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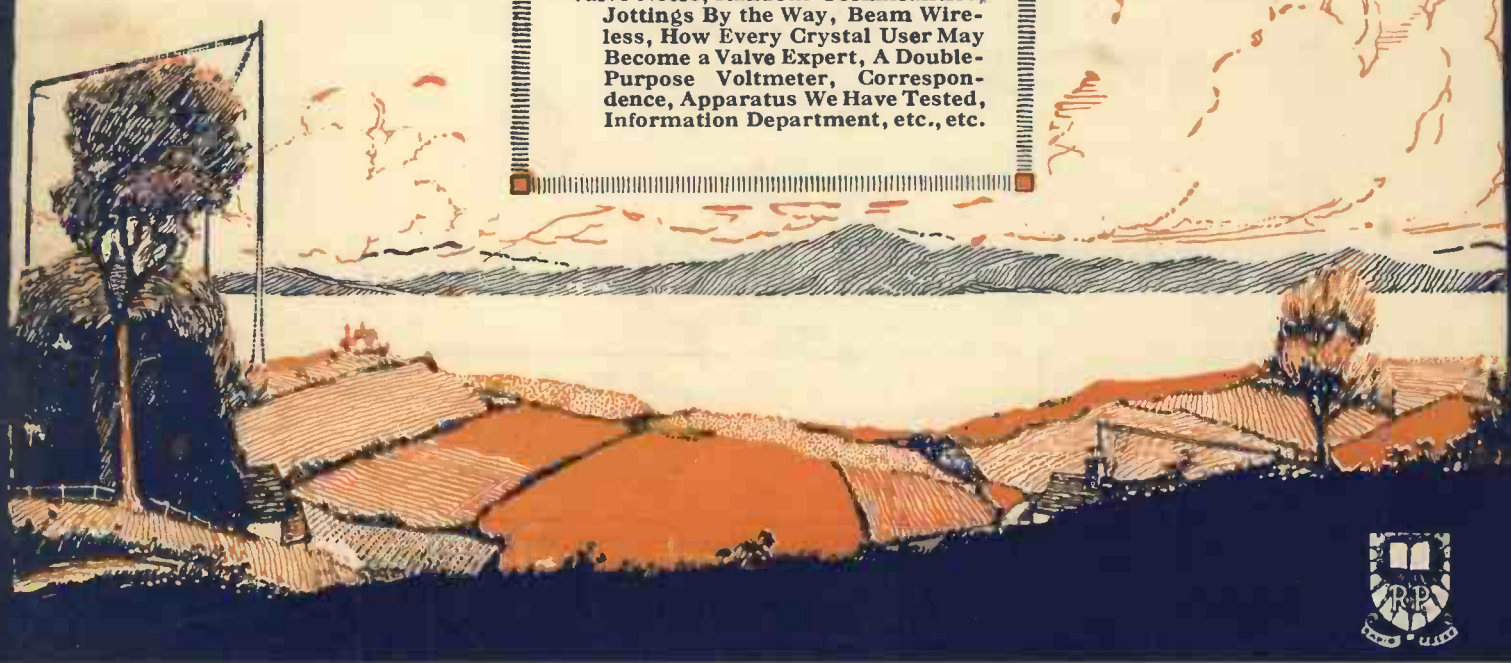
Wireless Weekly

and the Wireless Constructor.

Vol. 4.
No. 13.

CONTENTS



H.F. Transformers Explained

Every step fully explained—

EVEN if a man has never built a Set before—if he has never had the opportunity of examining one closely—if he knows absolutely nothing about Wireless—if he has no friends to advise him—he could still select a suitable design from among those described in ***"Wireless Sets for Home Constructors,"*** and get spendid results from the very beginning.

The complete beginner—if he lived near a Broadcasting station—would probably build one of the Crystal Sets. Even if he wished to start with a Valve Receiver right away, without going through a probationary period on a Crystal Set, he would find the 2-Valve Broadcast Receiver a wonderfully simple and efficient instrument, costing but little for material. The more advanced experimenter, on the other hand, will appreciate the many exclusive and original features which are incorporated in the 4-Valve Universal Receiver—its sensitiveness and its power.

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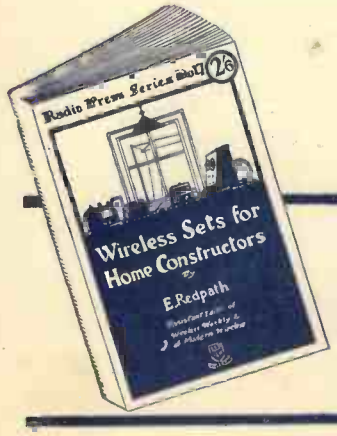

Wireless Sets for Home Constructors

By E. Redpath.

2/6

Radio Press Series No 17.

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Wireless Weekly

Vol. 4, No. 13
July 30, 1921

CONTENTS

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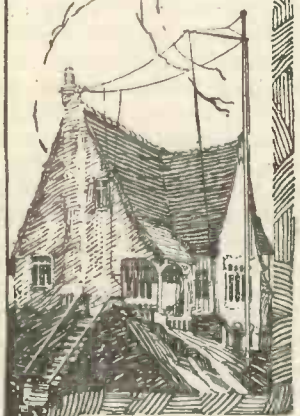


Editorial

Imperial Wireless and the "Beam"

In our Editorial for July 9 we referred to Senatore Marconi's latest work with directional wireless in developing the system which has now received the popular title of "the wireless beam." Fully realising the importance of the great inventor's work we have been publishing in the last few issues a complete report of the Paper given by the well known inventor before the Royal Society of Arts, so that by this time our readers will be able to judge for themselves the full purport of the Paper. It is of some interest to note in passing that *Wireless Weekly* is the only radio journal to reproduce this Paper in full.

The Rugby Station

In the Editorial referred to we stated that it was probable that the Post Office would complete their present plans for the Rugby station while carefully watching any developments on the shorter waves, and we are glad to see that this policy has been adopted by the Government. Instead of abandoning, as was suggested in some quarters, the work on the Rugby station, the giant installation which, when completed, will be the greatest in the world, the Government have wisely decided to push forward with the present work whilst co-operating with the Marconi Company in trials of the new "beam" system. In a few days' time, perhaps even before these lines appear in print, an agreement will be submitted to the House of Commons for their approval, whereby the Marconi Company will erect, as contractors, a "beam" station in England adapted for communication with Canada, and capable of extension so as to provide for "beam" communication with South Africa, Australia, and India.

According to the provisional arrangement, the station is to be completed within twenty-six weeks of the time when the site is made available for the Company, and it is conditional that the contract for the installation shall only be accepted and paid for by the Government if it fulfils certain important guarantees.

The Question of Cost

In giving further details, the Postmaster-General stated that the Marconi Company were erecting a station for the Government at cost price, plus 10 per cent. contractor's profits, the maximum to be £58,000. Should additional units be required for Australia or South Africa additional units would cost a maximum of £36,000. Thus, in a short time the British Government should possess a well equipped high-power station of great range at Rugby, together with a station of the new system for comparison with the older method. This certainly seems to be the common-sense way of dealing with the problem.

The Dominions and the "Beam"

So far as the Dominions are concerned, they apparently do not all see eye to eye with the Home Government. In a statement before the Australian Parliament, Mr. Bruce said that the Government intended to proceed with the erection of a "beam" station at once. The British Government had advised the construction of both a "beam" and a high-power station of the older type, as the "beam" system can only maintain communication with Australia for seven hours daily. The Federal Government, which was unable to accept those views, was influenced to some extent by what was considered to be the shortness of vision shown by British experts in the past. Owing to the great development of the "beam" system, Mr. Bruce said it was probable that if a high-power station were now adopted it would, when completed, be obsolete.

It will thus be seen that the Australian Government intends, in the language of the racecourse, to "put all its money on one horse" by abandoning the idea of erecting a high-power station on lines already proved capable of satisfactory work during a large part of the day, and confining themselves to the "beam." They are therefore likely to find themselves in a position of considerable difficulty if, after more prolonged tests, the "beam" system should fail to live up to its promise. At the same time, the British Government, by having both high-power and "beam" stations available, will be in a much sounder position.

A Gratifying Feature

One aspect of affairs is most gratifying to all who are interested in the progress of the art. We refer to the fact that the Government and the Marconi Company seem at last to be working in accord. We hope that we have seen the last of unpleasant bickerings in this direction, which have done much to hinder progress in the past.

Garden Aerials

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

In view of the warm weather many readers may wish to enjoy the experience of wireless reception in the open air. The following article describes the best methods of arranging temporary aerials for this purpose.

EVEN in the worst of British summers there are occasions when the listener-in feels tempted to take a receiving set out into his garden and spend a lazy hour listening to the music of one or other of the broadcasting stations. Of course, such a thing can be accomplished by the use of long telephone leads taken from the set in the house, but, with such an expedient, difficulties in tuning may arise. Besides that, there is not the same charm about it as having the set within easy reach of a comfortable deck-chair.

Fortunately, British broadcasting is now so efficiently carried out that it is possible to get good results from a temporary aerial and a temporary earth connection such as may be installed in a garden in a very few minutes.

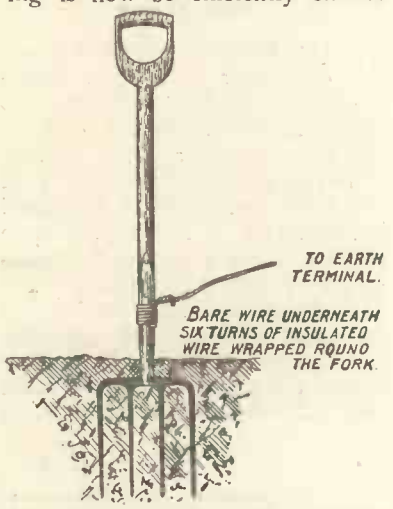


Fig. 1.—A quick and convenient method of making a temporary earth connection.

Some Recent Experiments

I have recently made a few experiments with small aerials in a garden and the results obtained are worth setting down as an indication as to what can be done in this way.

Earth Connections

First of all, there is very little difficulty in making a good earth connection in a garden. Often enough, there is a convenient water-point handy, but failing that, a good earth connection can be quickly made with an ordinary garden fork. In most of the experiments under consideration, the earth connection consisted of a garden fork driven as far in the ground as possible. The metal on the handle of the fork was first scraped clean and rubbed with a file for three or four inches. Then the bared end of a length of bell-wire was laid on the clean patch of metal and several turns of the insulated wire were wrapped round the fork handle over the bared wire. After these several turns had been wound as tightly as possible over the fork handle, the insulated wire was twisted with the free end of the bared wire in order to keep the wire in position. Fig. 1 illustrates the way in which the fork was used as an "earth."

Testing the Earth Connection

Before putting up an aerial, the efficiency of the fork as an earth was tried. Using a two-valve set and the earth connection alone, no aerial at all being used, 2LO 15 miles away was distinctly audible in the telephones.

The First Aerial

The first aerial tried consisted of about 12 ft. of bell-wire placed 4 ft. above the ground. Fairly good results were obtained on the telephones from 2LO with this aerial. Raising the wire so that one end was about 9 ft. above the ground, the other end still being 4 ft. above the ground, increased signal strength a little, and 2LO was audible on the loud-speaker up to distances of a yard or two.

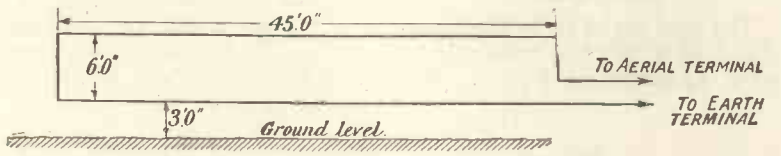


Fig 2.—Illustrating a type of aerial which was tried, the relative heights and lengths being given.

Another Aerial

The next aerial to be tried consisted of 15 ft. of bell-wire with a 3-gallon watering can attached to the end of it. With the watering-can fastened at a height of 11 ft. up an elderberry tree, music from 2LO received on a small loud-speaker could be heard from 5 to 10 yds. away. The addition of another 15 ft. of wire to the aerial, making 30 ft. in all, increased signal strength appreciably, even though the 3-gallon can was placed only 7 ft. above the ground, being hung over the top of an open window frame. With this aerial, a fox trot from 2LO was heard a good 15 yds. away from the loud-speaker. When the 3-gallon watering can was removed from the end of the aerial wire, there was only a small diminution of signal strength.

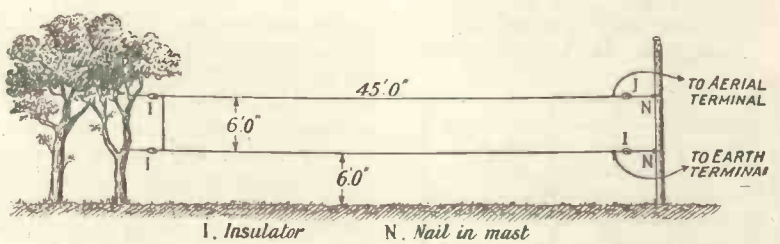


Fig 3.—A form of garden aerial which can be recommended.

Further Trials

The next aerial tried consisted of 100 ft. of bell-wire fastened at one end to a pear tree and at the other to the house. The wire was only about 7 ft. above the ground and at the middle of its course the wire passed under a large elderberry tree. Signal strength with this aerial was better than had been obtained with the other aerials tried, but the loud-speaker was unable to compete with a noisy lawn-mower a couple of gardens away.

Best Results

The next aerial to be tried consisted of a vertical rectangle of wire, as shown in Fig. 2. The height of the top horizontal wire was 9 ft. above the ground, the height of the bottom horizontal wire, 3 ft. above the ground. As will be seen from the diagram, no earth was used. The wire used in making this aerial was, as before, No. 18 bell-wire. Results with this aerial were so good that a second aerial of the same shape was made of No. 24 enamelled wire and placed a yard higher than the last aerial. Small insulators tied to a tree were used to support the wire at one end, and at the other end the wire was twisted round nails driven in an aerial mast, a thin piece of rubber tubing being placed over each nail before the wire was twisted round it. Fig. 3 is a sketch illustrating this aerial.

Stations Received

The type of aerial shown in Fig. 3 is one to be recommended for use in a garden. It can be quickly put up with the aid of a small ladder or a pair of steps, and the results obtainable with such an aerial are remarkably good. With the aerial illustrated in Fig. 3, the writer obtained splendid loud-speaker strength from 2LO 15 miles away. In addition, Birmingham, over 100 miles away, was received at excellent telephone strength. Moreover, tuning with this aerial was noticeably sharp.

Fixed Condenser Capacities

THOUGH it is not possible to arrive at an accurate measurement of the capacity of a fixed condenser unless a capacity bridge is available, one can nevertheless obtain a pretty good idea by making use of the rough-and-ready test to be described. The only essential is a variable condenser whose maximum capacity is known. Cheap condensers are sold as ".0003 μF," ".001 μF," and so on, but no guarantee is usually given with them and they are very seldom up to the stated figure.

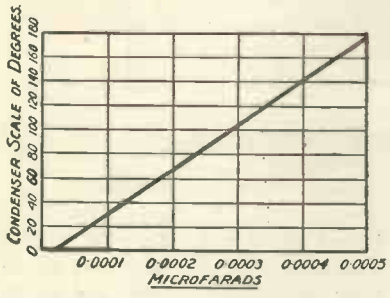


Fig. 1.—Curve showing relation of capacity of .0005 condenser to scale of degrees.

Guaranteed Capacity

If, however, one purchases a variable condenser from a good maker a guarantee will come with it that its capacity is as stated. This condenser should be of the square law rotary vane type, which gives a regular increase from minimum to maximum as the knob is rotated. There is, as a matter of fact, a slight irregularity in increase at the very bottom of the scale, but for all practical purposes a good condenser with a well-centred spindle and absolutely straight plates will give a regular increase. The chart shown in Fig. 1 may be used for the average .0005 μF, and a similar one can be made in a few minutes to suit any other value. It will be noticed that a small allowance is made for the minimum capacity of the condenser which will never be zero. This charge enables the approximate capacity at any given setting to be read off in a moment.

Wiring Up

Now wire up the variable condenser and the fixed condenser which it is desired to test in the way shown in Fig. 2. It is not necessary to use a D.P.C.O. switch, though it saves time to do so. Throw the fixed condenser into circuit first of all and plug in different A.T.I.'s or work the slider of a single layer inductance until you hit upon a signal which is as sharply tuned in as possible. Suppose that the condenser under test is stated to have a capacity of .0003 μF, then the .0005 μF variable condenser should give the same tuning when set at about 105 degrees.

Indications

If you find that you have to set this condenser at a higher reading, then the fixed condenser is above its stated capacity. If, on the other hand, a lower setting is required, then the capacity of the fixed condenser is less than it should be. The approximate amount of the error can be ascertained by noting the variable condenser readings and seeing by means of the chart the capacities which they indicate. Thus if to obtain the same tuning we must set the variable condenser at nearly 140 degrees, then the capacity of the fixed one is about .0004. In the same way a variable condenser reading of 60 degrees means that the real capacity of the fixed condenser is about .00018 μF.

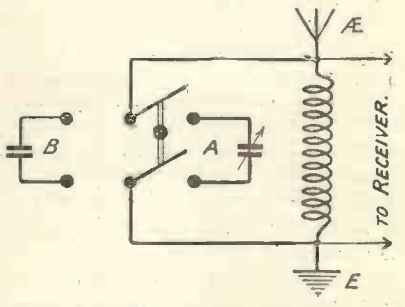


Fig. 2.—The method of connecting the switch for comparison of condenser capacities.

R. W. H.

GOOP-WAYFARER No. 761

Synopsis of Previous Chapters

Professor Goop and Wireless Wayfarer, the discoverers of a new circuit of stupendous possibilities are engaged in describing in detail the results of their labours for the benefit of all really serious experimenters. So far entirely original methods of insulating the aerial, of making the tuning inductance, of concocting the condenser and of attaching leads have been described. If you want to be at least eighteen months ahead of the fashion in wireless

BEGIN THIS GREAT NEW SERIAL NOW!

The Telephone Receiver

It is not perhaps usual to deal with the telephone receivers when only the ATI, the ATC and certain leads have been wired in the circuit. But this is not a usual circuit. No harm can be done by providing the telephones at this stage. They should be worn day and night by the constructor for a week or so in order that his ears may be properly flattened before he brings them into serious use, and that all superfluous hairs immediately above his ears may have been plucked out before the actual process of "broadcatching" on a grand scale begins.

Making Receivers Comfortable

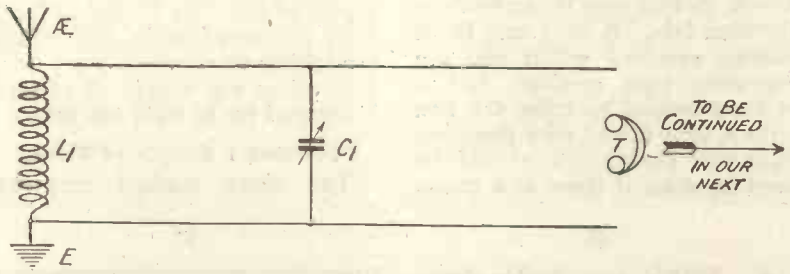
You may discover when you first don the headbands that your head is adorned with peculiar bumps. Should this happen the best thing is to take your seat in the armchair wearing the phones, and to get a friend to hammer the bands gently but firmly until they are shaped to the contours of your cranium. It might be as well prior to this operation to consult a phrenologist. It would be sad, for example, supposing you had the bump of electrical genius highly developed, to have it flattened out in this way. Many a promising career has been ruined by failure to attend to little matters of this kind.

A New Headgear

Personally I have always disliked metal bands, for though my head is of a noble, intellectual type, which head harness of any good make fits to perfection, I have a thin patch on the top, and in cold weather the feel of a steel band sends cold shivers all down my spine. I have therefore adopted for my own use an entirely original type of gear. Look at the pictures. Compare the look of agony on the face of the fellow caught in the grip of a pair of ordinary rat-traps with the contentment, the beatitude, the *joie de vivre* of his opposite number who is revelling in the comfort of the Wayfarer Brimbolophone. The apparatus gets its name from the fact that it is made from the brim of a discarded bowler hat. The hat should be placed first of all in the lathe, and its crown neatly turned off. Should you not have a lathe, it is best to engage the services of a skilled scythe-wielder. You then sit upon the ground with the hat firmly upon your head whilst he mows off the top with one sweeping stroke. As scythecraft is not much practised in our larger towns, I may say that the city dweller who has neither lathe nor scythe at his disposal will be able to make quite a good job of it with a tin opener. The receivers are then detached from their bands. Little slits are made in the brim quite close to the crown immediately above the ears. The thingamejigs of the receivers are next pushed through the slits and attached to the crown by means of paper fasteners. The use of drawing pins for this purpose is not recommended.

Method of Use

The use of the Brimbolophone calls for a little self-restraint on the part of those who have been brought up with the manners of a perfect gentleman. My friend Poddleby had a sad accident when he first donned the Brimbolophone. He was sitting before his wireless table, wearing, of course, both the apparatus and the pleasant expression which it brings, when the door opened and Mrs. Poddleby entered, ushering in Selina Snaggsby, who was dying to hear some wireless. Naturally Poddleby leapt to his feet, and, without thinking what he was doing, swept off his Brimbolophone in



Goop-Warfarer circuit No. 761 as described up to date. The method of obtaining the telephone receivers is detailed in this instalment.

polite salutation. One of his receivers caught the visitor a shrewd blow in the left eye, and, owing to the sudden jerk upon the phone-cords, large portions of his set were torn up by the roots. Be very careful, therefore, when you are wearing the instrument not to mistake it for a hat. Should you find that you are unable to restrain your natural politeness, it would be as well to fix it on with sticking-plaster as a precaution. It is important that the Brimbolophone when not in use should always be hung on a peg screwed on to the edge of the table, and never laid flat. Gubbsworthy, another convert to this latest fashion in wireless millinery, neglected this precaution, and was astonished on returning from a long week-end to discover a family of seven kittens established in his Brimbolophone. Pay due attention to these small points, and the Brimbolophone will bring a new joy into your life.

Acquiring the Receiver

I promised the week before last to tell you how to obtain a telephone receiver for threepence. Since I wrote the Postmaster-General has, I believe, reduced his charges for the use of call boxes, so that now it can be done for even less. A little care is, of course, required whilst you are capturing your receiver, and it is most unwise to leave the box with a long tail of wire dangling from your pocket. Nor should the deed be done if there is a queue of people waiting outside to use the box after you. Not only is this method of obtaining a receiver inexpensive, but it may also provide the obtainer with a holiday and an entire change of scene for fourteen days or more at no expense whatever. Personally I favour a safer and even cheaper method of providing oneself with headphones. I have never bought a pair yet, but I have always at least one excellent set in use. My method is to go round to Poddleby and borrow a pair from him. If he forgets about them, well and

Abolish discomfort by wearing this fashionable type of receiver.

good, but should he be mean enough to come at some future date and demand their return I hand them back with a haughty stare and a few cold words of thanks. Then I toddle round to Snaggsby and obtain the loan of a pair of his. As I have at least forty wireless friends, and others are taking up wireless every day, I calculate my supply of phones is assured for at least ten years.

