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Wireless Weekly

and the Wireless Constructor.

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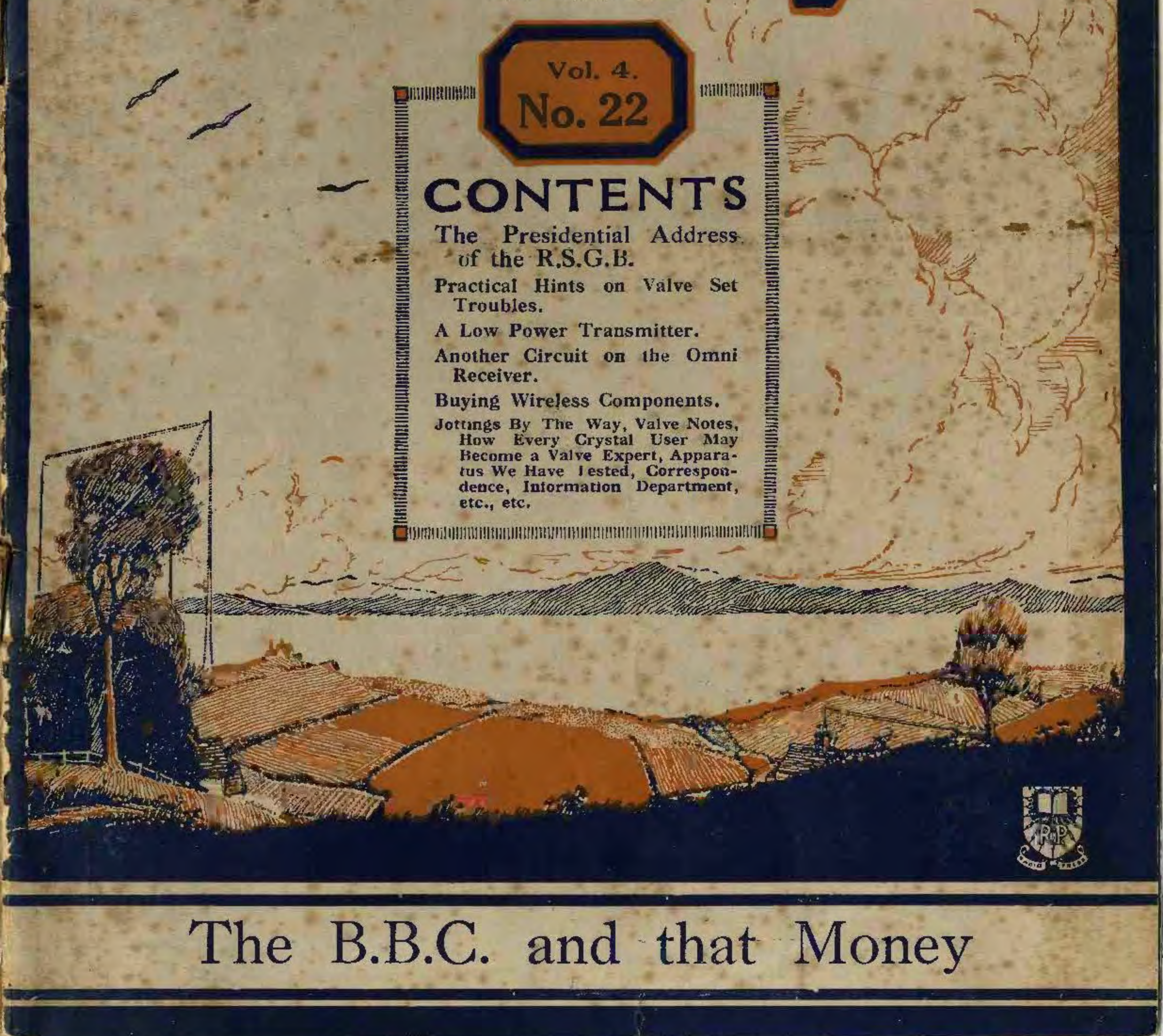

The B.B.C. and that Money

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£500 To Fight The Post Office

Our readers will, no doubt, have seen in the daily Press that the Editor, on behalf of *Wireless Weekly*, has offered the sum of £500 to the Radio Society of Great Britain towards the expenses of fighting a test case with the G.P.O. Since the announcement of this offer the *Wireless World* have also offered a similar sum, and by the time this appears other wireless interests may have followed our lead.

