a continuous rotary motion up to an ample maximum.



Easily fitted—
one-hole fixing—
terminals to
facilitate wiring,
extension handle
to minimise hand-
capacity effects. Alto-
gether an ideal
condenser for
the work.

PRICE
3/6

Overall size under
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meter.

Fit one COLVERN GENERAL PURPOSE VERNIER to every large tuning condenser. Gives much higher efficiency than the vernier in association with a main condenser. The COLVERN persuades the utmost power and gives increased selectivity—at a very moderate price, 2/6.

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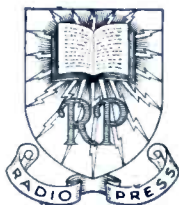
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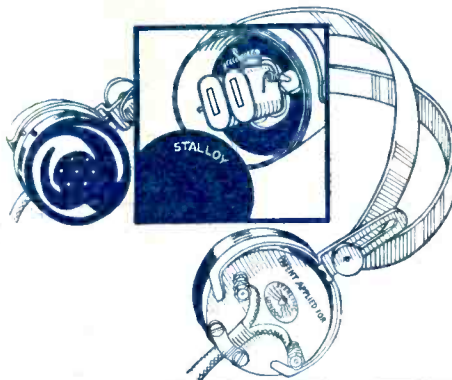
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