Obtaining a Supply of Valves

The same method may be employed for keeping up a stock of valves. In this case it is as well to purchase a milliammeter, which need not necessarily be in working order. You can then offer to take valve curves for any of your friends, and tubes of all kinds from peanuts to power valves will positively rain down upon you from all quarters. Some of these people will, of course, come round and demand to see the curves. In this case you can always copy those published by makers (with slight variations) on to a sheet of graph paper. You then give back the valve, saying that it is a pretty priceless dud, certainly not worth the trouble of carrying home. It is ten to one that your victim will bow before your superior knowledge—the possession of the milliammeter gives one a wonderful amount of prestige—and that he will request you to throw the thing into your dust-bin in order to save him trouble. With the exercise of a little ingenuity it is really possible to avoid having to purchase anything at all in the way of wireless gear. It is just the knowledge of these things which marks out the expert from the beginner. Next week I will show you how to provide yourself with as many high-tension batteries as you want at absolutely no cost at all with the help of an entirely new method which involves neither borrowing nor the other thing.

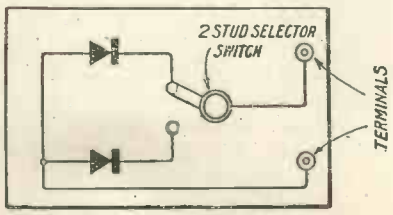
WIRELESS WAYFARER

□ □ □

A USEFUL DOUBLE DETECTOR

A VERY neat double detector, which is a most useful pattern for the experimenter to have, can be made in the way shown in the diagram. On a small panel two detectors are mounted which may be either of the same type or of quite different patterns. One contact of each is connected to one of the two terminals on the panel, whilst the other is taken to one of the contacts of a 2-stud selector switch from whose arm a lead runs to the other terminal. It will be seen that either detector can be thrown into action by simply turning the switch across to the appropriate stud.

With such a contrivance crystals can be tested against one another in the easiest possible way. This double detector may also be used for general receiving purposes, it being a distinct advantage to have two crystals, either of which can be used at will should one of them get out of adjustment, or should it seem to have lost its original sensitiveness. Another use for this double detector is as follows: Wire the detectors so that the cup of one and the catwhisker of the other are connected to the common terminal, joining the other contacts to the studs of the selector switch. Now place a piece of the same crystal in each, and the device enables you to see at once in which way current should pass, for it can be reversed by the simple process of turning the switch from side to side.



By means of the arrangement shown, crystals may easily be compared.

R. W. H.

□

Beam Wireless

By SENATORE GUGLIELMO MARCONI, G.C.V.O., LL.D., D. Sc.

Continued from page 378. Vol 4, No. 12.

THESE experiments with Australia were continued during the month of May, consistently good results being obtained at two receiving stations situated in the vicinity of Sydney.

It seems obvious, if we consider the position and altitude of the sun, that during the morning period the waves travelled from England to Australia starting in a westerly direction, across the Atlantic and Pacific Oceans, along the longest route, which is approximately 12,219 nautical miles, whilst during the evening period they travelled in an easterly direction over Europe and Asia, along the shortest route, which is about 9,381 nautical miles.

In Canada, at Montreal, reception was found to be possible for 16 hours out of the 24.

These results were so encouraging that I was tempted to try a wireless telephony test to Australia.

With rather experimental arrangements at Poldhu, intelligible speech was transmitted for the first time in history from England to Sydney on Friday, May 30, of this year.

Oil-Cooled Valves

For the telephony test to Australia, oil-cooled valves were employed for the main valve and for modulating valves. The wavelength was 92 metres and an independent drive was employed for controlling the main valves. The total power supplied to the valves was approximately 28 kw. divided up as follows: 18 to the main valves, 8 to the modulating valves and 2 to the drive valves. No reflector was employed.

Mr. Leon Deloy (8AB) whose success has done much to popularise 100-metre work amongst amateurs.

A continuous development of the short-wave transmitter has been taking place at Poldhu. To utilise considerable power, required the study and development of circuits for paralleling valves satisfactorily, and the design of special valves to maintain the wavelength steady has necessitated the application and development of an independent drive. These problems have been solved satisfactorily and the production of commercial transmitters dealing with powers up to the order of 50 kw. now presents no difficulties. (Slides were shown here of the interior and exterior of the small experimental station at Poldhu.)

It was gratifying to all concerned that the experiment succeeded the very first time it was tried, Mr. C. S. Franklin being in charge of the transmitting apparatus at Poldhu and Mr. Ernest T. Fisk (with whom I have never discussed technical matters in my life) of the receivers at Sydney.

It is also interesting to observe that these extreme distances were obtained without the use of any reflector at either end.

The results obtained between England and Australia easily constitute a record for ratio of distance to wavelength, for Sydney, by the shortest route, is approximately 189,000 wavelengths from Poldhu.

In my opinion, it appears to have been proved conclusively that adequately designed reflectors, even if of comparatively moderate size, will enormously increase the effective strength of the signals.

This cannot but augment the efficiency of communication, besides increasing the number of hours during which it will be possible to work with very distant countries.

Use of Reflectors

Moreover, the use of receiving reflectors will be of the greatest advantage to practical working, because whilst magnifying the strength of the received waves they reduce all interference whether caused by atmospheric electricity or other stations, un-

less, of course, the direction from which the interference may be coming happens to coincide exactly with that of the corresponding station.

The energy magnification, due to the concentration of the energy by the directional effect, has been carefully calculated by Mr. Franklin, and tests carried out at Poldhu have fully confirmed his figures.

The slide shows comparative polar diagrams of the field in all directions from three separate transmitters. The red circle is a polar curve of a plain non-directional aerial. The green curve shows the polar curve of a two-wavelength aperture reflector. The black curve shows the polar curve of an 8-wave aperture reflector, such as we propose to use for practical purposes.

(A slide was here shown.)

The case which was tried experimentally at Poldhu was an aerial and reflector ½-wave high 3 waves wide, the aerial being fed at four points with a cable feeder system. The horizontal polar magnification figure of about 30 was found.

General Laws

Mr. Franklin believes there are some general laws regarding these aerials which may be stated as follows :—

(1) The ratio of the loss by radiation to the loss by ohmic resistance, and therefore the efficiency, remains constant for all sizes of the aerial at the same frequency. This efficiency figure is very high, and can easily be of the order of 80 per cent.

(2) The natural decrement of the aerial is very high, and remains constant whatever the extension, as the ratio of the inductance to the resistance of the aerial remains the same.

(3) The greatest magnification for a given area, and therefore for a given cost, is obtained by having equal areas of reflector or aerial at the transmitter and receiver. Thus an aerial of 20 square wavelengths at transmitter and receiver gives a magnification of 200, but if divided into two aerials at transmitter and receiver, each of 10 square wavelengths, gives a magnification of 10,000.

(4) For a given area of aerial at the transmitter and receiver, the magnification goes up as the fourth power of the wave frequency used. Thus, assuming aerials 1 kilometre wide and 100 metres high at transmitter and receiver, these would each be 10 square wavelengths for 100-metre wave, and would give a combined magnification of 10,000. For half this wavelength (50 metres) each aerial would be 40 square wavelengths, and would give a combined magnification of 160,000.

Energy Capacity of Aerials

Up to what ranges this fourth power law can be effective in compensating for the greater attenuation of the shorter wave has yet to be ascertained.

The energy capacity of these aerials is enormous, and they could never conceivably be worked to their limit. It would be quite possible practically to superimpose several waves and thus several services on the same aerial.

It should not be lost sight of that very high speeds of working appear to be possible only if short waves are employed, whilst speeds of the same order are quite unattainable with the long waves now in general use for long-distance radio communication.

I might, in other words, state that there exists no theoretical reason why with a frequency of 3,000,000, such as is the frequency of oscillation of a 100 - metre wave, the speed should not be one hundred times as great as the speed attainable with a frequency of 30,000, which represents the frequency of a wavelength of the order of those which it is proposed to use for the Imperial stations. Of course, this is not taking into account the mechanical difficulties.

Further Tests

Between the 12th and the 14th of June (both inclusive) of this year, some further important tests were carried out between Poldhu and a small receiving station at Buenos Aires in the Argentine, the distance between the two points being 5,820 nautical miles (10,780 kilometres).

For this radio-telegraphic test the wavelength was 92 metres and the power to main valves was 21 kw. This gave a radiation of 17 kw. The parabolic reflector was employed to concentrate the energy towards South America, and gave a strength of field in that direction which would otherwise have required a radiation of approximately 300 kw. from the aerial without reflector to produce the same effect.

Although many of the arrangements employed were far from perfect, very strong signals were received for over ten hours each day at Buenos Aires.

Messages were sent by the Argentine Minister of Agriculture, Dr. Le Breton, who happened to be in London, to the

Mr. Dan Godfrey, Jr., conducting the augmented wireless orchestra at the London Studio.

Minister of War, General Justo, in the Argentine, and every message transmitted was correctly received in one transmission.

At the conclusion of the tests we received a communication from the Argentine Committee, representing the wireless interests in the Argentine, who are conducting the wireless telegraph services through their super-power station with Europe and the United States of America, to the effect that the signals from Poldhu transmitted by this new system were received at Buenos Aires with such regularity and extraordinary strength as to permit a service being conducted at any speed, and expressing the opinion that the Argentine station should be immediately equipped with the new system which, they are confident, will handle more than double the traffic in six hours than they are now able to handle in twenty hours with their present super-power station. Excellent results were also obtained at Rio in Brazil.

A Prophecy

All these results, many of which have greatly exceeded my expectations, convince me that by means of this system economical and efficient low-power stations can be established which will maintain direct high speed services with the most distant parts of the globe during a considerable number of fixed hours per day.

I am further of the opinion that by means of these comparatively small stations a greater number of words per 24 hours could be transmitted between England, India and her distant Dominions than would be possible by means of the previously planned powerful and expensive stations.

Comparative Privacy

Another particular advantage of this system should not be overlooked. As distant stations situated only within a certain angle or sector of the beam are enabled to receive, this condition brings about a comparative privacy or secrecy of communication unobtainable with any other system of radio communication, and this may prove to be of the greatest value in war time, besides considerably increasing the number of stations it will be possible to work, by reducing the possibilities of mutual interference between them.

The comparative economy in capital cost of these stations, the small amount of electrical power which need be employed, together with the capability of working at very high speeds, should make it possible to bring about a substantial reduction in telegraphic rates. The importance of this to the Empire must be obvious.

I wish to take this opportunity of expressing my high appreciation to Mr. C. S. Franklin for all the valuable work he has carried out in order to make this system a practical success, and also to Mr. G. A. Mathieu for his practical and theoretical assistance.

I also wish to thank Mr. Ernest T. Fisk, the Managing Director of the Amalgamated Wireless (Australasia), Ltd., Mr. H. H. Beverage, Research Engineer of the Radio Corporation of America, Mr. J. H. Thompson, Chief Engineer of the Marconi Wireless Telegraph Company of Canada, Ltd., Commander J. Lloyd Hirst, Marconi's Wireless Telegraph Company, Ltd. Representative on the Commercial International Committee in the Argentine, and Mr. P. Eisler, Manager of the Commercial Radio International Committee in Brazil, for their most valuable co-operation in arranging at very short notice to successfully receive in their respective countries the signals transmitted from Poldhu.

(Finish)

□

The Harkness Circuit and Some Claims.

WE have received a number of inquiries regarding the so-called "Harkness" circuit, for which great claim has been made in the American press. Reports regarding this circuit have been published in the lay press of this country, together with the claim that it is easily capable of covering the range of 1,000 miles or more, and to be incapable of oscillation or interference.

The actual circuit, however, has little in it to justify such claims. Incidentally it should be stated that the receiving conditions in America are on the average greatly superior to those in this country, which possibly accounts for the extraordinary claims frequently made for quite ordinary circuits. The present circuit consists of a single valve receiver with aperiodic aerial tuning and a high-frequency transformer in the anode circuit. The high-frequency currents in the secondary of this circuit are rectified by a crystal and fed back through a low-frequency transformer to the grid circuit of the first valve in the normal way.

It will thus be seen that there is nothing essentially novel in the circuit. The method of coupling the aerial to the closed circuit is of the type already described in these pages, in which a single layer coil on a suitable former has wound over it a smaller number of turns constituting the aerial circuit. An identical arrangement is used in the anode circuit of the valve, the smaller number of turns forming the primary winding and the larger the secondary. No direct reaction is provided for.

It will thus be seen that the arrangements closely resembles many of the reflex receivers previously described in these pages, and its range cannot be expected to be any greater. Any claims made that the set will not energise the aerial should be accepted with the greatest reserve, for in a loose-coupled set with a tuned circuit directly or indirectly connected to the plate, the inter-electrode capacity of the valve may be quite sufficient to feed back enough energy to create oscillations, although, of course, the damping introduced by the crystal is a stabilising factor. Stability in circuits such as this is usually obtained by sacrificing sensitivity, for obviously if the set cannot be brought near the oscillating point, the maximum amplification is not obtainable.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

A New Method of Feeding Back the Low-Frequency Currents in a Reflex Circuit.

THE method which I have developed for feeding back the low-frequency currents in a reflex circuit, and which has become standard with most experimenters, sometimes has raised against it the objection that the aerial sometimes picks up A.C. current from electric light mains, etc., and these currents traverse the secondary of the transformer connected in the aerial circuit, thereby producing potential differences across this circuit which are communicated to the grid of the valve, and consequently produce a hum in the telephones or loud-speaker.

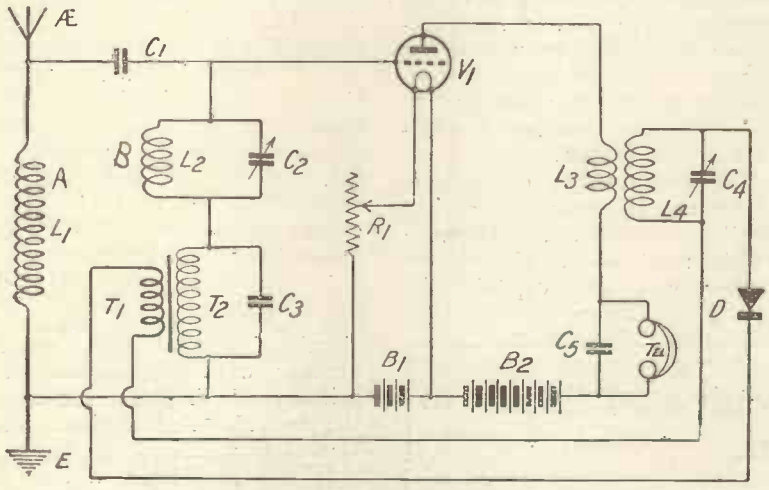


Fig. 1.—A circuit for eliminating A.C. hum.

Experience shows that this effect is rarely experienced, especially when constant aerial tuning is employed, but where severe trouble occurs the only alternative method has been the parallel input arrangement used on a number of commercial sets. Readers will recall that this method consists in feeding the low-frequency currents through a choke coil to the grid of the valve, the aerial circuit being also connected across the grid and filament of the valve, a stopping condenser being employed.

This latter parallel method is not, of course, as straightforward and simple as the method which connects the transformer in the aerial circuit, and some trouble is sometimes experienced due to the resonating of the choke coil.

I have now developed a method which possesses all the merits of the series input arrangement, while at the same time all chance of picking up low-frequency A.C. is practically eliminated, and is certainly eliminated in so far as the aerial picks up the parasitic currents.

Details of Circuit

Fig. 1 shows the method. It will be seen that in this circuit the aerial is connected to earth through an inductance coil L1. The main tuning circuit is L2 C2, acting, of course, in conjunction with the aerial capacity. A fixed condenser C1, having a capacity of, say, .0003 μF, is connected in the position shown, while a condenser C3 of .001 μF capacity is connected across the secondary T2 of the feed-back low-frequency transformer T1 T2. A high-frequency transformer L3 L4 is included in the anode circuit of the valve and a crystal detector is used for rectification purposes. The low-frequency potentials established across T2 are communicated to the grid of the valve through the inductance L2, while the condenser C1 prevents the current from being short-circuited through L1.

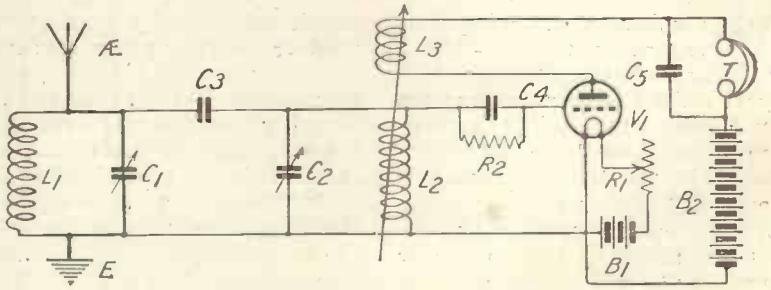


Fig. 2.—A circuit which is not quite what it appears to be.

This circuit may be operated in two ways; either the inductance L1 may be made of very high value, in which it is regarded purely as a short-circuit for low-frequency currents picked up by

the aerial from electric light mains, or the inductance L1 may be made an integral part of the main oscillating circuit. If L1 is used as a choke coil some of the disadvantages of the parallel input method will be experienced. The coil L1, under these circumstances, will have negligible impedance to low-frequency currents and negligible resistance. Any low-frequency currents picked up by the aerial will consequently not produce any noticeable potential differences across L1 which could be communicated to the grid of a valve. On the other hand, the coil L1 would choke back high-frequency currents which would traverse C1, the circuit L2 C2, the condenser C3, and so to earth.

I much prefer, however, to make the coil L1 an integral part

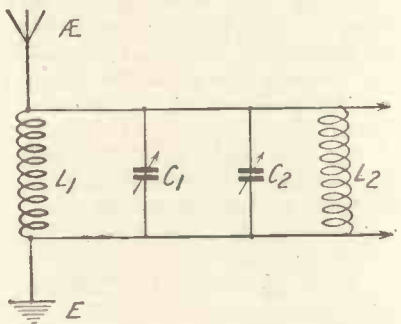


Fig. 3.—A circuit which acts similarly to that of Fig. 2.

of the main oscillation circuit, and in these circumstances the aerial, C1, L2, C2, C3, L1 and the earth form one single oscillating circuit, the wavelength of which may be altered by altering any of the inductances or capacities.

This raises a very interesting point which I have not seen raised before, and experimenting with the Fig. 2 circuit really brought the matter home to me. This circuit, at first sight, appears to be simply a tuned aerial circuit coupled to a tuned grid circuit L2 C2, reaction being introduced from the anode circuit of the valve into the circuit L2 C2.

It would, in most cases, be thought that the condenser C3 simply served as a coupling condenser between the two tuned circuits, and that all the merits of inductive coupling would be obtained. I have tried various sizes of the condenser C3 down to .0001 μF, and in all cases I found that the two circuits L1 C1 and L2 C2 acted together to produce what was virtually a single circuit. There was certainly no increase in selectivity, and any change in the condenser C1 so as to detune the aerial circuit could be compensated for by making a suitable change on the condenser C2. If, for example, C1 were increased, signals would disappear, but could be brought back again by reducing C2. The whole circuit acts very similarly to the arrangement of Fig. 3, which, of course, may be simplified into the arrangement of Fig. 4, which is the simplest of aerial tuning arrangements.

Size of Coils

Fig. 3, of course, is not intended to indicate a circuit equivalent to Fig. 2, but nevertheless the effects are very similar. For example, an increase of C1 may be compensated for by a decrease of C2, and the inductances L1 and L2 are, in Fig. 2, considerably larger than they would be if they were not acting in parallel with each other. Since they act in parallel, of course, the net inductance is smaller, and consequently larger coils are required than would otherwise be the case.

A Useful Example

A useful circuit embodying this method of feed-back is illustrated in Fig. 5, and it will be seen that a constant aerial tuning condenser C1 is provided. The coil L1 may be shunted by a variable condenser or not, but since the variable condenser does not make any difference, except as a duplicate method of tuning, it is omitted. In the Fig. 5 circuit a tuned anode circuit L3 C4 is provided, the crystal detector D and the primary T1 of the step-up transformer T1 T2 being con-

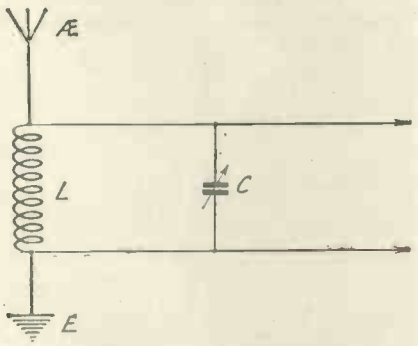


Fig. 4.—Simplified form of Fig. 3.

nected across this circuit. The variable condenser C2 governs the wavelength. The coils L1 and L2 may conveniently be of the same size, and for the reception of stations on the waveband 300 to 500 metres it will usually be found that the following values will serve.

The condenser C1, of course, has a capacity of .0001 μF, while L1 is a No. 75 Lissen coil, for example. The condenser C3 may have a capacity of .0003 μF, while C2 has a maximum capacity of .0005 μF. The inductance L2 is another No. 75 plug-in coil, while C5 has a capacity of .001 μF. The anode inductance L3 is a No. 50 plug-in coil for wavelengths up to 420 metres, and above this wave-

(*Continued in col. 3, page 423.*)

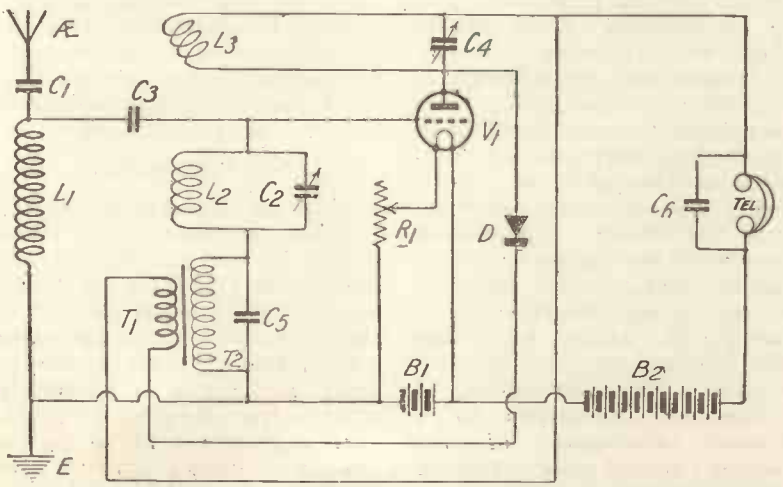


Fig. 5.—A useful circuit with constant aerial tuning embodying the feed-back system of Fig. 1.

Dame Clara Butt at the microphone.

5XX AT WORK

A VISIT TO THE HIGH-POWER EXPERIMENTAL STATION OF THE BRITISH BROADCASTING COMPANY.

UPON the occasion of the recent recital given by Dame Clara Butt from the new high-power broadcasting station, the transmitter and studio were for the first time thrown open to Press inspection by the courtesy of the British Broadcasting Company. I had, in consequence, the privilege of inspecting the whole station from microphone to aerial, and I think my feelings may best be compared to those of Sinbad in the Valley of Jewels; here before me was fascinating experimental work of all sorts going on, and it seemed that almost unlimited interesting information was to be had for the asking, yet I had only one head in which to carry it away. Before attempting to reduce my impressions to a coherent description of the station, I should perhaps explain that the present arrangement of 5XX is a purely experimental one, and does not in any way represent the final form of the station. Even its location should not be assumed to be the present one, since it is possible that it will be moved from Chelmsford to some other similar position outside London when once the preliminary experiments are over, and permission has been obtained from the Postmaster-General to erect the permanent station.

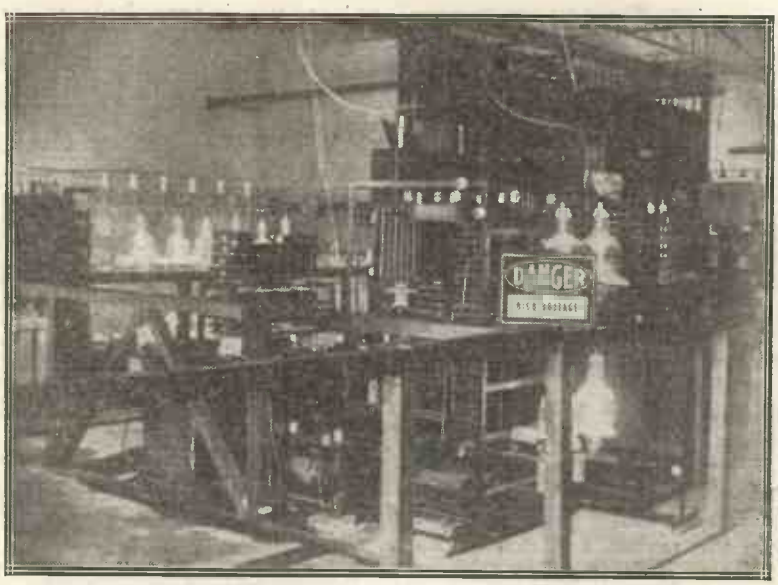
The Transmitter

Since the station is regarded as entirely temporary, the transmitter is laid out without any attempt to reproduce the sound engineering qualities of one of the permanent stations, the whole aim of the engineers in charge being at present to produce a plant which will enable the necessary experiments to be carried out with the minimum of expense. So experimental is the installation, indeed, that certain of the main feed switches are arranged upon a temporary switchboard attached to a pillar, and from the handles of the switches cords are led through pulleys to a handrail, beside which an attendant is constantly standing, with his hand ever ready to jerk the switches open by means of the cords should any mishap occur in the transmitting plant itself. The cords are necessary, of course, in view of the fact that with the very high voltage input heavy arcing is liable to take place on these switches, which would be liable to cause injury to anyone opening them by hand. Incidentally, this arrangement led to a somewhat amusing episode, which occurred during my visit to the station. This was responsible for the momentary break in a transmission which listeners may have noticed.

A Startling Incident

During the mild confusion brought about by the influx of the Press representatives to the shed containing the transmitter, one of the photographers entered, and set up his camera in a distant corner. Presently he ignited his magnesium powder with somewhat startling effect, since the spectators had not noticed his arrival, and consequently were quite unprepared for the sudden small explosion and blinding flash of light, accompanied by the sound of small fragments scattering across the floor, which signified that he had exposed his plate. The engineer at the switchboard was similarly unprepared, and the flash of the magnesium powder was followed practically instantaneously by the clatter of the switches as he jerked at his

Intimate details of the working of the new station are given below by "Wireless Weekly" special representative, who visited the station recently.



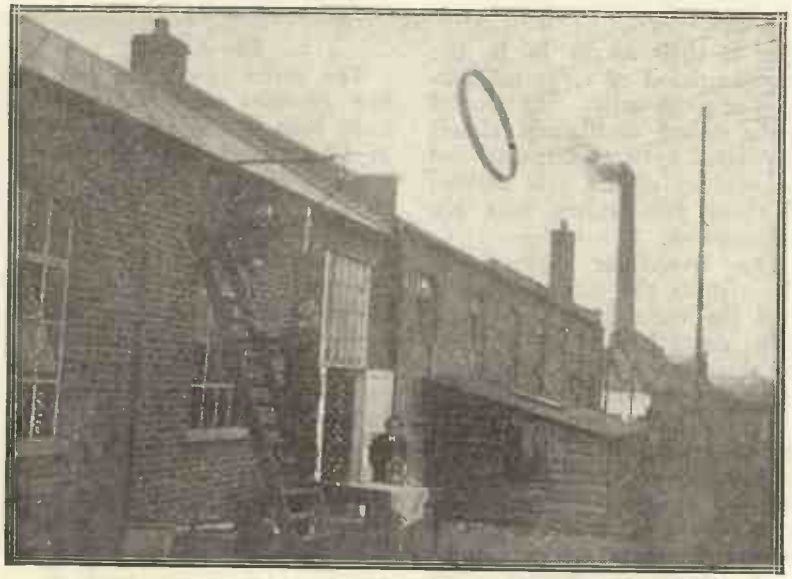
In the foreground is the drive oscillator (bearing the word danger). The main bank of rectifying valves and the closed circuit condenser are visible in the background.

cord. He realised almost instantly, of course, that he was the victim of an unintentional practical joke, and swiftly closed the switches again, so that the break was only short.

The Studio

The studio itself, which is, of course, only of a makeshift nature, is situated in the main buildings of the Marconi's Wireless Telegraph Company's works, in what I took to be the board room. An inner wall of hanging felt has been erected in this room, the floor and ceiling being similarly covered. There is thus a space, perhaps five feet wide, left all round the felt wall, but inside the main wall of the apartment. The microphone is of the now familiar type devised by Captain Round, and first used at 2LO. It is mounted in the usual soft rubber saddle and supported upon a movable tripod. It was placed for the recital in one corner of the inner enclosure, and the grand piano occupied a position near the middle of the opposite side. The singer was placed at a considerable distance from the microphone itself.

The leads from the microphone are taken out into a small passage outside the board room to one of the portable speech amplifiers commonly used for the broadcasting of operas and plays. The first check on the quality of the speech currents takes place on this amplifier, and controls are provided for adjusting the relative prominence of high and low notes.



The cage lead-in at 5XX, showing the lead-in insulator.

The Control Room

The output from the speech amplifier adjacent to the studio is taken to a hut at a distance of about 100 yards from the main building, where the usual control room has been established. Here the output is subjected to further amplification to bring it up to the required strength for application to the modulator valves, and the main checking of the quality of the speech currents is done. The principal impressions of the visitor here are of rows of power-amplifying valves, apparently being worked in parallel, most of them with their anodes glowing with a cheerful red heat. A loud-speaker is provided here which can be fed either with the speech currents which are being handled by the amplifiers, or by a frame aerial receiving set in an adjacent room, which enables actual comparison to be made of the quality of the speech currents applied to the transmitting set, and of the actual transmitted signals. This loud-speaker was arranged with its trumpet near one of the windows of the hut, and the majority of the visitors heard the recital with its aid.

In the control room also is located the telephone for communication between the studio and the control room, the control room and the transmitting room, and the control room and Savoy Hill.

The Transmitter

The whole of the transmitting plant is contained in one large shed, from alternating current generator to aerial tuning inductance. One's first impression on entering the shed is of the roar of revolving machinery, the blinding glare of banks of enormous valves, and the splashing and trickling of water. This latter is discovered upon investigation to proceed from the cooling system of the main oscillator and modulator valves, which are of the recently developed water-cooled type.

The main power supply for the transmitter is a converter consisting of a motor running direct from the mains, and driving an alternator generating current of 300 cycles per second. The output from this alternator is then fed through a step-up transformer, and supplied to a bank of 12 rectifying valves. The output from these valves after being suitably "smoothed" appears as a direct current of 9,000 volts, which forms the main high-tension supply.

The Circuit

The circuit is precisely the same as that employed at 2LO—that is to say, a master oscillator system is employed, in which a small local oscillating circuit is used, to generate high-frequency oscillations of the desired frequency, which are then amplified by a further bank of valves, and applied either directly or through a loose-coupled arrangement to the aerial circuit. The "drive oscillator," as it is called, consists of two rectifying valves, supplying the current for two large transmitting valves of a type known as the M.T.7A., whose filaments are supplied with 24-volt current, and which give an output of approximately 3.5 amperes of high-frequency current to the main amplifying valves. The 4 valves required for the drive circuit are mounted upon one panel, with the necessary controls, the usual standard inductance with ball reaction coil being employed. The condenser is of the air dielectric type, and the total power in the drive circuit can be taken as 6 kilowatts.

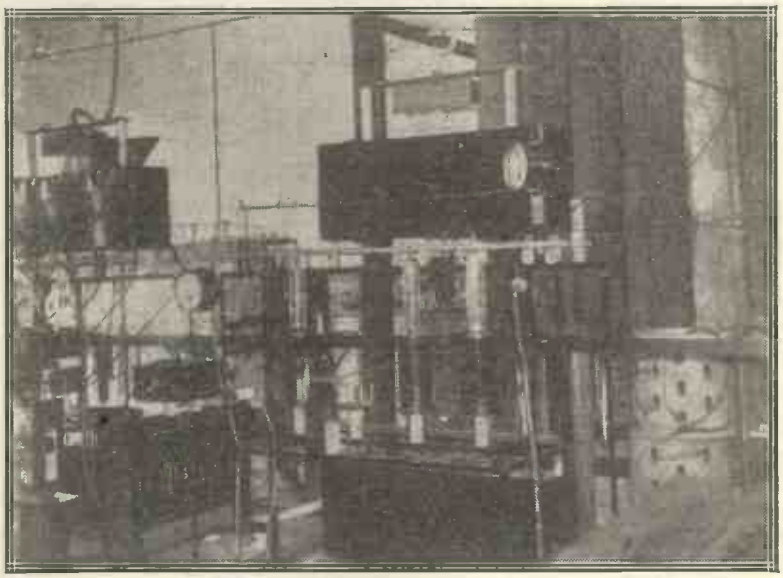
The output from the drive is taken to the two magnifier valves, which are of the water-cooled type. These two valves together then increase the high-frequency energy to between 15 and 16 kilowatts, transferring it to a closed oscillatory circuit, whose condenser consists of a great bank of plates separated by air. This bank is decidedly reminiscent of the huge one which was employed at the old spark station at Clifden, Ireland, for trans-Atlantic work, and consists of nearly 30 plates approximately 8 feet by 5 feet, spaced about 1 foot apart, and hung beneath the roof of the shed.

The filament voltage of the magnifier valves is in the neighbourhood of 40 volts, and the input to their anode is in the neighbourhood of 1,700 milliamperes at 9,000 volts. The current in the closed oscillatory circuit was stated to be 25 amperes, and the reading of the grid current of these two valves was 200 milliamperes.

The modulator valves, to whose grids the output currents from the main speech amplifier in the control room are applied, are three more Marconi-Osram water-cooled valves, whose filaments are supplied with 48-volt current. The anode current of these valves is again 1,700 milliamperes at 9,000 volts, and a most enormous negative bias is applied to their grids. Some most interesting figures were given to show the relative strength of modulation of different types of transmission, the following examples being some of the most striking.

Nature of Transmission.	Relative Strength.
Speech.	12
Music.	20
Savoy Bands.	25
Big Ben.	30

The main aerial tuning inductance is composed of stranded cable, which appeared to be about ¾ in. thick, and the reading of the aerial ammeter was in the neighbourhood of 40 amperes, the actual power at the time being 16 kilowatts. A direct earth is used.



The large water-cooled valves are used as magnifiers and as modulators

The Aerial

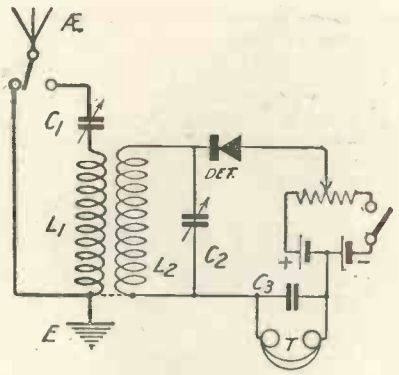
The aerial is carried on the two 450-foot steel masts which have been in use for some time at Chelmsford, and consists of a single cage of the "L" type, its natural wavelength being between 1,300 and 1,400 metres. The actual length of the horizontal span is considerably less than the distance between the masts, and consequently the down lead can be kept well away from the mast at one end, with a view to reducing absorption effects in the mast itself. The down lead is also of cage formation, and comes down to a leading-in insulator made of porcelain of truly impressive dimensions.

G. P. K.

Practical Back-of-Panel Wiring Charts

A Carborundum Crystal Receiver

By OSWALD J. RANKIN



The Circuit.

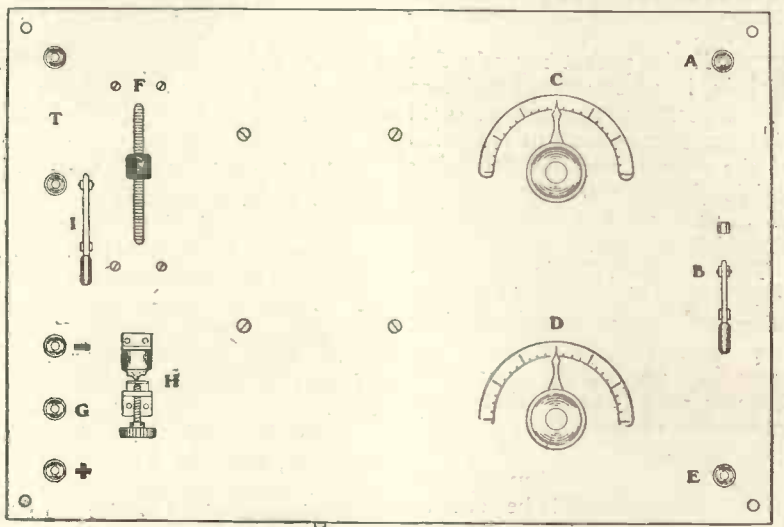
THIS is a simple crystal receiver employing a loose-coupler, vario-coupler, or basket coils. B is a single pole, double throw switch for earthing the aerial direct when the receiver is not in use. The variable condenser C has a capacity of 0.001 μF, and is connected in series with the aerial tuning inductance P. The secondary coil S is tuned by the variable condenser D, whose capacity is 0.0005 μF. H is the carborundum detector and F the usual potentiometer of about 400 ohms resistance. The single pole, single throw switch I is optional, but if not used, the batteries added externally to the set should be disconnected when the receiver is not being used. Its purpose, of course, is to switch off the current which would otherwise flow through the potentiometer unnecessarily. Across the telephone terminals T is connected the condenser J of 0.001 μF, and this may be conveniently fixed as shown.

As regards the external batteries, two dry cells may be connected in series, a negative terminal of one being joined to a positive terminal of the other, the remaining two terminals being connected to the minus and plus terminals on the set. From the point where the two cells are joined a tapping is taken and connected to terminal G.

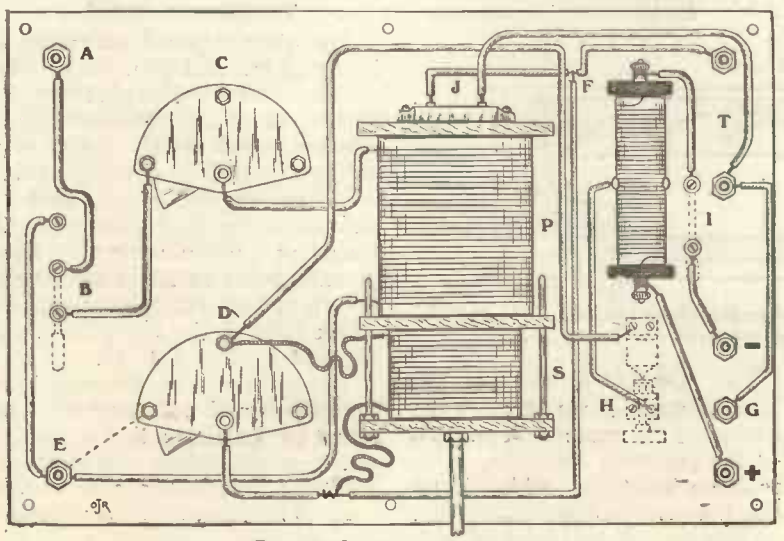
Tuning is carried out by adjustment of the variable condensers C and D, and by variation of the coupling between P and S. The simplest method is to couple the two coils closely to commence with, and tune first on C, and then on D, the coil coupling being varied when interference is experienced.

To adjust the detector correctly first place the potentiometer slider in the centre and apply more pressure to the crystal than is usual with the ordinary detector. Having received signals, vary the potentiometer slider for loudest results. A little experimenting is advisable.

Slightly better results are sometimes obtained by making a permanent connection between the earth terminal and the variable condenser D, as illustrated by a dotted line on the wiring chart.



The lay-out of the Pahel.



Practical wiring diagram.

□ □ □

PERSONAL

We are given to understand that Mr. W. H. Lynas, of Messrs. Alfred Graham & Co., sailed from this country for New York on July 26, and we have been asked to point out that readers wishing to communicate with him after that date should address their correspondence to the Company.

Utilising .. Valves .... to Best ... Advantage

HOW TO MAKE A USEFUL GRID BIAS UNIT.

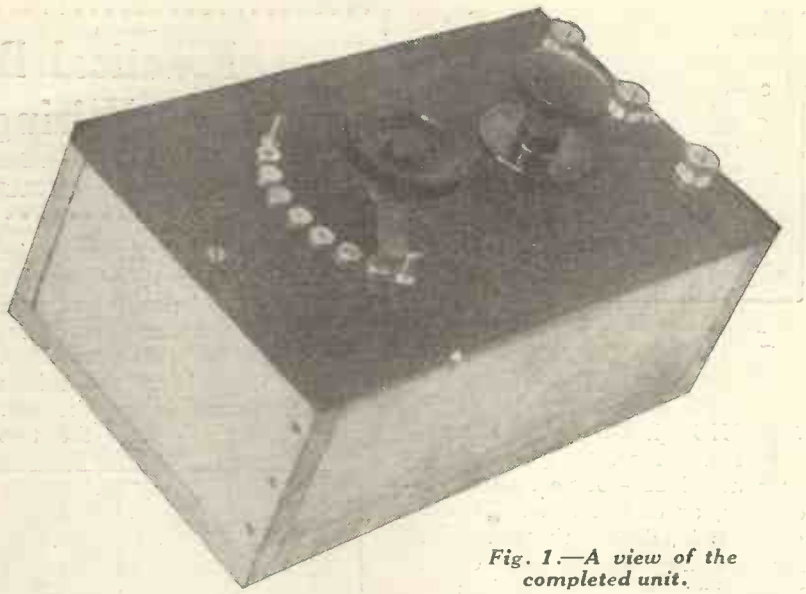


Fig. 1.—A view of the completed unit.

FOR the purest reproduction in low-frequency amplifiers a certain amount of grid bias must be applied to the grids of the valves, and the following article gives constructional details of a neat method of obtaining variable grid bias.

The compact little unit described may be applied to any set using low-frequency amplification, and since the connections and operation are simple, the constructor need have no theoretical knowledge of the subject to use it with success.

The box is made of wood $\frac{3}{8}$ in. thick, which should be cut as follows :—

From a piece $2\frac{1}{4}$ in. wide cut the two end pieces each $4\frac{1}{4}$ in. long, and from the same width cut two pieces 8 in. and $7\frac{1}{4}$ in. long respectively. These two latter are the sides, the longer being fixed later to one of the end pieces by means of a small hinge so that the interior will be easily accessible.

The base is 8 in. long and $4\frac{5}{8}$ in. wide.

The two end pieces are now fixed to the base as in Fig. 2 (*a*), by means of small screws or nails. It should be noted that these end pieces are flush with one side of the base, thus leaving a space of $\frac{3}{8}$ths of an inch on the other side.

Two pieces of $7\frac{1}{4}$ ins. long are now cut, one 3 in. wide, the other $1\frac{1}{4}$ in. wide. *These two pieces are joined at right angles, so that the wider piece has the thickness of the other piece added to its length, as in Fig. 2 (b) and (c).*

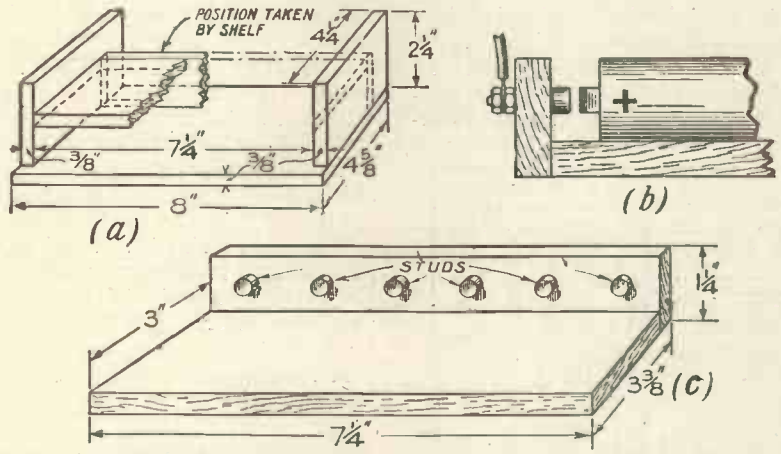


Fig. 2.—Details of the containing box, showing the positions of the studs, and the method of making contact with the batteries.

Contact Studs

Six contact studs are to be inserted in the smaller piece. To find the positions for these, three flashlamp batteries, which comprise the grid biasing battery, are laid side by side, negative to positive, on the wide piece, and with their terminal strips touching the smaller piece.

The six studs are now fixed in position so that each stud makes contact with a different terminal strip of one of the batteries. It will generally be found advisable to snip off a small portion of each negative terminal (the longer strip, if not marked otherwise) in order to ensure good contact between terminal strip and stud, and to prevent possible short-circuiting.

The ledge is now fixed between the ends of the box in the position indicated in Fig. 2 (*a*), $\frac{7}{8}$ths of an inch above the base, and with the studs in the lower section. This section is now complete except for the insertion of the flashlamp batteries.

The Ebonite Panel

The ebonite panel measures 8 in. by $4\frac{5}{8}$ in., and $\frac{1}{4}$ in. thick. As will be seen by the photograph, Fig. 1, there are two controls; a selector switch which varies the voltage used from 0 to $13\frac{1}{2}$ volts in steps of $4\frac{1}{2}$ volts, and a potentiometer, in this case one of Burndept manufacture. This potentiometer varies in extremely minute stages, the voltage applied to the grid of the valve from the filament heating battery.

The positions on the panel for the switch and potentiometer are found by drawing a line down the centre of the panel, and marking points at $2\frac{1}{2}$ in. and 5 in. from one end. The former is the position for the potentiometer, and the

latter is that of the selector switch. This latter should be placed temporarily in position, the arm pointing to the nearer end of the panel. The arm is now depressed until it touches the panel, and is then moved round to about 2 in. from the centre line, then back again to a similar distance

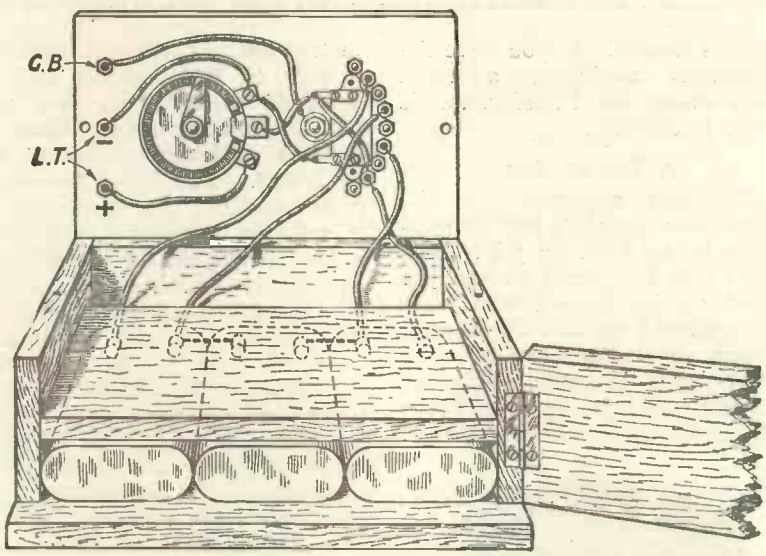


Fig. 3.—The internal wiring of the unit, showing connections to the batteries. Note the dead studs of the selector switch.

on the other side, using enough pressure to leave a mark on the panel. This procedure for finding the positions for the studs is advisable rather than following definite measurements, as the arms of different makes of switches vary in length. Seven studs of 5/16th in. diameter are to be inserted with their centres $\frac{3}{8}$th of an inch apart, and these distances are marked off *along the line made by the switch arm, the*

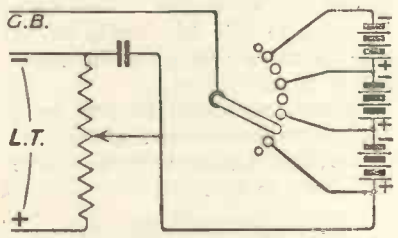


Fig. 4.—A circuit diagram showing how to wire the unit.

centre stud occupying the point where this line crosses the centre line of the panel. The potentiometer, which must be of the rotary type, is easily assembled, and there remains but the wiring up of the components. This is easily accomplished by referring to Fig. 3, or Fig. 4, in which the connections are clearly seen. A fixed condenser of .0003 μF capacity is connected, as shown, in order to by-pass any high-frequency currents which may be flowing in the circuit.

Dead Studs

It will be noticed that the second, fourth and sixth studs of the selector switch are left dead. This is necessary, as short-circuiting of parts of the battery would take place as the arm moves if each stud were connected to the battery.

Joints may be soldered or made by means of lock-nuts, according to the ability of the constructor, the former method, of course, being preferable.

Fitting the Panel into the Box

The panel may now be screwed to the box providing the potentiometer spindle does not press on the shelf. If this occurs a hole large enough to take the spindle without friction is bored in the shelf. With the panel in position, the sides, which have until now been omitted in order to facilitate securing the wires to the battery studs, are fixed in position, the longer one, as mentioned before, being fastened by means of a hinge.

Securing the Batteries

Since flashlamp batteries vary somewhat in size it may be necessary to insert some cardboard strips, which have been soaked in paraffin wax, behind the batteries, so that they will be pressed tightly against their studs when the hinged side is closed.

The instrument is now mechanically complete, the polishing or varnishing being left to the reader's taste.

Fig. 5 is a circuit diagram of the grid bias unit in use with a low-frequency amplifier. When more than one stage of low-frequency amplification is used, the unit will effectively apply negative potential to the grids of two or even three valves, providing that these are of the same type.

Alteration to Existing Amplifier

Only one alteration to the amplifier is necessary, and this is the breaking of the connection between one side of the transformer secondary winding and the valve filament. This transformer lead is connected to the terminal G.B. of the grid bias unit, preferably, by means of a terminal which should be mounted on the amplifier for this purpose. The terminals L.T.– and L.T.+ are merely connected to the corresponding terminals on the filament battery or on the set.

A considerably higher anode voltage must be applied to the valves when using grid bias.

Assuming that a 6-volt accumulator is used in conjunction with a bright emitter valve, as in Fig. 5, with 4 volts across its filament,

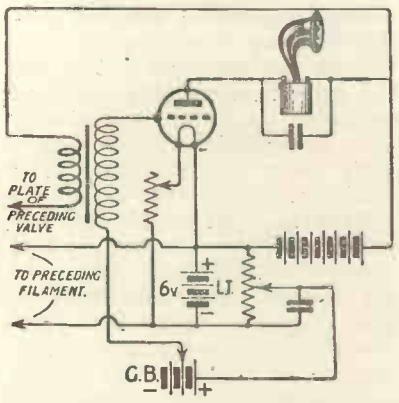


Fig. 5.—A diagram showing how the unit is connected up to an existing amplifier.

and with the rheostat in the negative lead, the negative terminal of the accumulator will have a negative potential of 2 volts with respect to the filament. Thus with the switch cutting out all the batteries in the unit and with the potentiometer slider as its extreme negative end, the grid has

(*Continued in Col. 3, Page 419*)

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

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

THE "D coil" receiver, which was described in *Wireless Weekly* recently, appears to have interesting possibilities. Some readers may wonder whether, in a coil wound to have so little external field, the total inductance may be comparable with a coil of the same diameter wound in ordinary solenoid form. For the purpose of finding to just what wavelength such a coil will tune, I wound a specimen from the data given by the inventor. If you will refer to the article you will see that it consists of ten turns for one winding and forty for the other on a 3 in. former. The ten turns of the smaller coil and ten of the larger are wound simultaneously, the four ends of the coils being brought out to suitable terminals.

Practical Tests

Using the ten turns as an aperiodic aerial coil and the forty as the secondary winding of a crystal receiver (a variable condenser being shunted across the coil in the usual way) I tested the coil on an ordinary aerial to find what would be the minimum and the maximum wavelength with .0003 μF condenser. The minimum turned out to be 180 metres and the maximum 450 metres. With a .0005 μF it was possible to include 600 metres in the range. The inductance is thus slightly larger than one would obtain with the same number of turns wound in the conventional way upon an ordinary former of the same diameter.

Transformer Data

It is surprising how few experimenters trouble to base the opinions they so freely express upon a sound foundation of measurement. Take, for example, the question of inter-valve L.F. transformers. How many experimenters trouble to make an accurate comparison between the various makes? If you have the apparatus available, a rapid comparison of transformers is most interesting.

A Testing Box

My own apparatus for the purpose consists of a box measuring 9 in. by 6 in. by 5 in. deep, fitted with an ebonite panel. This panel carries three knobs, each controlling a switch. The central switch is a four-pole two-way type, while the other two are the two-pole two-way type. There are, in all, fourteen terminals on

The experimental D Coil.

the panel, a row of eight along the back, two on the left, two on the right, and two in front. The row at the back is marked "IP, OP, IS and OS" in duplicate. The pair of terminals on the left are connected to the receiver. Those on the right are for connection to a valve panel. The pair of terminals in the front belong to a grid biasing battery, so that the valve used may be suitably adjusted on its curve.

The central switch changes the receiver from one transformer to the other, all four connections being altered at once. The switches on the left and right serve as reversing switches for IP and OP and IS and OS respectively. For operation the instrument is connected up with a pair of transformers (one a standard transformer, the capabilities of which are well known), and the other the transformer to be tested. The input terminals of the test box are connected to a suitable receiver. The two output terminals are joined to a single-valve panel and, of course, the necessary grid bias applied by means of the terminals provided. A station is then tuned in, accurate adjustment of filament and plate voltages being made on the valve panel. A turn of the knob in the centre then removes the first transformer and substitutes the second, while a turn of the left- or right-hand knob soon establishes which way the transformer works better (IS or OS to grid and IP or OP to plate).

Single Stage Work

If you intend to use only one stage of transformer coupled note magnification on a crystal receiver, you will probably not find a great deal of difference in the various makes of transformers. If, however, you desire to use two stages you will find there is a great difference. It is here that the cheap and shoddy transformer shows up so badly. One may seem quite fair by itself, but a pair of them will give the most irritating distortion.

When transformers are used with valve detectors a change of valve often makes a considerable difference in quality.

An Important Difference

The average crystal has a fairly low impedance, and may work very well indeed with a transformer, the primary of which has far too low an impedance for the average valve. To get the very best results the impedances of valve and transformer should be matched, which means, of course, that all valves will not work equally well with the same transformer.

A Novel Crystal Detector

ONE of the chief drawbacks of most crystal detectors is that they are too easily set out of adjustment by a slight knock or other cause, and many of them require a good deal of adjustment before a sensitive point is found. Carborundum in contact with a steel plate is perhaps the least troublesome of ordinary crystal detectors, but

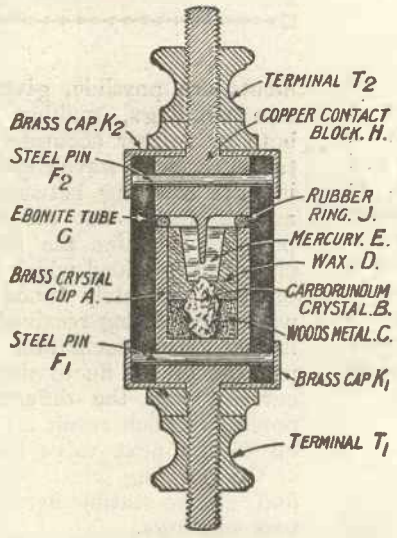


Fig. 1.—A sectional view of the detector, showing the construction.

even this type has its disadvantages. If the crystal point is allowed to scrape on the plate it is likely to be spoilt, and in its usual form the crystal and contact plate are exposed to the atmosphere and dust.

The detector about to be described was devised to overcome these defects, and it gives very good results.

Its main features are a carborundum crystal in contact with mercury enclosed in an air-tight space.

The mounting of the crystal in the cup calls for special attention. The crystal is first fixed in position with a little Wood's metal in the usual way, as shown in Fig. 3 (a). It is then necessary to cover the crystal and the inside of the cup with insulating material, leaving only the point of the crystal exposed for making contact with the mercury. This is accomplished by filling the cup with wax, while holding a tapered soft metal plug firmly on the point of the crystal, as shown.

The stem of the cup may be held in the vice while the plug is held in place with the left hand, and the filling done by pouring the melted wax from a small tin held in the right hand. The wax must be allowed to set firmly before removing the plug. Fig. 3 (b) shows the completed crystal cup. On removing the plug a small cavity will be left with the crystal point exposed at the bottom.

In assembling the detector, the cup is first of all inserted in one end of the ebonite tube and the pin inserted to hold it in position. The brass cap and terminal are then fitted. The tube is then held vertically and the wax cavity filled with mercury. The rubber ring is next put in place and the copper contact piece inserted.

The rubber ring should be of sufficient thickness to necessitate a little pressure being exerted on the copper contact before its fixing-pin can be inserted. This will ensure that the cavity containing the mercury will be leak-proof.

The pin having been inserted, the brass cap and terminal are fitted and the detector is complete and ready for use.

It may be remarked that it is advisable to test the crystal itself for sensitivity with an ordinary steel contact before mounting in the detector described.

It is, of course, necessary to use a battery and potentiometer

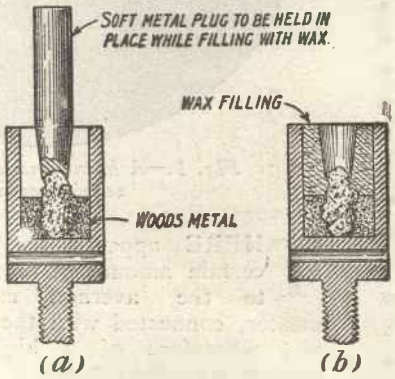


Fig. 3.—The crystal cup, showing method of fixing the crystal.

in conjunction with carborundum detectors to secure maximum sensitivity.

T. A. LEDWARD.

ERRATUM.

We are asked to point out that in the advertisement columns of our last issue, the address of Messrs. W. Molback was wrongly given, the correct address being 24, High Holborn, W.C.1.

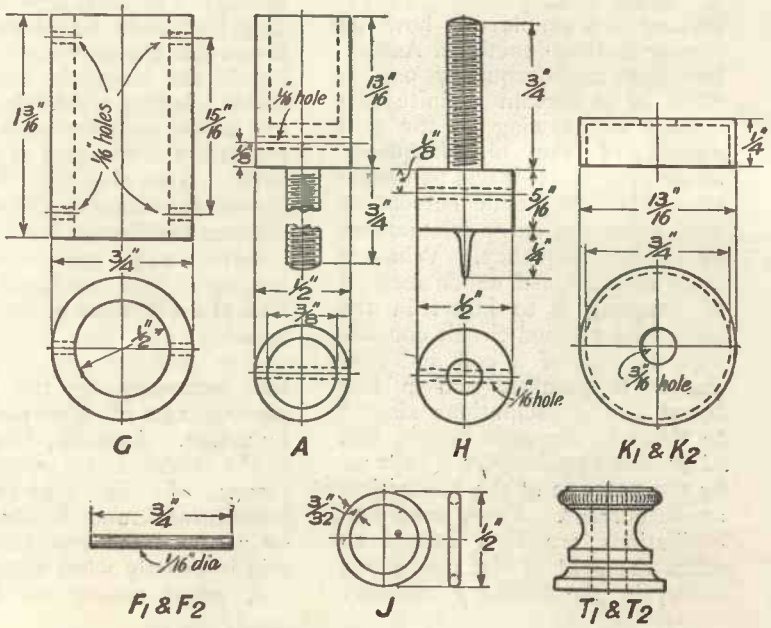


Fig. 2.—A detailed diagram showing the construction of the necessary parts.

High-Frequ

By G. P. KENDAL

In view of the increasing p transformer, the following a and use of these instrument

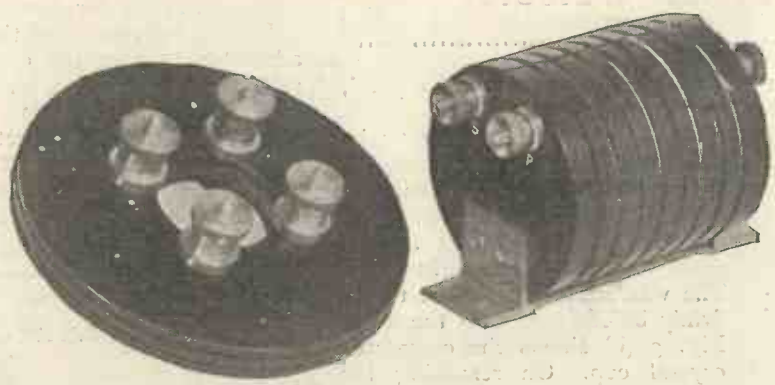


Fig. 1.—A home-made transformer of the disc type, and a semi-aperiodic "barrel" transformer.

THERE appears to be a certain amount of mystery, to the average experimenter, connected with the why and wherefore of a high-frequency transformer, but I hope to show in the course of these notes that it is a perfectly straightforward piece of apparatus, whose elementary theory is quite easily understood. True, there are mysteries connected with its behaviour, but they are not such as to affect the ordinary user.

The Tuned Anode Method

To anyone who understands the working of the tuned anode method of high-frequency amplification the transformer system will present little difficulty, and it should first, perhaps, be explained in a simple way how the former method functions. Assuming that high-frequency oscillations of a certain definite frequency are flowing in the grid circuit of the high-frequency amplifying valve, it will be understood that the anode current of that valve will carry fluctuations of similar frequency. What is done in the tuned anode method of coupling is to insert in the plate lead a tuned circuit consisting, usually, of a coil and condenser in parallel, and in this tuned circuit oscillations similar to those in the grid circuit, but of greater amplitude, are built up by the passage of the fluctuating anode current. These amplified oscillations are then caused to affect the grid of the succeeding valve, in the ordinary manner. The grid of the next valve is actually connected through a small condenser to the plate end of the tuned anode circuit, in order to prevent the high positive potential of the anode battery upsetting its functioning. Since a grid condenser must be used in this way, it follows that a grid-leak must also be employed, usually, to maintain the grid at a suitable working potential.

Action of a transformer

In its essentials, the high-frequency transformer functions in a very similar manner, the main difference relating to the method of handing the energy on from the anode circuit of the first valve to the grid of the next. Instead of making a direct connection through a suitable condenser, the high-frequency transformer performs this transference by including in the magnetic field of the anode winding a secondary winding whose ends are connected to the grid and filament of the next valve. Assuming that the transformer functions in the ordinary manner familiar in the case of a low-frequency transformer, the magnetic field produced by the flow of oscillations in the primary winding will then cause alternating voltages to appear in the secondary by the familiar phenomenon of electro-magnetic induction. Actually, this is one of the controversial points in the theory of the high-frequency transformer, and it should not be assumed too confidently that this is exactly what happens.

A great variety of arrangements are possible, given these two windings, making one or both or neither accurately tuned to the received wavelength, varying the coupling between them, and so forth, but the essential principle remains the same. A circuit is provided which is more or less accurately tuned to the wavelength being received, which is set into oscillation by the passage of the fluctuating anode current, and the differences of potential which result are passed on to the next valve by virtue of the coupling (electro-magnetic and electro-static) between the two windings.

Types of High-Frequency Transformers

There are three main types of high-frequency transformer at present in use, and since they have somewhat different characteristics and hence applications, it is desirable for the experimenter to understand in a general way how they work and

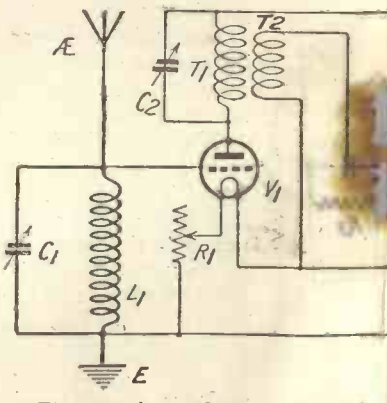


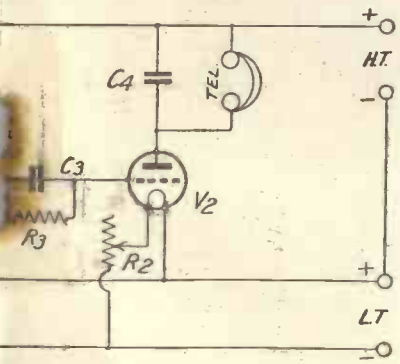
Fig. 3.—A 2-valve circuit with a

ency . . .
Transformers

L, B.Sc., Staff Editor.

opularity of the high-frequency le, which explains the action ill be of considerable interest.

how they differ from one another. The tuned type is the one which is now most commonly seen, and this is the simplest from the theoretical point of view. In one form not often used, but nevertheless capable of giving good results, the "transformer" can consist simply of two ordinary plug-in coils, tuned by two variable condensers, mounted upon a two-coil holder and more or less closely coupled together. This arrangement, of course, is exactly the same as that which is known as a loose-coupled tuner in which the coils are respectively the aerial and secondary circuit inductances. The two circuits must be tuned to resonance with the desired frequency, and the energy is handed from one to the other mainly by virtue of the magnetic coupling between them. When this arrangement is used as a transformer one of the coils is connected in the anode circuit of the high-frequency amplifying valve, and the other



"tuned primary" transformer.

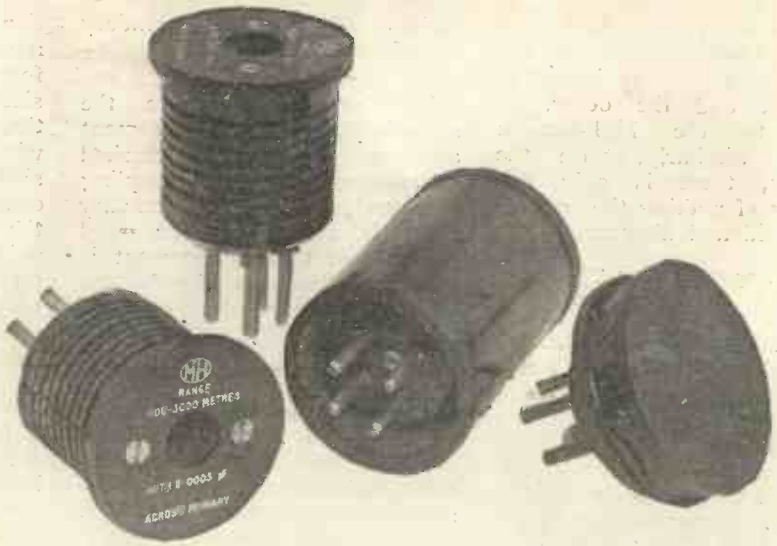


Fig. 2.—Various types of tuned transformers with plug-in mountings.

is connected to the grid and filament of the following valve. The general effect of varying the coupling is practically the same as in the case of the loose-coupled aerial and secondary circuit tuner, that is to say, that the closer the coupling the stronger the signals up to a certain point, and the weaker the coupling the greater the selectivity, with diminished signal strength.

Later Improvements

It will soon be found by the user of such an arrangement as this that tuning is somewhat difficult, and the whole device rather cumbersome. If experiments are made towards its simplification, it will be found that if the coils are placed exceedingly close together to secure the maximum possible coupling, the tuning condenser across one of the windings, say, the secondary, can be entirely dispensed with, with only a very slight diminution in signal strength. Two circuits which are exceedingly closely coupled, it is well known, can be tuned by means of only one variable condenser, and advantage is taken of this fact in the majority of present-day tuned high-frequency transformers. The two windings are commonly placed in narrow slots in an ebonite former, the actual winding being carried out in a more or less haphazard manner, the result forming what is known as a slab winding. Since exceedingly close coupling between primary and secondary appears in many cases to give improved results, one of the earliest successful tuned high-frequency transformer receivers employed transformers in which the two windings were run into the slot simultaneously, so that the two wires actually lay more or less side by side throughout the winding. Good results were obtained in this way, but the practical difficulties were considerable, since the insulation of these very fine wires is by no means robust, and leakages here meant short circuiting the high-tension battery.

A modification which was adopted to overcome this trouble is to wind on first the primary winding, then a few turns of silk to completely cover the wire, and then over this the secondary. Such transformers function quite well, but they have the practical drawback from the point of view of the experimenter that of all the various ways of connecting them up there is only one which gives proper results, and a number of others which give only poor results, so that it is sometimes exceedingly confusing to decide whether a given trans-

former is really doing its best. It is usually found that only one of the two windings can be employed as the primary, and that it is most essential that the correct end should be joined to the plate, and the other, of course, to the high-tension positive. Similarly, with the secondary, there is only one right way of making the connection to grid and filament.

The Separate Slot Type

The matter becomes very much simpler when the two windings are placed in separate slots side by side, with a narrow space of ebonite between them. When this is done, one winding can be adopted as the primary, quite arbitrarily, and it merely remains to reverse the connections to the two ends of this winding or alternatively of the secondary to obtain correct results. In the majority of cases this arrangement is now adopted, and in at least two well-known makes a number of slots are employed connected up alternately in series, primary and secondary, and it appears that the slight loosening of coupling which results is not really disadvantageous. Indeed, a deliberate further loosening is done in some cases by cutting the slots for the primary a little deeper than those for the secondary. It is difficult to see what advantage this can be without separate tuning of the windings, but the transformers in question certainly perform very well.

Tuning Arrangements

With any of these types it is possible to tune either primary or secondary, and there is little to choose between these two possibilities. The majority of those now upon the market are intended to function with a condenser across the primary, and their turn numbers are calculated accordingly. Nevertheless, the tuned secondary has some advantages, the principal one being a slight increase in the stability of the receiver when two or more stages are employed. When the secondary is tuned it is duly set into oscillation, of course, by the passage of the fluctuating anode current through the primary, and it would appear that there is a little less back-transference of energy through the valve in this case. This appears to be the reason for the slight gain in stability with the tuned secondary transformer.

Loose Coupling

The only case where the secondary tuning arrangement appears to possess marked advantages is where the coupling between primary and secondary is made variable, and a good example of this arrangement is that known as the Grebe C.R.13. In a good form of this circuit two plug-in coils are used for primary and secondary, two No. 75's being suitable for broadcast wavelengths. A variable condenser of .0003 μF can be connected across the secondary coil, and the two should be mounted upon a two-coil holder.

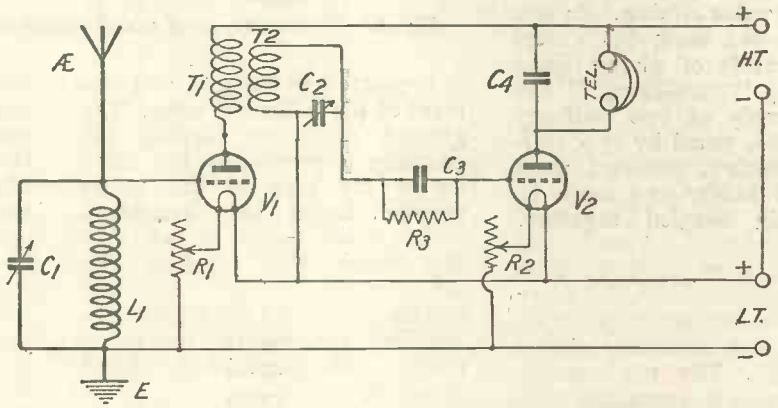


Fig. 4.—The connections of a "tuned secondary" H.F. transformer.

There appears to be definitely a best position for the primary coil with respect to the secondary, and a little care should be taken in adjusting the coupling. The principal advantage of this circuit appears to be that very little energy is transferred back through the inter-electrode capacity of the high-frequency valve to its own grid circuit, consequently there is no need to damp down the amplification obtained to prevent self-oscillation. In the case of two stages of high-frequency amplification this method can be employed, and is capable of giving wonderfully good results in fairly skilled hands, but, of course, there are a large number of variable factors.

Construction

The construction of high-frequency transformers of the tuned type provides a most interesting line of experiment for anyone possessing the means to carry out the fairly simple constructional work involved. A lathe is most desirable for the making of formers of various sorts and sizes, and given this appliance there is no reason why anyone with a certain amount of patience should not make some useful contribution to our knowledge of the subject. As a good starting-point for experiment, a transformer should be made capable of giving results equal to those of the best types now in use, and this can be done by either turning or obtaining ready turned an ebonite bobbin 2½ in. in diameter, ½ in. thick, and with two slots ⅛ in. wide and ¼ in. deep turned in its edge. These slots can be spaced apart about 1/16th in., that is to say, the dividing wall between them should be 1/16th in. thick, and about 80 turns of No. 40 s.s.c. wire in each will be found correct with a variable condenser of .0003 μF across the primary for wavelengths of 300 to 500 metres. Since rapid comparison is essential in working with high-frequency transformers, as indeed it is in the majority of wireless experiments, it is desirable to adopt the convenient convention of mounting the transformer with four valve pins in its centre, to plug into an ordinary valve socket. Transformers of all sorts are thus interchangeable, so long as the same scheme of connections is adhered to, and one can always instantly compare any new developments which one may produce with the standard. Also, of course, rapid changes of wavelength become possible.

(To be continued)

A Double Purpose Voltmeter

MOST of us use a voltmeter either for testing the condition of the filament battery or for discovering the E.M.F. most suitable for the filaments of various types of valves; but comparatively few people ever bother to measure the amount of grid-biasing voltage applied to their low-frequency valves, being content to use flashlamp batteries for the purpose and to reckon them always at 1.5 volts per cell. This is unsatisfactory, for two reasons: in the first place, voltage falls off when the battery has been in use for some time, even though the current drawn from it is of tiny proportions, and secondly, no account is taken of the voltage drop through the filament rheostat. A simple method of using a voltmeter which is not mounted on the set for measuring both grid and filament potentials is shown in Fig. 1. Leads from the filament busbars are brought to one pair of terminals, whilst to another pair are taken leads running from the negative leg of the filament and from the I.S. of the transformer secondary. With some voltmeters it does not

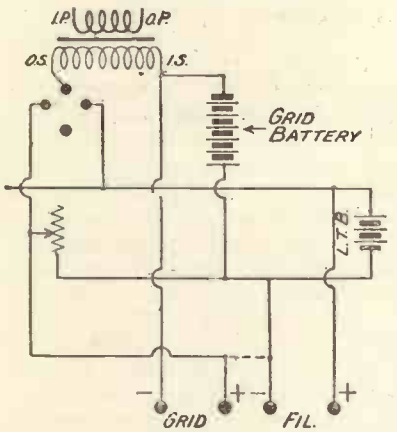


Fig. 1.—The internal wiring necessary when a voltmeter is used outside the set.

matter in which direction current is passed through them, as they have a central zero mark, but other instruments have terminals marked plus and minus and read only if current flows in the right direction. If terminals are arranged and marked, as shown in the drawing, readings can be obtained in a moment of either grid or low-tension potentials. The low-tension reading in this case will show the E.M.F. of the accumulator. If it is desired to be able to read the voltage applied across the filament of the valve, then the negative-filament terminal should be connected (as dotted) to the negative leg of the valve instead of to the busbar lead.

Where the voltmeter is mounted on the set a rather more elaborate arrangement will be necessary.

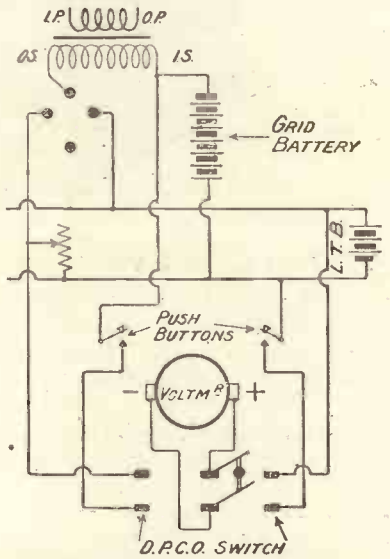


Fig. 2.—Showing how to wire up when the voltmeter is mounted upon the panel of the set.

Fig. 2 shows how this can be done quite neatly. Two small push-buttons are mounted one on either side of the voltmeter, and either above or below it is placed a double-pole change-over switch of the midget type. When the switch is brought over towards the right, pressure upon the right-hand push-button will cause the instrument to record the E.M.F. of the low-tension battery. By throwing the switch over to the left the other push-button can be used to obtain the grid voltage reading. Here again the low-tension voltage reading will be that of the accumulator. If it is desired to obtain the filament reading the right-hand push-button must be wired into the lead from the negative leg of the valve as previously indicated, by disconnecting the push-button from the negative lead to the accumulator, and connecting it to the negative leg of the valve filament.

R. W. H.

Utilising Valves to Best Advantage

Continued from page 413.

a negative potential of 2 volts with respect to the filament. This voltage can be changed to 4 volts + by rotating the potentiometer knob until the slider is at the other end of the resistance. Only the negative part of this variation is of any use, however, but by switching in one flashlamp battery by placing the switch arm on the third stud, a variation between $6\frac{1}{2}$ volts – and $\frac{1}{2}$ volt – is obtainable. With the arm on the fifth stud, the variation is from 11 volts – to 5 volts – and by switching over to the last stud variation between $15\frac{1}{2}$ – and $9\frac{1}{2}$ volts – may be obtained, this being for use only with very high anode potential.

The particular voltages given apply only when the valve is used under the conditions mentioned; but regardless of the voltage allowed across the filament, providing a 6-volt accumulator is used, any voltage between zero and $13\frac{1}{2}$ – may be applied to the grid of the valve in the manner described.

Should a 4-volt filament heating battery be used or one of lower voltage in conjunction with dull emitter valves, a continuous variation of the grid potential will not be obtainable. The lower the voltage of the filament battery, the greater will be the gaps between the variations. This is owing to the fact that the difference of potential across the gaps is equal to the voltage across any two consecutive tappings of the biasing unit ($4\frac{1}{2}$ volts) minus the voltage of the filament battery. Thus to avoid these gaps it will be seen that the filament battery should have a voltage of not less than $4\frac{1}{2}$ volts. Using a 4-volt battery, however, the gaps which are of only $\frac{1}{2}$ a volt, may be easily compensated for by adjustment of the anode potential.

How Every Crystal User may become a Valve Expert

By E. REDPATH,
Assistant Editor.

Continuing from last week's instalment, the present article explains how reaction may be employed and gives constructional details of a complete receiving set embodying the principles dealt with so far.

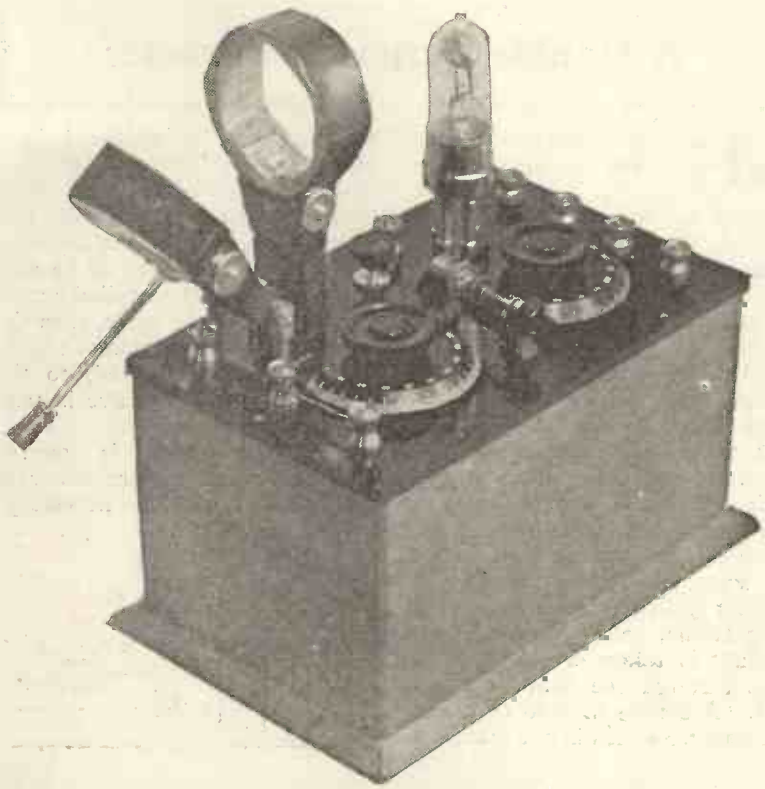


Fig. 1.—A photograph of the complete receiver described in this article.

Introducing Reaction

BY slightly modifying the arrangement described in the last article, as indicated in the circuit diagram, Fig. 3, it is possible to make use of the principle of reaction. Referring to Fig. 3, it will be seen that, in addition to the aerial tuning inductance L1, and the original anode-tuning inductance L2 (part of an original crystal receiving set), a further inductance, L3, has been introduced in the anode circuit of the valve.

As it is necessary that L3 should be variably coupled with the aerial tuning inductance L1, a very convenient method would be to remove the single fixed coilholder from the baseboard of the apparatus illustrated in the previous article, and substitute a two-coil holder provided with the usual ebonite knob or lever, by means of which the angle between the coils may be varied. In this case, the coil L3 may conveniently consist of a No. 35 or No. 50 plug-in coil.

A pictorial representation of the suggested arrangement is given in Fig. 4, and the action involved is as follows:—

The high-frequency pulses of anode current, which, in the oscillatory circuit L2, C2, build up to fairly powerful oscillations, are now made to traverse the coil L3. If this coil is coupled to the aerial tuning inductance L1 in the *correct direction as regards their respective windings,* the effect will be to strengthen the oscillations in the aerial circuit, thus causing increased changes in grid potential, and consequently more powerful anode pulses with oscillations of greater amplitude set up in the circuit L2, C2, and louder signals in the telephones T.

If the coupling between the coils L3 and L1 is increased unduly, by bringing them too close together, the strengthening effect will be such as to cause the whole system to become unstable and to actually *generate* oscillations.

A Precautionary Rule

This point must be most carefully watched, as the radiation of energy from the aerial, which occurs when the set is oscillating, is certain to cause interference with adjacent receiving stations.

It is thought that it may be taken for granted that no reader will wish to interfere with any neighbouring receiving station by using reaction in a manner not only contrary to the terms of his licence, but which must of necessity impair the clarity of his own reception.

A safe plan is to make a rule never to increase the reaction coupling sufficiently to cause the received speech, music, etc., to lose its natural quality and tone.

A Complete Receiver

The photograph, Fig. 1, shows a receiving set complete with valve and plug-in coils. Fig. 2 is another photograph of the same set with the coils and valve removed to show more clearly the arrangements of the various components.

In this one set are embodied the various principles explained in the beginning of this present and preceding articles. The valve functions as a high-frequency amplifier and incoming signals, after undergoing one stage of high-frequency amplification, are rectified by a crystal detector.

By this arrangement, signals which would be quite unable to actuate the crystal detector *direct,* may be made to give clearly audible signals in one or two pairs of telephone receivers, a result which could not possibly be obtained by using one or even more valves as low-frequency amplifiers following a crystal set.

The Results Obtainable

With the set as illustrated, used in conjunction with a good outdoor aerial, perfectly clear speech was received from several

of the British broadcasting stations, also from Chelmsford, Radiola, Paris, Brussels, the Hague and Amsterdam, suitable coils being used, of course, in the case of the long-wave stations.

Speech and music transmitted by the local broadcasting station, some 15 miles distant, were received with considerable strength and with particular clarity and purity of tone. At such a distance from the transmitting station it was these latter points which proved more noticeable than mere loudness.

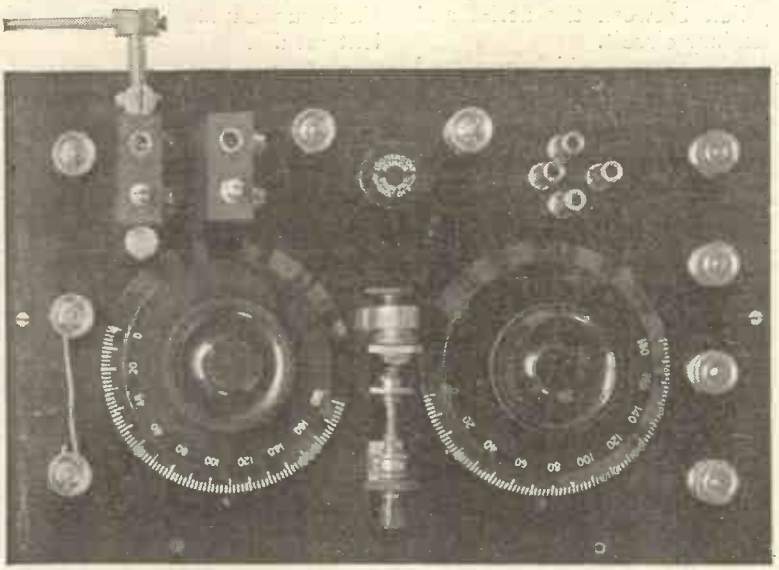


Fig. 2.—A close-up view of the top of the panel, with coils and valve removed, to show the layout of the parts.

The set also proved extremely selective, and, although there are only three variable controls, careful adjustment of these is necessary in order to obtain the best results. This matter will be referred to again presently.

Circuit Arrangements

Fig. 5 is a theoretical circuit diagram of the receiving set, and careful reference to the diagram in conjunction with the following explanation will enable the action to be understood.

On the left of the set are three terminals, A1, A2 and E (Fig. 5). With the aerial lead connected to the terminal A2 and the terminal E earthed, the variable condenser C1 is in series between the aerial itself and the aerial tuning inductance L1. This is the best arrangement for the reception of short waves, the inductance L1 consisting of a 50-turn plug-in coil.

With the aerial lead connected to the terminal A1, and terminals A2 and E connected together by means of the short-circuiting link shown (or a piece of bare copper wire), the condenser C1 is in parallel across the inductance L1 which, for the British broadcasting wavelengths, may be a 35-turn or a 50-turn coil. For the Hague and Amsterdam a 100-turn coil will be necessary, a 150-turn coil for Chelmsford and Radiola, and a 250-turn coil for Eiffel Tower.

The sizes of the coils depend to some extent upon the dimensions of the aerial to which the set is connected, but, provided that the variable condenser C1 has a maximum capacity of 0.001 μF, the sizes quoted will be found satisfactory.

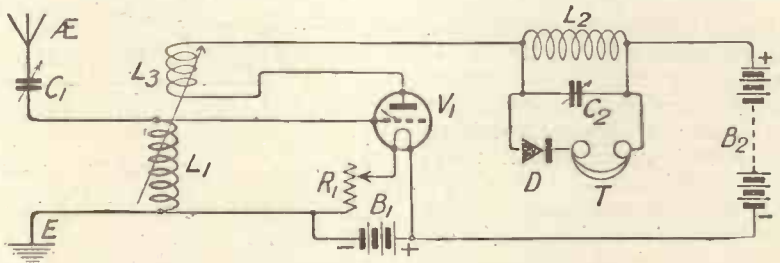


Fig. 3.—A circuit similar to that given in Fig. 3 of our last issue, but with a two-coil holder to enable reaction effects to be obtained.

Capacity of Variable Condenser

In connection with any receiving set, it should be borne in mind that when using a variable condenser in series in an aerial circuit, its value should not be reduced below about 0.0002 μF and preferably should vary between 0.0003 and .001 μF. When using a variable condenser in parallel across an aerial tuning inductance, it should be the object of the operator to have as large a value of inductance and as small a value of parallel capacity as possible.

Referring again to the theoretical circuit diagram, Fig. 5, it will be seen that the aerial end of the tuning inductance L1, is connected direct to the grid of the valve, whilst the earth end of the same coil is connected to the negative side of the filament. When the aerial circuit, therefore, is tuned to the same frequency as the incoming signals, potential differences are set up between the ends of the coil L1 and are applied to the grid and filament of the valve. The positive side of the high-tension battery B2 is connected to the anode of the valve, via the inductance L2, whilst the negative side of the battery is, of course, connected to the filament of the valve.

The varying grid potential, due to the incoming signals, causes the electron flow from filament to anode (equivalent, of course, to current flow from the high-tension battery to the anode) to vary at the same frequency. In parallel across the inductance L2, however, there is the variable condenser C2, and, if the latter is adjusted so that the oscillatory circuit L2 C2 is tuned to the same frequency as the aerial circuit, the high-frequency pulses of current from the high-tension battery cause oscillations of considerable amplitude to be built up in the closed oscillatory circuit. The action is, in fact, somewhat similar to the development of large swings or oscillations of a heavy pendulum by the application of small but correctly-timed impulses.

Rectification

The amplified oscillations in the closed circuit L2 C2 are then

rectified by the crystal detector D and made audible in the telephone receivers T, both of which are connected across the variable condenser C2.

The anode inductance L2, which should consist of a coil at least one size (50 turns) larger than the aerial coil L1, is variably coupled to the latter, and, provided that their respective windings are in the correct sense, some of the energy of the amplified oscillations will be re-transferred to the aerial circuit, so strengthening the oscillations applied to the grid and filament of the valve. This is known as a reaction or regenerative effect, and, as already pointed out, an unnecessarily tight coupling between the coils L2 and L1 (that is to say, bringing the coils too close together) will not only completely spoil the effect, but will be practically certain to cause interference to adjacent receiving stations.

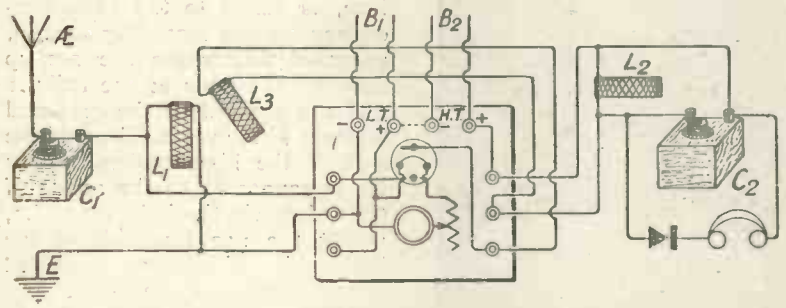


Fig. 4.—A pictorial representation of Fig. 3. The coil L2, condenser C2, crystal detector and telephones being those of any crystal receiving set.

As a Crystal Receiver

Suppose the valve, rheostat, filament lighting battery B1 and high-tension battery B2 to be omitted from the diagram, Fig. 5. There remains an ordinary inductively coupled crystal receiver with aerial circuit tuned by the series-parallel condenser C1, the closed oscillatory or secondary circuit L2 C2, inductively and variable coupled to the aerial circuit, and the detector D with telephones T connected, as usual, across the secondary condenser.

With the set illustrated in the photograph, Fig. 1, it is only necessary to turn out the valve and disconnect the high-tension battery to enable it to be used as a selective crystal receiver. This will be found very useful on occasions when the accumulator gives out unexpectedly. At the same time it indicates that it is a comparatively simple matter to add a high-frequency amplifying valve to an existing inductively coupled crystal receiver, the valve itself acting as a kind of amplifying link between the aerial and secondary circuit.

A photograph which appeared with the first article of this series, illustrated one of the ex-Government Mark III* receivers with a high-frequency amplifying valve added in this manner.

Components Required

The following are the components as fitted in the actual set illustrated. It is to be understood, however, that any reliable make of components may be employed. Similarly, it is not essential that the containing box and ebonite panel should be of exactly the dimensions specified, and, provided that all connections are correctly made, the results obtained should prove quite satisfactory:—

Nine terminals.

Four valve legs and nuts.

One filament rheostat (Lissenstat).

One 2-coil holder.

Two variable condensers, one 0.001 μF, and one 0.0005 μF (Jackson Bros.).

One crystal detector. (That fitted to the original set is an ex-Government "Perikon" detector.) Practically any type of detector will do, but, for stability, one of the firm contact type is preferred to one of the cat-whisker type. Carborundum-steel gives excellent results.

(Further constructional details will be given next week.)

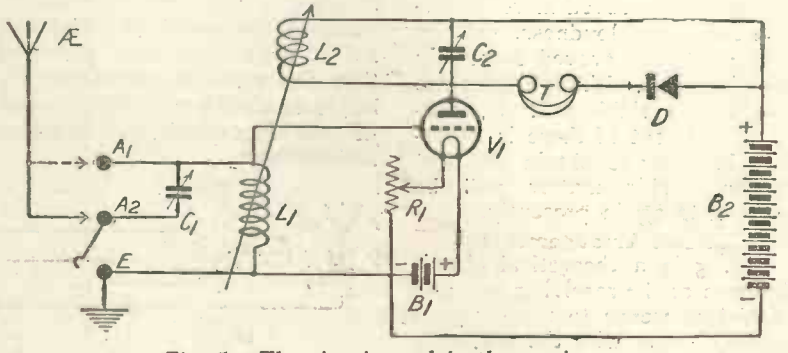


Fig. 5.—The circuit used in the receiver.

Handy Pliers

ONE of the most ingenious kinds of pliers that the writer has struck is a pattern made in America. These are so arranged that however wide open or close together the jaws may be they are always parallel with one another. With ordinary pliers the jaws are, of course, at an angle to one another, which means that they can never obtain a very secure grip upon a round object. The parallel jaw pliers are delightful to work with, for once they have a grip they never slip. The writer uses a small pair of gas pliers of this kind for wireless work and finds them a great help. Nuts can be tightened with them without any risk of their slipping and burring the edges, and they are of the utmost value in a whole host of other ways. These pliers are very little more costly than those of the ordinary type, and any constructor who visits a tool shop should certainly ask to see them.

Another tool which is exceedingly handy is a pair of nut pliers of small size. These are so arranged that they do not slip when a nut is gripped with them, and they are exceedingly useful for getting at small nuts in out-of-the-way corners. R. W. H.

Time Signals

SOME INTERESTING CORRESPONDENCE

The following letters, which have passed between Radio Press, Ltd. and the British Broadcasting Company, Ltd., will doubtless prove of interest to our readers.

The British Broadcasting
Co., Ltd.,
2, Savoy Hill,
Victoria Embankment,
London, W.C.2.
July 16, 1924.

DEAR SIRS,—We believe that your time signal broadcasting system is one of the most useful features of your service, but we think that its value would be greatly enhanced if a time signal could be sent out at 8 a.m. and at 12 noon. The present times are not by any means always convenient, and the "10 o'clock time signal" is often sent later.

The proposed 8 o'clock time signal would be extremely useful for those going to business, and what is more, those who are regulating clocks and watches would not have to wait 24 hours, as at present, in most cases.

Trusting you will give these suggestions careful consideration.—We remain, yours faithfully,

RADIO PRESS, LTD.,
JOHN SCOTT TAGGART,
Chairman and Managing Director.

Messrs. Radio Press, Ltd.,
Devereux Court,
Strand, W.C.2.
July 18, 1924.

DEAR SIRS,—Many thanks for your letter of the 16th inst. regarding our time signals, which we have read with interest.

From your allusion to the possibility of having to wait twenty-four hours for our time signal, it appears that you are not fully aware of the number of times daily when either Big Ben or Greenwich, or both are broadcast. For your information we would mention that the Greenwich signal is given daily at 4 p.m. and 10 p.m., subject, of course, to there being nothing in course of transmission which does not interfere. Big Ben is broadcast at 1 p.m. on Tuesdays, Thursdays and Fridays and daily at 6 p.m. and 7 p.m. On Sundays Big Ben is given at 3 p.m. and 5 p.m.

We think that you will probably agree that with all these time signals being broadcasted most of our hearers have already sufficient opportunities for synchronising their watches or clocks.—Yours faithfully,

C. H. LEWIS,
Organiser of Programmes.
The British Broadcasting Co., Ltd.

The British Broadcasting
Co., Ltd.,
2, Savoy Hill,
Victoria Embankment,
London, W.C.2.
July 21, 1924.

DEAR SIRS,—We thank you for your letter of July 18, but regret to say that we still consider the time signal transmission inadequate for the purposes we mentioned.

The transmission of Big Ben, while interesting and perhaps sufficiently accurate for some, is not accurate enough for the correct checking of watches and clocks.

The Greenwich time signal is the only one which may be said to be sufficiently accurate for this purpose, and this signal, as you state, is given at 4 p.m. and 10 p.m. In the first place, the time between 4 p.m. and 10 p.m. is rather short for adequate checking, and, secondly, the great proportion of those who wish to check their watches would be at business at 4 p.m., and consequently the signal would be of no assistance to them.

We cannot help but feel that, in view of these remarks, a time signal transmission at 8 a.m. from Greenwich and one at, say, 1.30 p.m., would be desirable.

We particularly think that the 8 a.m. time signal should be sent to enable many of your listeners to check their watches and clocks before going to business in the morning.—Yours faithfully,

RADIO PRESS, LTD.,
JOHN SCOTT TAGGART,
Chairman and Managing Director.

P.S.—With your permission we would like to publish this correspondence in view of the interest taken in the transmission of accurate time signals throughout the country.

J. Scott-Taggart, Esq.,
F.Inst.P., A.M.I.E.E.,
Radio Press, Ltd.,
Devereux Court,
Strand, W.C.2.
July 23, 1924.

DEAR SIR,—We are in receipt of your letter of the 21st inst., and note that you still consider our time signals inadequate for those who wish to check accurately their clocks and watches.

We have been considering for some time the question of revising our present arrangements in regard thereto, and we are happy to inform you that, in future, the following time signals will be relayed from Greenwich and Big Ben:—

Greenwich daily at 1 p.m., 4 p.m. and 10 p.m.

Big Ben daily at 6 p.m., 7 p.m., and at the end of the evening programme if this finishes within five minutes before any ½-hour.

We note your suggestion with regard to the 8 a.m. time signal from Greenwich, but we do not consider this is necessary at the present time.

We shall be happy for you to publish this correspondence if you so desire.—Yours faithfully,

For the BRITISH BROADCASTING Co., LTD.,
C. H. LEWIS,
Organiser of Programmes.
The British Broadcasting Co., Ltd.

VALVE NOTES

(*Continued from Page 407.*)

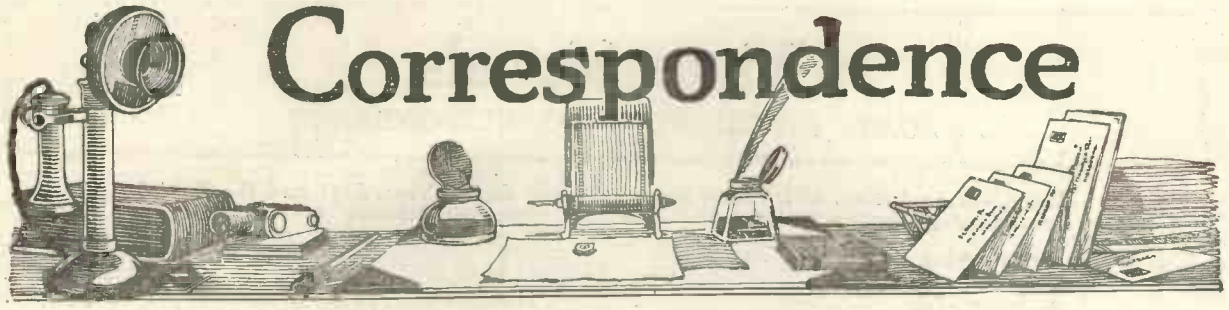
length, although a No. 50 will do, the best size is probably No. 75. The condenser C4 may conveniently be a .0005 μF variable condenser, or one of .0003 μF capacity. The telephone condenser C6 has a capacity of .002 μF.

Experiments may be carried out by cutting out C1, and the experimenter will be interested in trying the effect of coupling L3 to L1, instead of to L2.

BINDING CASES

Binding cases and indexes for Vol. III are available, and binding can be done for those readers who desire it. Back numbers should reach us during the last week of each month, and binding is done during the first week of the following month.

Prices: Cases only, cloth 2s. 6d. (post 4d.), half leather 4s. 6d. (post 4d.); binding and supplying case and index 4s. 6d. (post 1s.) and 7s. 6d. (post 1s.) respectively.



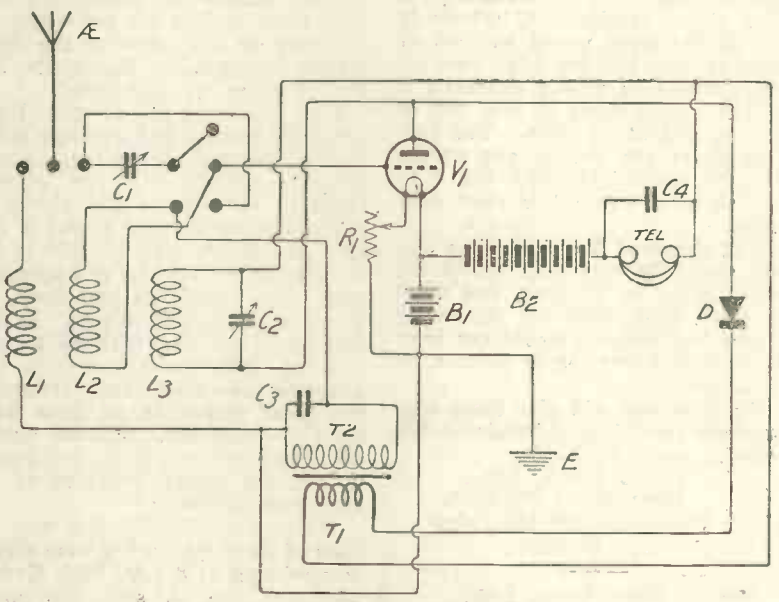
A ONE-VALVE REFLEX CIRCUIT

SIR,—It may not be known to many home constructors what interesting results can be obtained by the use of a single-valve reflex circuit with a loose-coupled aerial.

The set is easy to construct, comparatively inexpensive, and, above all, harmless to one's neighbours (which cannot be said of the straightforward one-valve set with reaction, especially in the hands of a beginner), since the well-known property of the reflex valve of rapidly changing from H.F. to L.F. oscillation (and vice-versa), will compel the unfortunate culprit to loosen the reaction.

The addition of the three-coil holder does away with probably the chief objection to a reflex circuit, namely, the coarseness of tuning, with the result that a really good variable condenser with vernier (such as the Sterling "straight line" condenser) is essential for tuning.

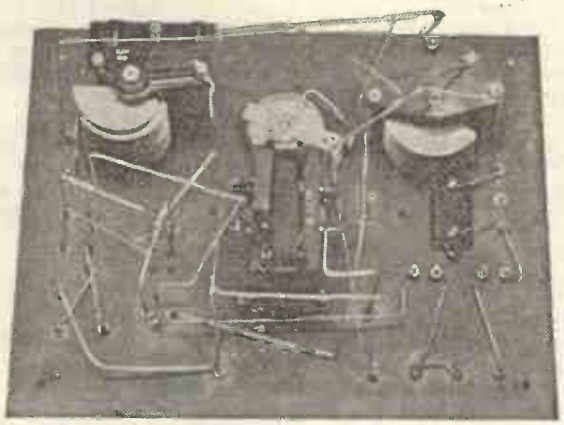
It will be seen from the diagram that the usual "tune-stand-by" switching has been simplified and the DPDT has been replaced by a SPDT switch; but, what is more important from the financial point of view, the same condenser with vernier is used both for "tune" and "stand-by" positions. A cheap variable condenser, should the user so desire, can easily be put across the primary coil by slipping its leads into the Igranic coil-holder spring clips, but the writer has not found this essential, and prefers to resort to home-made basket coils for the necessary rough tuning of the primary.



A diagram of the circuit, showing improvements made by our correspondent.

With regard to components and cost, the panel is 9 in. x 12 in., and made of 3-16th in. thick ebonite with two supporting legs. This, although rather too thin, was used because it was already in the possession of the writer, and has been tested electrically and found satisfactory, which only too often is not the case with the ebonite at present on the market. Two small tumbler switches for H.T. and L.T. were fitted on the panel; these, while adding somewhat to the appearance of the set, cannot be regarded as at all essential. Several transformers were tried, and it was found that the better makes (Marconi, R.I., Sterling, etc.) were practically equal (perhaps the 1:3 is a little better than the 1:5 in a reflex cir-

A photograph of Mr. Naunton's receiver.



A view of the wiring of the one-valve reflex receiver.

cuit), whereas with the cheaper brands there was considerable howling when the valve was fully turned on. With regard to the crystal rectification, it is essential to have some mechanical contrivance for adjusting the pressure of the cat's whisker, because under certain conditions of reception, too much pressure is as harmful as too little. Hertzite, with a small spring of Resistin wire (or any nickel alloy) was found very satisfactory. Lastly, we come to what is the most important component, namely, the valve. When a valve is being used for some single purpose in a non-reflex circuit there is usually little to distinguish one make from another; this, however, is far from true when used in reflex circuits. The writer has tested several valves, British and foreign, on this set, and there is no doubt that the outstanding valve is the Cossor (PI). This assertion is made for no other reason than giving credit where it is due. The Cossor was found to work best on this set with 6v. L.T. and 66v. H.T., although good results were obtained with 4v. L.T. The total cost of the parts (including the mahogany cabinet) was about eight pounds.

When wiring the panel care should be taken to keep the plate and grid circuits as well separated as possible.

Another precaution which amply repays the trouble is to test the valve-holder (and ebonite through which the valve sockets pass) on the megger. The writer knows of a reflex set which was a constant source of worry to the owner until the leaky composition holder was replaced. It will be found, however, that whatever precautions are taken the valve will always rectify to a certain extent when the circuit is not acting dually—a state of affairs brought about when the anode tuning is unsatisfactory.

A PECULIAR EFFECT

The reaction effects with a dual circuit differ in some respects from those obtained with an ordinary one-valve circuit, notably in the fact that when listening to a near-by station reaction has practically no effect upon signal strength, whether this is due to high-frequency saturation or not the writer is at present unable to say.

The results obtained with the set are excellent, and *at times* approach the performance of a three-valve set, the writer wishes to emphasise the words "at times" because, in his opinion, therein lies the difference in results obtained with this set and the more powerful, straightforward circuits. Most of the British broadcasting stations, including Aberdeen and Bournemouth, and the School of Posts and Telegraphs (Paris) have been heard with the set, but, unlike working with, say, a three-valve tuned anode reaction set, it is impossible to tune-in any given station at will, for example, the announcer's voice at Aberdeen may be quite clear on one evening and impossible to hear at all on the next. Within about ten miles, depending upon the district, of a broadcasting station, the set will operate a small loud-speaker, although to obtain really satisfactory volume the addition of an L.F. panel is essential.

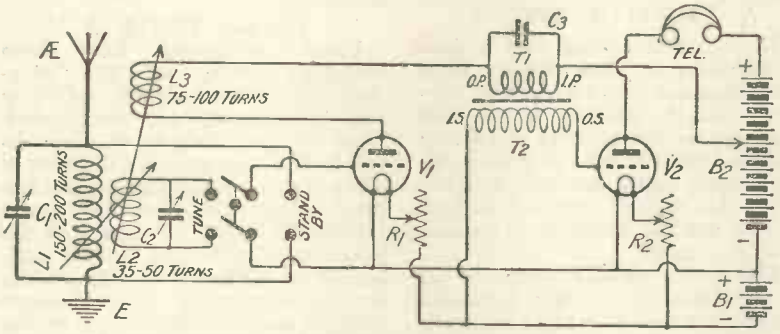
FREAK RESULTS

Freak receptions have been obtained; thus, on one occasion, Glasgow was clearly audible on the loud-speaker (at Manchester). Used on the outskirts of Manchester, it has been possible to listen to other stations while that station has been transmitting, but here again the results vary. On occasions the loose coupling can be opened sufficiently to eliminate the Manchester station entirely; on other occasions a slight metallic distortion is noticeable (this distortion disappears when Manchester shuts down), while again, at times, the near-by station can only be eliminated sufficiently to make the distant station readable. On such occasions loosening the coupling still further entirely eliminates the distant sta-

tion. Lastly, there are evenings during which the writer is unable, while Manchester is transmitting, to obtain any other station.

In conclusion, the writer thinks there is little doubt that the ST74 circuit with three-coil holder is the cheapest and most convenient set for the beginner to practice tuning experiments with the minimum of annoyance to his neighbours. —Yours faithfully,

W. J. S. NAUNTON,
M.A. (Camb.), M.Sc. (Lond.)
Manchester.



A circuit diagram showing the tuning arrangements for listening to either 5XX or 2LO, as used by Mr. Lloyd.

RECEIVING 5XX

SIR,—The following report of some experiments with a two-valve (Rectifier and 1 L.F.) experimental set employing a universal loose-coupled aerial tuner may be of interest.

Owing to my being out all day, and the fact that my people at home desired to have facilities for listening either to 5XX or 2LO as they might wish, without having to change coils, or undertake any tuning operations, I first tried connecting two receiving sets in parallel across aerial and earth. This was satisfactory up to a point, but not sufficiently stable to leave for an inexperienced operator to manage.

The following arrangement, however, will be found quite satisfactory, and is now in daily use at my receiving station.

To proceed—insert a coil of 150 or 200 turns in the primary aerial socket L1, and one of, say, 75 or 100 turns in the reaction socket L3, place stand-by-tune switch in "stand-by" position and tune in 5XX. When this is satisfactorily accomplished place a coil of 35 or 50 turns in the secondary aerial socket L2, tightly couple the primary and secondary coils, place stand-by-tune switch in the "tune" position, and tune in 2LO, using reaction if necessary.

If any mutual interference is encountered, ascertain whether or not the secondary aerial circuit is earthed. If it is, break this connection, as it is important that this secondary circuit should be isolated. If the interference is still experienced, loosen the coupling between the primary and secondary aerial coils and retune. It will be noticed that the tuning of the closed circuit is very sharp.

When these tuning operations have been accomplished 5XX will be received on "stand-by," and 2LO on "tune." The principle underlying this arrangement is that of the now well-known acceptor wave-trap, which absorbs the usually unwanted frequencies, but in this case the desired ones.—Yours faithfully,

S. E. LLOYD.
Goodmayes.

Apparatus we have tested

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

An Automatic Crystal Detector

The " Utility " Crystal Detector, submitted by Messrs. Wilkins and Wright, Ltd., is an ingenious device in which the searching for sensitive spots is made mechanically, instead of requiring the customary process of hand-setting.

The mechanism is enclosed in a metal case 2¼ in. long by 1½ in. diameter, adapted for mounting behind a panel in the usual one-hole-fixing style. The lid of this case, which is fixed, carries the small terminal screws; a spindle and knob outside the panel actuates the device. The crystal, of the galena type, is mounted in a small spring cup on a vertical axis inside the case.

Rotating the controlling knob performs three operations: turns the crystal-cup slowly; advances the latter by a cam action to and from the exploring cat's whisker; and moves the cat's whisker by an irregular eccentric action over the face of the crystal. The combination of these motions effectively explores the whole exposed face of the crystal in time, provided that the parts are properly adjusted at the start.

It was found necessary to make small adjustments in the sample submitted before the action was satisfactory—a matter of no great difficulty. The particular portion of crystal found therein was also of indifferent quality; it was replaced by a reliable piece, and then very satisfactory results were obtained. On an average, one good setting was found for every complete revolution of the knob, with the apparatus closed up. The rectifying efficiency of such good settings was found, by measurements, to be on a par with the optimum results obtained by careful hand-setting with the usual open type of detector.

Provided that the crystal is inserted (not a very easy matter) and the instrument adjusted by

competent hands, this device can be termed "fool-proof" in operation, good settings being obtained by quite blind and casual rotation of the exposed knob; and as such will offer obvious advantages in broadcast crystal receivers for family use.

Radio Construction Tools

Messrs. Thos. R. Ellin (Footprint Works), Ltd., have submitted for inspection and trial a set of small tools of a type suitable for home-constructional work.

An extension hacksaw frame, taking blades from 8 in. to 12 in. in length, and of sturdy construction, has pegs to carry the blade in two alternative positions at right angles, without removing the adjusting screw—a convenience at times when working into a difficult corner of a panel. On trial it was found rigid in use and handy to adjust.

An 8-ounce soldering iron, with bit adjustable to any angle, proved extremely convenient in use to get at awkward connections behind a boxed-up panel; it is of a useful weight for small radio work, and the special type of hollow perforated handle was found to keep comfortably cool.

A 4-ounce pin hammer appeared just the right size for small cabinet work; it has a polished ball at the other end of the head, which is useful for small rivetting.

Seven-inch japanned tinsnips were convenient for cutting off wire-ends and trimming condenser plates, etc. The 7-in. all-bright snips, with spring handle and leather loops for holding closed when put away in the tool-chest, appealed particularly to the writer, as an exceedingly handy tool in general radio work.

The 5-in. round-nose electricians' pliers were convenient for making terminal loops, etc., had sharp-cutting edges, and also a small pipe-grip type of rounded toothed jaws, which proved excellent for holding and turning obstinate bolts and nuts of small size.

A tiny, narrow-jawed, adjustable spanner, opening, however, to about ¾ in. maximum, proved invaluable for handling those No. 2 B.A. nuts on condenser spindles and the like which defy ordinary spanners.

The quality of these tools was obviously of the highest order, as might be expected from a maker whose trade-mark is familiar to all engineers. The tools included in this selection can be recommended as likely to give every satisfaction to the amateur constructor.

Valve-Windows

A neat and at the same time an economical finish can be given to an American type of multi-valve cabinet receiver by the valve-window or peep-hole fitting recently marketed by Messrs. Grafton Electric Co.

Samples submitted showed a nickel-plated ring 1¼ in. outside diameter, with a back-ring of similar size for the rear of the panel, and provided with three small screws and nuts for fixing. A small circle of fine wire-gauze is placed in position behind the front ring.

Actual trial showed that these windows were easy to fit, and gave a very pleasing and finished appearance to the receiver at a minimum of trouble.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

J. McL. (LEITH) asks: Is the efficiency of a set appreciably increased by using separately insulated stranded wires for tuning coils?

Since high-frequency currents travel entirely upon the surface of a conductor, and not through its substance, theoretically all conductors should have their surface area increased as much as possible by constructing them of a large number of fine separately-insulated strands. The resulting reduction in high-frequency resistance should undoubtedly prove of considerable benefit in all wireless circuits carrying high-frequency oscillation. A practical difficulty occurs, however, in the use of conductors consisting of a large number of very fine wires (such as "Litzendraht"), and special care must be taken to make proper connection to every strand, as considerable losses occur if even one strand remains unconnected, and therefore it is doubtful whether the amateur constructor should attempt to use it. It is further argued that the dielectric losses in the insulating material between the strands may become serious on the shorter waves.

H. J. C. (BARROW-IN-FURNESS) asks whether there is any objection to making the exten ion handles of variable condensers of metal?

This does not seem to be a very desirable practice, since one of the objects of a long handle to the knob of the condenser is to reduce capacity troubles from the hand of the operator, and if the handle is made of metal it may simply form an extension of the condenser itself. To obtain the greatest benefit from an extension handle it should undoubtedly be made of some insulating material, and it should be as rigid as possible.

T. S. W. (KIDDERMINSTER) states that he wishes to make a piece of ebonite tube of a size which he cannot obtain from any dealer, and asks for our advice as to its production from a thin sheet.

The first essential is some kind of former upon which to mould the ebonite, and a jam jar will be very suitable, in view of the fact that the tube has only to be 4 in. in length. Try and find one of the right diameter, and then obtain a piece of ebonite sheet ⅛-in. thick, and measuring 4 in. in one direction and such a size in the other that it will pass round the former and give a small overlap. The sheet should then be softened by immersing for some little time in boiling water, and then taken out and quickly bent round the former and tied in position with tape quite tightly. Upon cooling it will be found that it retains the shape which has been impressed upon it, and the overlapping edge can be bevelled off by means of a file.

U. S. M. (TINTAGEL) inquires whether it is advantageous to use copper foil instead of the more usually recommended tin foil for fixed condensers.

Electrically there is little to be said upon the matter, but practically the copper foil is much to be preferred, since it is so very much easier to handle and also soldering is made very much easier. Tin foil, it will be remembered, is very apt to burn when one attempts to solder it.

F. H. (SOUTHEND) asks whether there is any practical limit to the size of a loud-speaker horn?

It would seem that within quite wide limits the larger the loud-speaker horn the better the reproduction that is obtained, provided that the signals are of sufficient strength and the reproducing mechanism attached to the horn is of adequate size. For use out of doors loud-speaker horns have been constructed in America with lengths up to 18 feet, and it is reported that they have given remarkably good reproduction. So large a horn, of course, involves quite an elaborate wooden structure.

A. B. L. (LIVERPOOL) experiences a good deal of difficulty in obtaining a critical setting of his reaction coupling, and asks whether we can suggest any modifications in his circuit to improve matters?

The trouble which our correspondent appears to be experiencing is that known as overlap, which should be removed rather by modifications of the conditions under which the valve is working than by actual alterations to the circuit. Vary the plate voltage and filament current over quite wide limits, try a different value of grid leak, and if necessary try a different valve as a rectifier. When you have secured correct values for all these factors, it should be quite possible to set the reaction to the threshold of oscillation without any tendency to flop over into actual self-oscillation.

LISSENIUM

How to tell good parts—

WHEN signals roar in from stations only one hundred miles away, it is more difficult to tell the difference between good parts and bad parts. But when stations are being tuned in many hundreds, perhaps thousands, of miles away, then you can tell your good parts ARE good parts. Then, too, it is that every fraction of applied energy takes effect—IF THE PARTS ARE RIGHT.

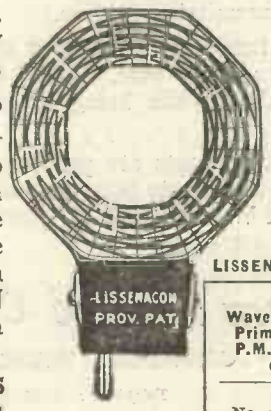
THOSE who use **LISSEN** PARTS sooner or later all realize how continually improving results seem to keep pace with one's better understanding. Though initially quite easy to use, **LISSEN** Parts have been designed and made so that for even the most skilful experimenter there is wide enough scope in a receiver built with **ALL LISSEN** Parts to make the receiver for ever a fascinating thing.

PARTS WITH HIDDEN POWER—LISSEN PARTS

The function of an inductance—

THE two chief functions of an inductance in radio frequency circuits are, firstly, to give the largest possible E.M.F. across its terminals for any frequency within its range, and, secondly, to transfer this energy by means of its magnetic field to another inductance in another circuit.

A COIL that has a strong magnetic field *may not necessarily be the coil which builds the highest E.M.F. across its terminals. Particularly is it difficult to combine these two desirable objects in compact coils. A great fault with many coils is that electrical efficiency is sacrificed to considerations of size, outward appearance, and attractiveness to the eye.*



THE shape of the coil, the absence of a solid former, the gauge of the wire, the well designed air spacing, these are some things which make **LISSENAGON** coils so efficient electrically, and the shape of the coils also, which brings the inductance down to a compact size, while the whole voltage across each coil is distributed evenly, so that when current is passing through it, the resultant magnetic field is an extremely strong one, *while the E.M.F. also is very high.*

HOLD A LISSENAGON COIL UP TO THE LIGHT

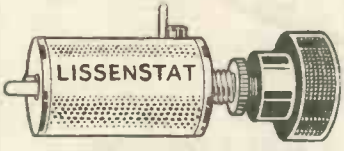
LISSENAGON TUNING CHART. Note the Intermediate Coils, 30,40, and 60

TABLE I. Wavelength range when used as Primary Coils with Standard P.M.G. Aerial and .001 mfd. condenser in parallel.			TABLE II. Wavelength range when used as Secondary Coils with .001 mfd. condenser in parallel.		
No. of Coil.	Minimum Wave-length.	Maximum Wave-length.	Minimum Wave-length.	Maximum Wave-length.	PRICE.
25	185	350	100	325	4/10
30	235	440	130	425	4/10
35	285	530	160	490	4/10
40	360	675	200	635	4/10
50	480	850	250	800	5/-
60	500	950	295	900	5/4
75	600	1,300	360	1,100	5/4
100	820	1,700	500	1,550	6/9
150	965	2,300	700	2,150	7/7
200	1,885	3,200	925	3,000	8/5
250	2,300	3,800	1,100	3,600	8/9
300	2,500	4,600	1,400	4,300	9/2

The Key to fine detection—

THE key to a large safe often strikes one as appearing wholly inadequate for the massive door—yet how easily it turns in the lock.

LISSENSTAT control, so guileless in its outward appearance, opens the way to fine detection just as easily. Critical electronic flow follows every fractional turn of its noiseless control. Silently it works—and well. Stations that have before been difficult to get, stations that have been impossible to get—now they come in distinctly and with great certainty. It is now known that receivers which are fitted with **LISSENSTAT** or **LISSENSTAT MINOR ARE EQUIPPED FOR FINE DETECTION.**



LISSENSTAT Gives the most acute tuning possible **7/6**

LISSENSTAT MINOR Is replacing many thousands of discarded and inefficient rheostats. Provides such a high degree of LISSENSTAT control at a popular price **3/6**

You can get more out of your valves by using unique filament control.

Have you got an unreliable Grid Leak?

IF so, it is impossible for you to properly regulate the charge that should accumulate on the grid. You should preferably fit the **LISSEN** Variable Grid Leak—you know then that you have a control which will give correct grid potential for every valve or circuit you choose to employ. LISSEN ONE HOLE FIXING, OF COURSE. POSITIVE STOPS BOTH WAYS. **2/6**

A STABILIZING RESISTANCE. LISSEN Variable Anode Resistance, 20,000 to 250,000 ohms. Same outward appearance as the LISSEN Variable Grid Leak **2/6**

Tone so Pure—

every instrument of an orchestra can be identified.

Judge an audio frequency transformer—
FIRSTLY, in terms of tone purity.
SECONDLY, in terms of volume.

With **LISSEN Transformers** TONE QUALITY HAS *ALWAYS* COME FIRST.

LISSEN Transformers are so designed that they build up a whisper of sound to a great degree of loudness with absolute purity of tone—each of the three types is tested for *purity first* right through the whole range of audible frequencies—*then* tested for volume.

SUPERLATIVE AMPLIFICATION. If you contemplate buying an expensive tranformer, be sure there is none to equal the **LISSEN T1**—use it always behind the detector valve and throughout when superlative amplification is desired. ALWAYS FOR POWER WORK, too **30/-**

FOR REFLEX CIRCUITS. Under all conditions, the **LISSEN T2 Transformer** is one which will give pure and powerful amplification in these circuits **25/-**

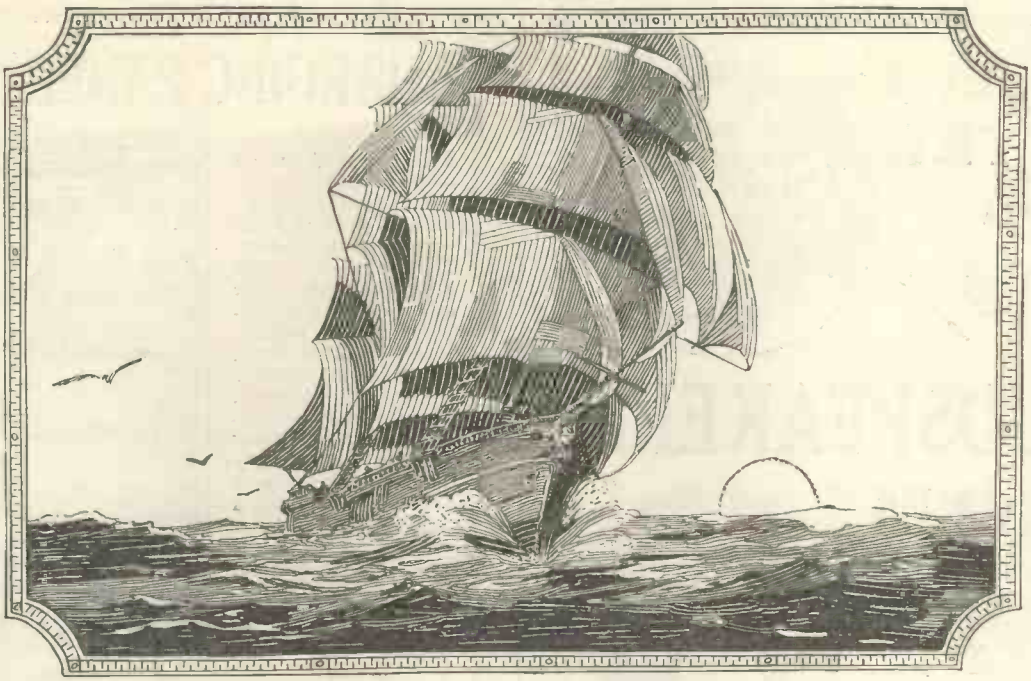
A POPULAR TRANSFORMER. Money cannot buy better transformer value than the **LISSEN T3.** Because of its skilfully balanced design, this transformer actually compares with many other transformers sold at nearly twice the price **16/6**

FIT EITHER TYPE OF LISSEN TRANSFORMER—and make sure

Don't Use Mixed Parts—

Use LISSEN Transformers for purity and volume.
Use LISSENAGON COILS for sharp tuning, for strong tuning.
Use LISSEN Radio Frequency Parts for extending range.
Use LISSENCEPTOR for eliminating interference.
Use LISSEN TUNER for covering a wide wavelength with one control.
Use LISSEN MICA Variable Condenser for nice tuning.
Use LISSEN VERNIER CONDENSER for fine tuning, especially in H.F. circuits.
USE A LISSEN PART WHEREVER YOU CAN—and your receiver will give results you could never get with mixed parts

LISSEN LIMITED 30-32, Woodger Rd., Goldhawk Rd., Shepherd's Bush, London. W.12.
Parts with hidden power—LISSEN Parts



Voyages of Discovery

TO the new user of a Cossor P.2 Valve (designed specially for long distance reception), every occasion gives an opportunity for discovering new Stations.

While previously the Receiving Set was probably limited to two or three hundred miles, now practically every Continental high-power Broadcasting Station is brought within its range.

Why this marked superiority? The reason lies in the actual design of the Cossor Valve—so d fferent to all others.

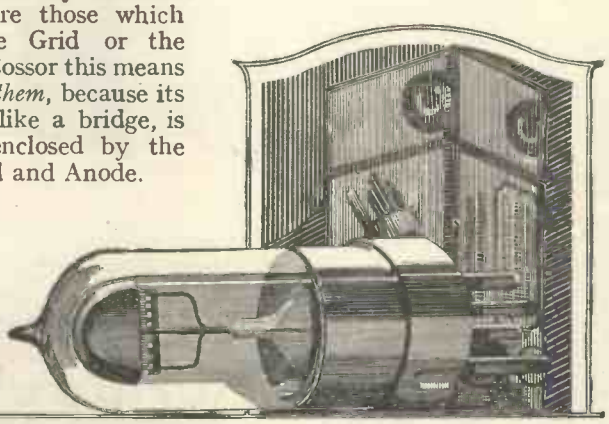
Amplification and rectification is dependent upon the efficient use of the electron stream given off by the heated filament. These electrons shoot off at a tremendous velocity at all angles. In a Valve with a tubular Anode, and long, straight filament, a large proportion of the stream escapes from the ends of the tube, only to be wasted against the sides of the glass.

Remember that the only electrons that are used are those which reach either the Grid or the Anode. In the Cossor this means *practically all of them*, because its filament, arched like a bridge, is almost totally enclosed by the hood-shaped Grid and Anode.

¶ *This Advertisement explains why the P.2 Valve has achieved such remarkable results in high frequency amplification —easily the most exacting branch of Radio.*

Prices:

P.1. For Detector and L.F. amplification ..	12/6
P.2. (With red top) for H.F. amplification	12/6



Cossor

A. C. COSSOR, Ltd., HIGHBURY GROVE, LONDON, N. 5.

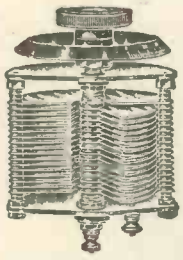
Valves

Gilbert Ad. 1157

HULLO EVERYBODY!!

RAYMOND'S VARIABLE CONDENSERS

NEW MODEL.



INCLUDING KNOB.

Nat. Phys. Lab. Certificate for Guaranteed Capacity.

Cap.	Price.	Height without connections.
·001	6/11	3⅛ in.
·00075	5/11	2⅝ in.
·0005	4/11	2 in.
·0003	4/6	1⅜ in.
·0002	4/-	1½ in.
·0001	3/6	1 in.
·00005 (vernier)	2/6	

EBONITE DIAL 8d. extra.

POST 6d. SET.

ALL PARTS NICKELLED
One hole fixing.
Narrowest spacing.
Aluminium end plates.
Accurate Constant Capacity.
Rigid Construction.
Low Loss.
Electrically and Mechanically Perfect.
Many unsolicited Testimonials.

NEW MODEL with 3 Plate Vernier at bottom. Specification as ordinary, but the Vernier allows absolutely the finest tuning possible. Very sharp and defined. They do not need varied long and technical words to recommend them. Satisfied users are the best recommendation. Assembled for panel mounting, and for a limited period. I will include *FREE* an *EBONITE* DIAL to retail customers only.

POST 6d. PER SET PLEASE.

Height	Cap.	Price
4 in.	·001	8/11
2¾ in.	·0005	6/11
2¼ in.	·0003	6/6

Complete with 2 Knobs and Dial.

POST FREE COLUMNS (except where marked).

Gauze Valve Windows	7d.
Double 'Phone Cords, 72in.	1/11
Porcelain S.P.D.T. Switch	1/11
Ditto, D.P.D.T. Switch	2/6
Battery Clips doz.	10d.
Ebonite Valve Holders	1/-
Variometer 250/650	2/6
Lead-in Wire 10 yds.	1/6
Twin Flex 12yds.	1/11
2 colour Flex 6 yds.	1/3
100 ft. 7/22 Aerial Wire with four insulators	3/9
Nugraving Titles	7½d.
Chatterton's Compound	8d.
"R.I." Choke Coil	10/-
Watmel Var. Grid Leak	2/6
Watmel Anode Resistance	3/6
Nickel Panel Switches, D P.D.T.	1/5
Ditto, S.P.D.T.	1/2
W.O. Pillar, large doz.	1/3
'Phone 4 B.A. doz.	1/1
'Phone 2 B.A. 6 for	1/1
Med. Pillar 4 B.A. doz.	1/1
Valve Sockets, plain	10d.
Ditto, with Shoulder	1/1
(Above with Nut and Washer.)	
Single Coil Plug on Stand	1/3
Ditto Swivel movement	1/6
Plug and Socket 6 pairs	10d.
Screw Spade Terminals doz.	1/-
Pin Screw Terminals doz.	10d.
Empire Tape ½ in. 12 yds.	9d.
Insulating Sleeving 6 yds.	2/-
Ebonite Coil Plugs 2 for	1/6
Best quality ditto 2 for	1/10
Ebonite Knobs 1½in. 2 B.A.	6d.
Moulded Knobs 1½ in. 2 for	8d.
Knobs ¾ in. 4 B.A. 2 for	8d.
Ditto 1 in. 2 B.A. 2 for	8d.
H.F. Transformers Plug-in type 250/700	3/11
Ebonite ex handles 6 in.	9d.
Ebon. Bushes 2 or 4 B.A. doz.	1/-
D.C.C., I.R.C. Bell Wire 10 yds.	1/-
Tinned Copper, square 16 gauge, 18 ft.	1/-
Spearpoint Whisker	4d.
Gold Whisker	4d.
Set of five, one gold	6d.
100,000 ohm Fixed	1/6

BASKET COILS.

Chelmsford (Tandco)	2/-
Tandco 1,300/1,750 metres (All Tandco in Stock)	1/8
Waxless set of 5 200/2,000	1/11
Waxed set of 6 200/3,600	1/11
Special Duplex Coil fitted on adaptor for Chelmsford (For Variometer 650 metres)	2/11

Post 4d. each.

LISSEN—

Variable Grid Leak	2/6
Anode Resistance	2/6
Lissen Minor	3/6
Lissenstat	7/6
Do. Universal	10/6
2-way Switch	2/9
Series Parallel	3/9
T1 Transformers	30/-
T2 25/-; T3	16/6
Lissen Coils and all parts stocked.	

IGRANIC—

Coils: 25, 5/-; 35, 5/-; 50, 5/2; 75, 5/6; 100, 7/-; 150, 7/10; 200, 8/8; 250, 9/-; 300, 9/5; 400, 10/3; 500, 10/6

Fil. Rheostat	4/6
Potentiometer	7/-
Vernier Rheostat	7/6
30 ohm Rheostat	7/-

DUBILIER CONDENSERS.

Type 600A.

.001, .002, .003, .004, .005, .006 Fixed	3/-
.0001, .0002, .0003, .0004, .0005	2/6
Type 577, .01	7/6
Grid Leaks each	2/6
Anode Resistance 50,000, 80,000 or 100,000, on stand complete	5/6

GOSWELL ENGINEERING CO.—

Patent Valve Holder	1/6
Cam operated Vernier, Two-way Coil Stand, Vernier	9/-

VALVES.

Cossor P.1, P.2	12/6
Mullard Ora	12/6
Ediswan	12/6
Marconi R. and R.5	12/6
A.R.D.E. Ediswan	21/-
D.E.R.	21/-
D.E.3	30/-

All Valves stocked Post 6d. each.

N. & K. HEADPHONES GENUINE STAMPED

4,000 ohms	12/9
6,000 ohms	13/3

Genuine N. & K. Post 6d. pair.

EBONITE ⅜ in.

cut to Size at ½d. sq. in.
Stock sizes.

6 × 6	1/6
7 × 5	1/6
8 × 6	2/-
9 × 6	2/3
10 × 8	3/4
12 × 9	4/6
12 × 12	6/-

ACCUMULATORS.

BEST MAKES.
UNDER MY OWN LABEL.

4 v. 40	17/6
4 v. 60	19/6
4 v. 80	23/6
6 v. 60	28/-
6 v. 80	35/-

Ebonite Valve Holder, cut from solid rod, hand-turned, 8 nuts and washers 1/3

HEADPHONES.

Sterling, 4,000 ohms	25/-
Brown, "F" type	25/-
Brown, "A" type	62/-
B.T.H.	25/
Siemens	25/-
Gecophone	25/-
Western Electric	25/-
Brunet, 4000	17/6
Single Brunet, 4,000	8/6
8,000 Brunet (for Crystal Sets only)	19/11
Brunet De Luxe	18/11
Lightweight "K"	10/9
Dr. Nesper adjustable	13/6
Ericsson (E.V.)	12/6

Post 6d. pair.

VARIOMETERS.

Ebonite 200/650	4/6
Ebonite Ball Rotor	7/6
Impregnated Board	3/6

EBONITE COIL STANDS.

2-way, ex handles	4/6
3-way, ex handles	5/6
2-way, good value	3/9
3-way, good value	4/11
Also at 4/3, 4/6,	5/11
2-way for Basket Coils	5/11
Universal	5/11

3-way, 1/6 each extra.

Franco:

2-way	12/6
3-way	17/6

Cam Vernier:

2-way	8/6 & 9/6

L.F. TRANSFORMERS.

Radio Instruments	25/-
Igranic, Shrouded	21/-
Powquip, Shrouded	18/-
Formo, Shrouded	18/-
General Radio	14/11
Brunet, Shrouded	11/9
Formo, Open	12/6
Powquip, 2–1 or 4–1	14/6
Raymond	10/-
Eureka Concert Grand	30/-
Ditto, 2nd Stage	22/6
Silvertown	21/-
Woodhall	23/9

EDISON BELL FIXED CONDENSERS.

.0001 to .0005	1/3
.002 to .006	2/-
.001	1/3
Twin Detector	5/9

Raymond—Fixed

.001 to .0003	10d.
.002 to .004	1/-
.006	1/3
.01, .02	1/6
.05	3/6
T.C.C. 1 mfd.	4/-
T.C.C. 2 mfd.	4/6

Post 3d. each.

WEST END DEPOT FOR

Polar; Jackson Bros.; R. I.; Burndept; Goswell Eng. Co.; Grafton Electric; Silvertown; Igranic; Lissen; Radio Press Envelopes; Dubilier; Edison Bell; Woodhall Goods, etc.

CALLER'S COLUMN. NO POST ORDERS.

Wound Coils (1600)	1/6
Tapped Coils (1600)	1/6
Filament Dials	2½d.
Ebonite 4½d., with knob	5½d.
Copper Foil, foot	2½d.
Washers, 2 and 4 B.A. oz.	1d.
Nuts, 2 B.A., 2 doz.	3½d.
Nuts, 4, 5, 6 B.A. 2 doz.	3d.
Filostat (D.E. or R. Valves)	1/9
Microstat (D.E. or R. Valve)	2/6
Allen Var. grid leak	1/6
Ditto Anode Res.	1/6
Good Fixed Condensers	8d.
Dutch Valves, Tubular	4/9
Dutch "R" type	5/-
Phillips "R"	7/6
French Metal	6/6
Porcelain Switches, S.P.D.T.	1/3
Ditto Switches, D.P.D.T.	1/11
Insulated Pliers, pair	1/-
Screwed Rod, 2 B.A., foot	2½d.
Ditto, 4 B.A., foot	2d.
Boxes 8 x 6 x 5 deep	2/6
Knobs, 1½ in. 2 B.A.	1½d.
Best quality ditto	3d.
1 in. 2 B.A.	2d.
¾ in. 4 B.A.	2d.
Real Ebonite Dials	1/-
Set of Spanners, etc.	1/3
Best Grid Leak and Condenser	2/2
Grid Leaks, 2 meg.	1/1
Easi-Fix Crystal cups	1d.
Vario. Crystal Sets	7/11
Ebonite Variometer	3/11

TERMINALS.

(With Nut and Washer).

Large W.O. or Pillar	1d.
Medium phone	1d.
Phone 2 B.A.	1d.
Small Pillar, 4 for	3d.
Pin screw terms, 2 for	1½d.
Spade Screw terms, 4 for	3d.
Spade Tags 5 a	1d.
Valve Sockets 2 for	1½d.
Valve Pins 3 a	1d.
Stop pins 4 a	1d.
Plug and socket pair	1d.
Spade Tags 4 for	1d.
Brass Plug and Socket, pair	1d.
Wander Plugs, pair	2½d.

Valve Holders, Ebonite	8d.
Basket Coil Adapters	8½d.
Ditto, extra quality	1/3
Plugs and Clips	6½d.
Shaped Coil Plugs	8½d.
Edison Bell	1/-
Ebonite Coil Plugs	4d.
Ditto, extra quality 6d., 7d.,	8d.
72 in. 'Phone Cords	1/5
Panel Switches, nickel S.P.D.T.	10½d.
Ditto, D.P.D.T.	1/4
Switch Arm (best) with 12 studs, nuts and washers	10½d.
Studs, complete, doz.	4½d.
Pointers 2 a	1d.
100,000 ohm res. and clips	1/3
Unit Coil Plug	1/1
Nugraving Titles	7½d.
Myers Valves	12/6
Adhesive Tape, roll	3d.
30v. H.T. Batt.	4/6
60v. H.T. Batt.	7/6
H.F. Transformers 250/700	3/6
Single Phones, 120 ohms.	5/-
Ditto 4,000	7/-
Button Brass	3/9
Button Aluminium	4/9
Stand for Phone	2/3
Coil-Stands, 2-way	2/6
Ditto, ext. handles	3/3
Ditto, 3-way	4/9
Electron Aerial, 100ft.	1/4
Copper Aerial, 100ft.	1/10
Extra Heavy, 100ft.	2/3
Egg Insulators	1d.
Rubber Lead-in, 10yds.	1/3
English 4.5 Batteries	4d.
Clips 2 a	1d.
Sleeving 4d., 3 yds.	10d.
16 g. Sq. Tinned Copper, 18 ft.	6d.
Twin Flex, 4 yds.	6d.
Burndept Detector	5/-
Variometers, 250/650	1/6
Raymond Transformer	9/11
Mic-Met Detector	6/-
Many good ones 10d. &	1/2
Nickel or Brass, best	1/6
(All above glass enclosed.)	
Hertzite	8d.
Tungstalite 1/- &	9d.
Gecosite 1/3 Neutron	1/6
Whiskers, silver or gold	2d.
Spearpoint	2d.
Filament Rheostats	1/3
Ormond Rheostat	1/9

Right Opposite
DALY'S
Gallery Door

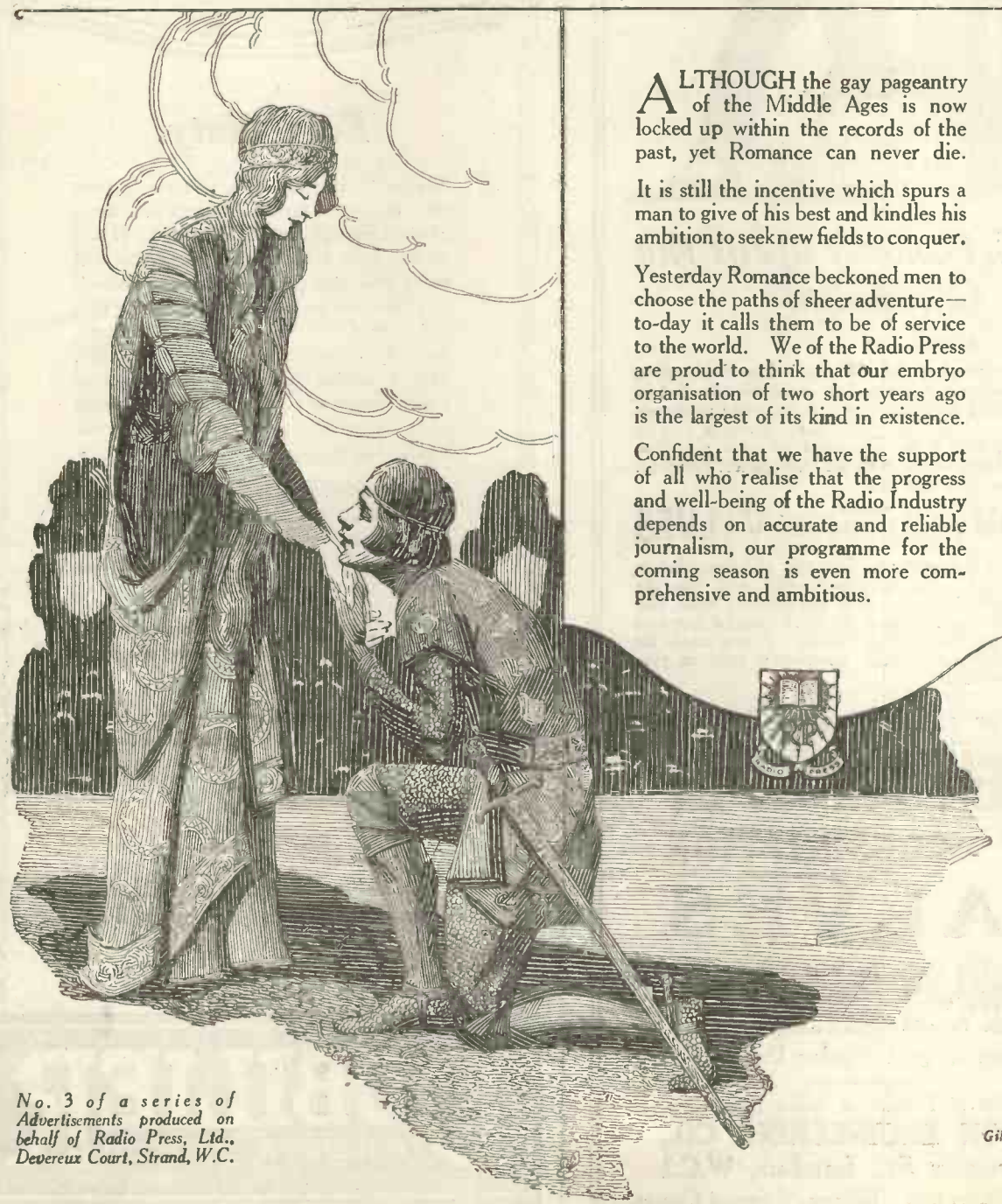
K. RAYMOND
27, LISLE STREET, W.C.2

'Phone: Gerrard 4637.

No responsibility accepted on post orders unless cheques and postal orders are crossed and made payable to K. Raymond. Moneys sent must be registered.

HOURS OF BUSINESS:
Daily - 9 to 7.45
Sundays 10 a.m. to 1 p.m.

ROMANCE



ALTHOUGH the gay pageantry of the Middle Ages is now locked up within the records of the past, yet Romance can never die.

It is still the incentive which spurs a man to give of his best and kindles his ambition to seek new fields to conquer.

Yesterday Romance beckoned men to choose the paths of sheer adventure—to-day it calls them to be of service to the world. We of the Radio Press are proud to think that our embryo organisation of two short years ago is the largest of its kind in existence.

Confident that we have the support of all who realise that the progress and well-being of the Radio Industry depends on accurate and reliable journalism, our programme for the coming season is even more comprehensive and ambitious.

No. 3 of a series of Advertisements produced on behalf of Radio Press, Ltd., Devereux Court, Strand, W.C.

Gilbert Ad. 1189

Wireless Weekly Small Advertisements

STUDENTS, successfully completing our 12 months' course on Wireless, are definitely guaranteed a position within one month of completion. Salary £150 to £500 per annum. (No Postal Tuition.) Prospectus free.—Wireless College, Bournemouth.

HEADPHONE REPAIRS.—Rewound, remagnetised, readjusted. Lowest prices quoted on receipt of telephones. Delivery three days. Est. 26 years.—Varley Magnet Co., London, S.E.18.

TELEPHONE RECEIVERS and Loud Speakers Rewound, 2,000 ohms, 3/6.—A. Roberts & Co., 42, Bedford Hill, Balham, S.W.12.

MARCONI L.S.5 valves, 2 at 30/- each, one U.3, 2 electrode, some Cossor and Ediswan R 7/-. Mic-Met and Hertzite, 4/-. Brown F 4,000, new, 17/6, Brown A 8,000, 30/-. Six 2 M.F. Mansbridge, 1/6 each. Two Igranic potentiometers, 4/- each. Moving coil volt and ammeter, 30/- each. Bonnard, 10, Kent Gardens, Ealing.

WHOLESALE ONLY.

WIRELESS DEALERS. Our New 68-page Trade List of Radio parts now ready shewing Trade and Retail prices. It is yours for the asking.

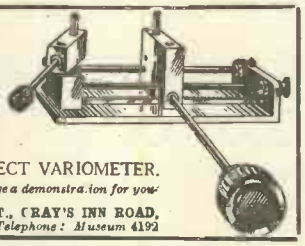
COMPLETE SETS, ACCESSORIES & COMPONENT PARTS

We were one of the very first Wholesale Factors of "Wireless," and our New Catalogue is the very latest thing in Wireless. Largest Radio List issued.

STAGGERING PRICES. HUGE STOCKS.
BUY FROM AN ESTABLISHED HOUSE.
IMPORTANT — Trade Only Supplied.

HOBDAY BROS., LTD., (DEPT. B.) 21, 23, 25 & 27 GT. EASTERN ST., LONDON, E.C.2
'Phone—CLERKENWELL 2800 (6 lines)

EL-BE UTILITIES
The "MIKROTUNE"



Makes Tuning Simple & Certain.

Reversible Coil-holder. Adds 50% value to any set. **12/6**

Coils under minutest control. A PERFECT VARIOMETER.

Send us the name of your Dealer and we will arrange a demonstration for you.

LEIGH BROS. 37, SIDMOUTH ST., GRAY'S INN ROAD, LONDON W.C.1. *Telephone: Museum 4192*

CABINETS YOU WANT

PICKETT'S Cabinets—they're good value. from 1/6 each, highly polished. Cabinet Works, Albion Rd., Bexley Heath, S.E. *Write for Lists W.L.*

EBONITE

Sheet rod and tubing in all sizes kept in stock and cut to any required size while you wait, or sent by post on receipt of cash.

WE CAN TURN ANYTHING IN EBONITE.

BURGE, WARREN & RIDGLEY, LTD.,
91/92, GREAT SAFFRON HILL, LONDON, E.C.1. 'Phone: Holborn 50

FINEST WORK & PROMPTITUDE.
INCOMPARABLE WHITE FILLING.

HAND AND MACHINE
ENGRAVING
ON ANY MATERIAL.

'Phone Central 1137.
CLIFFT & COCKLE
51, Arcade Chambers, St. Mary's Gate, MANCHESTER.

Radio Press Information Dept.
2/6 QUERY COUPON 2/6

WIRELESS WEEKLY. Vol. 4. No. 13. July 30, 1924.
This coupon must be accompanied by a postal order of 2/6 for each question, and a stamped addressed envelope.)

The Peto Panel Service

—an entirely new departure in Radio

BECAUSE we realise that an experimenter's chief difficulty in building up a good Set lies in the preparation of the Panel and the construction of the cabinet we are inaugurating the *Peto Panel Service.*

Types A and B.

Every Receiving Set described in future issues of MODERN WIRELESS and WIRELESS WEEKLY will be available in two forms. Type A will be the Set identical in every respect with the author's specification using the actual components illustrated in the article. Type B will be the pattern revised by Peto-Scott Co. Ltd., using their own guaranteed components and standardised cabinets. Both of these types will be available as finished instruments or in sets of parts for home construction. Naturally type B, while sacrificing nothing of the efficiency, will often mean a saving in cost of at least 25% in the initial outlay.

Guaranteed Ebonite.

Remember that every panel is of the highest grade Post Office Ebonite, fully guaranteed against leakage. Both sides are matted, and it is cut to size, drilled, tapped, and engraved. There is nothing for the experimenter to do except assemble the components on the panel and wire according to instructions.

Service Department free to users.

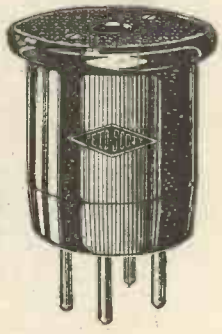
If, after completion, the Instrument does not work correctly it may be returned to us for testing—should the fault be traced to a component purchased from us it will be immediately replaced and the Instrument put in working order without charge. Should the fault, on the other hand, be due to incorrect wiring the Instrument will be put in working order at a nominal charge.

List of Sets available.

Decide now which of these Sets you will build and get full particulars and prices from us without delay:

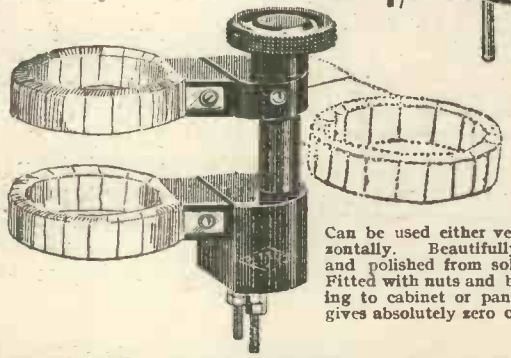
The Transatlantic V
The Puriflex
The S.T. 100
The 3-Valve Dual
The Omni Receiver
The All Concert de luxe
The S.T. 100 (3-valve).

Improved H.F. Transformers.



Specially designed for selectivity and low high-frequency losses. Tunes very sharply with a variable condenser of .0002 mfds. Primary and secondary wound in a number of separate grooves. Air core. Standard 4-pin fitting. Manufactured from pure ebonite, hand turned and polished.

Prices: 300 to 600 metres ... **6/6**
Chelmsford & Radiola Wavelengths **7/-**



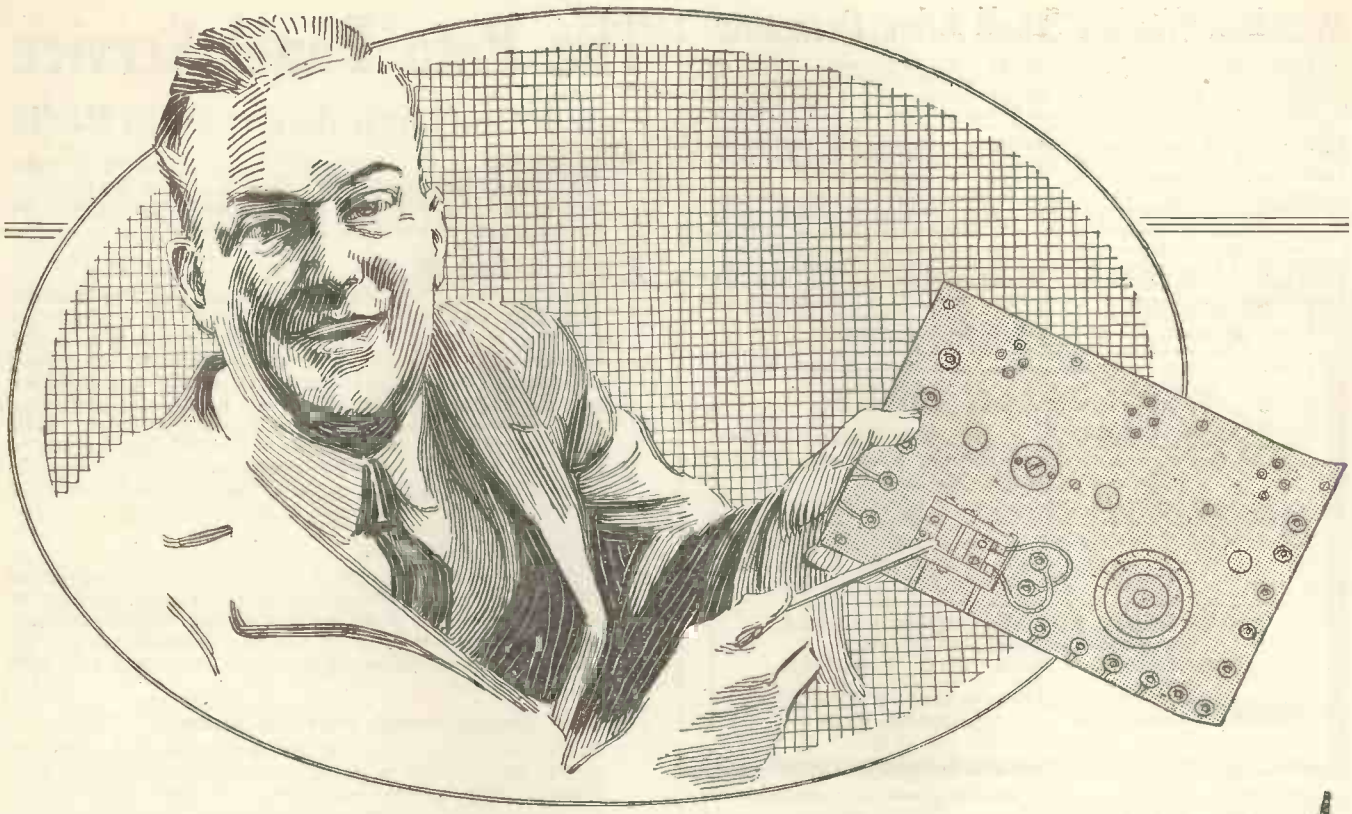
Rotary Coil Holder.

Can be used either vertically or horizontally. Beautifully hand turned and polished from solid ebonite rod. Fitted with nuts and bolts for clamping to cabinet or panel. A half turn gives absolutely zero coupling. **Price 7/6**

PETO-SCOTT CO. LTD.,

Registered Offices: **77, CITY ROAD, E.C.** *(For all Mail Orders).*

Branches: **London: 62, High Holborn, W.C.1, and 230, Wood Street, Walthamstow. Cardiff: 94, Queen Street. Liverpool: 4, Manchester Street. Plymouth: Near Derry's Clock.** G.A. 1165



Why, it's as plain as a pikestaff!

Panel Card No. 1

Giving full instructions for building a 3-Valve Set by means of a full size Cardboard Model. This Receiver has a range of 500 miles under favourable circumstances, and will operate a Loud Speaker from the nearest B.B.C. Station up to 30 miles away. Cost of complete components as specification is £5 12s. 0d.

1/-

Sold by all Booksellers and Newsagents and published only by RADIO PRESS LTD., Devereux Court, Strand, W.C.2.

AT last we have arrived at the very easiest method of demonstrating to a man how to build a Receiving Set. Our idea is this :—almost every Wireless Set consists of merely an ebonite panel and a cabinet—the latter being just a convenient method of supporting and protecting the underneath side of the panel. The panel itself is the only important part of the Set and therefore in this System we are issuing a series of full size panel cards of different types of Receiving Sets, cut to the exact size of the panel and containing a photograph of the top of the panel on one side and on the other side its wiring diagram.

Nothing could be simpler. On this full-size cardboard model it is easy to follow through every connection in the wiring, and to duplicate the Receiving Set with complete accuracy.

Included in every envelope are complete descriptive details of the Receiving Set together with a theoretical circuit diagram and a complete specification of components required.

Finally, full instructions are given for operating the Set and obtaining the best results.

This Radio Press Panel System is going to be one of the finest methods ever conceived for teaching the complete novice how to build a first-class Receiving Set without wasting time and money on early failures.

RADIO PRESS PANEL CARD SYSTEM

Gilbert Ad. 1127.

STEPPING STONES TO SUCCESS

SUCCESS in Radio is certainly dependent upon gradual and logical progress. The man who sets out to build an intricate and elaborate Receiving Set without first taking the trouble to learn some of the more elementary principles of Wireless, is very much like the man who is in such a hurry to reach the other side of the stream, that he omits to take due advantage of the stepping stones provided.

Radio—like every other hobby—wants understanding, and the easiest and most economical way of acquiring knowledge is to make systematic use of the Radio Press "stepping-stones" given below.

		Price
1	Wireless for All ... ... By *John Scott-Taggart, F.Inst.P.*	9d.
2	Simplified Wireless ... ... By *John Scott-Taggart, F.Inst.P.*	1/-
3	How to Make your own Broadcast Receiver By *John Scott-Taggart, F.Inst.P.*	1/6
4	How to Erect Your Wireless Aerial ... By *B. Mittell, A.M.I.E.E.*	1/-
5	The Construction of Wireless Receiving Apparatus ... ... By *P. D. Tyers.*	1/6
6	The Construction of Crystal Receivers... By *Alan L. M. Douglas*	1/6
7	How to Make a "Unit" Wireless Receiver ... ... By *E. Redpath.*	2/6
8	Pictorial Wireless Circuits ... ... By *Oswald J. Rankin.*	1/6
9	Wireless Valves Simply Explained ... By *John Scott-Taggart, F.Inst.P.*	2/6
10	Practical Wireless Valve Circuits ... By *John Scott-Taggart, F.Inst.P.*	2/6
12	Radio Valves and How to Use Them... By *John Scott-Taggart, F.Inst.P.*	2/6
13	500 Wireless Questions Answered ... By *G. P. Kendall & E. Redpath.*	2/6

RADIO PRESS PANEL CARDS.

No. 1	How to make the W.I. receiver ... By *Herbert K. Simpson*	1/-

		Price
14	12 Tested Wireless Sets ... ... By *Percy W. Harris.*	2/6
15	More Practical Valve Circuits ... By *John Scott-Taggart, F. Inst. P.*	3/6
16	Home-Built Wireless Components ...	2/6
17	Wireless Sets for Home Constructors By *E. Redpath.*	2/6
18	Tuning Coils and How to Wind Them By *G. P. Kendall.*	1/6

RADIO PRESS ENVELOPES.

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No. 2.	How to Build a 4-Valve Receiver *By Percy W. Harris.*	2/6
No. 3.	How to Build a "Simplicity" 3-Valve Set ... ... By *G. P. Kendall, B.Sc.*	2/6
No. 4.	How to Build the All-Concert de Luxe Receiver ... ... By *Percy W. Harris.*	2/6

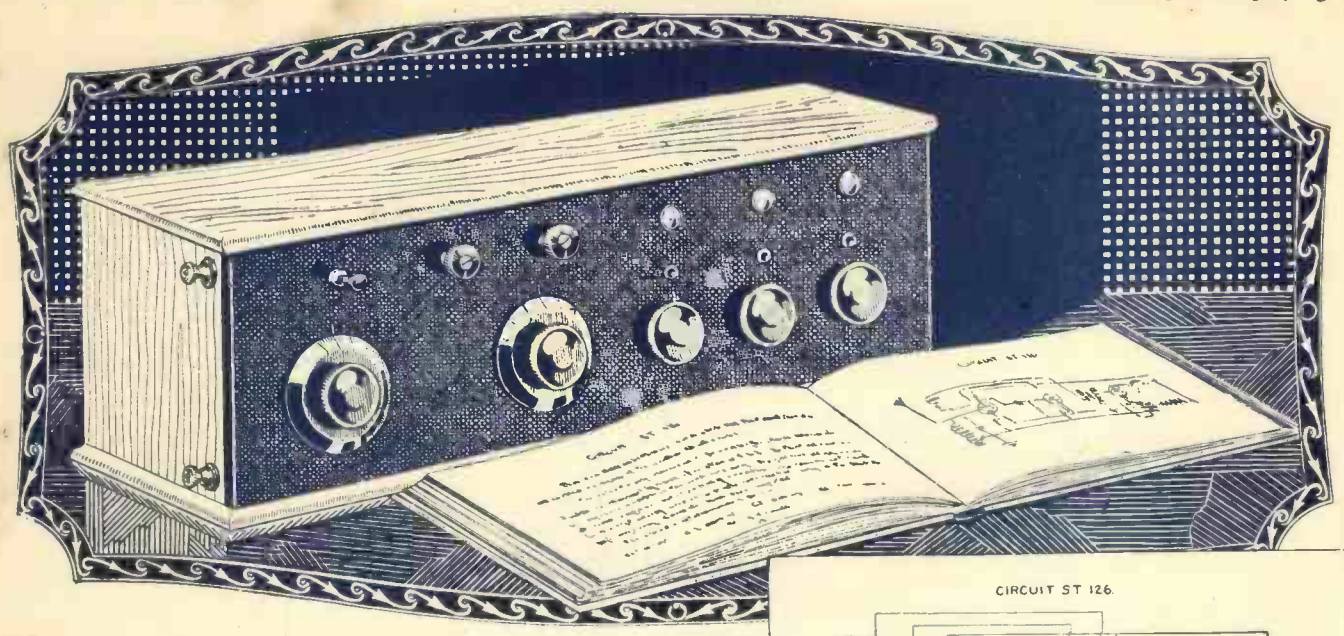
SIMPLEX WIRING CHARTS.

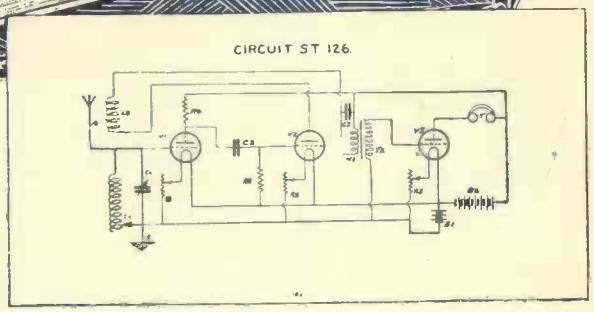
No. 1.	For 2-Valve Set	1/-
No. 2.	For 3-Valve Set	1/-
No. 3.	For 4-Valve Set	1/-

From all Booksellers, or post paid 2d. per book or 3d. per envelope extra direct from Publishers.

RADIO PRESS Ltd. — *the Largest Wireless Publishers in the World* — Devereux Ct., Strand, W.C.2

Gilbert Ad. 1192





Yes! you, too, need this fascinating Book of Circuits.

ALL the difference between success and failure in building a home-made Set lies in the correct values of the components and their arrangement.

Anyone who possesses a little wireless knowledge and who has built up a Set before will be able to pick up a copy of

MORE PRACTICAL VALVE CIRCUITS,

By John Scott-Taggart, F.Inst.P.

and build any type of Set according to his own ideas and incorporating any of the scores of circuits described in it without further assistance.

These clear diagrams are so accurate and the descriptions given are so complete, that to a man who already knows something about Wireless, the Book is almost as good as a huge constructional Book showing how to build dozens of different types of Instruments

For instance, opposite every Circuit is a full description of it—its advantages and disadvantages, how it should be used, the values of the fixed condensers and resistances, and so on. All this information is given because every Circuit is a practical one, and not a paper one. You can be confident that it will do all that is claimed for it.

This Book contains a very large number of circuits, including all the recent reflex circuits, together with such special Circuits as the Reinartz and the Flewelling. It is beautifully printed on good quality paper and bound in full cloth—a real reference Book, in fact. Get a copy from your Bookseller to-day, or direct for 3/8 post free.

RADIO PRESS Ltd., Devereux Court, Strand, W.C.2.

More Practical Valve Circuits

By John Scott-Taggart, F.Inst.P., A.M.I.E.E.

3/6 *in full cloth*

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