The remarks of Dr. Eccles, President of the Radio Society of Great Britain, appear elsewhere in this issue, and it will be seen that at last the Radio Society is appreciating the fact that the Post Office policy is to tighten up the reins as much as possible and to introduce as many difficulties as they can in the way of experimental transmitters.

With unfailing monotony the Post Office blandly declares their good intentions, while at the same time they introduce more and more restrictions and become more and more reluctant to grant licences at all.

If the Post Office is definitely challenged on the subject in Parliament or elsewhere, they fall back upon the old formula in which they declare that restrictions are necessary, because of possible abuses, but that all genuine experimenters will be given every facility and that extra power, extra wavelength, and all other so-called concessions are readily made in all suitable cases. Perhaps the Post Office can fob off the general public with statements of this kind, but the excuse offers little consolation to those intimately in touch with affairs.

To introduce all sorts of heavy restrictions and to leave a loophole by saying that these are removed in all suitable cases, is an attitude which we consider should not be tolerated for a moment.

In actual practice these restrictions are only lifted in a comparatively few number of cases, and a large number of highly competent applicants are refused licences altogether.

Dr. Eccles, in his address, disclosed the fact that the Post Office refused transmitting licences to a special list approved by the Council of the Radio Society. This list included applicants of the very highest qualifications, and if the Radio Society requires any evidence of what the Post Office thinks about their qualifications as judges in these matters, here is a startling example.

The Post Office simply relies upon the Wireless Telegraphy Act of 1903 for imposing all sorts of regulations and restrictions, quite unnecessary, and merely vexatious. Some of their acts, such as the imposition of royalties and the withholding of licences, are absolutely illegal and the sooner this is shown to be the case in the courts, the better.

We have often criticised the Radio Society in the past, and we will probably do so in the future, but our offer of £500 with a promise of more is ample proof of our earnestness in these matters. The Post Office have played the fool long enough with the Radio Society, and if the latter's eyes are not open now, they never will be. Let them stage a suitable case and openly challenge the Post Office to take action. It is the only way to bring matters to a head. If the Radio Society fails to show a strong spirit now, their influence will disappear.

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Dr. Eccles Attacks the Post Office

The Autumn Address before the R.S.G.B. by the President, reveals the strong feeling existing between the Society and the Post Office anent the transmitters' position.

Dr. W. H. Eccles, F.R.S., President of the Radio Society of Great Britain, whose trenchant remarks concerning licenses are given below.

THE Radio Society and its Affiliated Societies comprise every kind of amateur—the home constructor who has fallen a victim to the fascination of making or improving tuners and amplifiers, the ripe enthusiast who welcomes morse as much as music and constructs reflex circuits and other modern marvels, and the matured transmitter who fishes in the ocean of space and learns the ways of the waves in our ever-changing atmosphere. By uniting all these the Societies will surely gain in strength as time goes on. At present the Radio Society consists of about 800 ordinary members and over 200 Affiliated Societies and is governed by a Council and by a General Committee.

The advent of broadcasting has greatly augmented the ranks of the amateurs, especially those interested in building and experimenting with receiving apparatus. As broadcasting flourishes so will the number of amateurs increase. It is inevitable that a large proportion of these amateurs will in due time desire to supplement their knowledge of receiving apparatus by actual work with transmitting apparatus. We hope to see them join the Societies early and climb through the various stages into the Transmitter and Relay Section and thereby enter the ranks of the élite in the amateur movement.

We of the Society think that one of the most lasting benefits of the spread of broadcasting—a benefit much less ephemeral than the music and the speeches—lies in the stimulus it is giving to the study of electrical things; and from this point of view broadcasting is an immense force attracting the quicker minds of every country towards physical science. We think this is highly commendable because we know that the spread of a knowledge of electricity and the cultivation of electrical skill (for which there is no better medium than wireless) is in the widest sense of the utmost national value in this glowing morning of the electrical age of mankind.

Since the time when Admiral Sir Henry Jackson, my predecessor in office, gave the first autumn Presidential Address, the custom has grown up of employing the occasion to tell members and the public of the recent joys and sorrows of the Council. I shall take advantage of this custom to-night.

The International Congress

First of all, I have to inform you that the Society had the pleasure last Easter of taking part in the International Congress in Paris, held under the Chairmanship of Mr. Hiram Maxim, which led up to the formation of the International Amateur Radio Union. Mr. Marcuse, the Hon. Secretary of the Transmitter and Relay Section, represented the Society in Paris and was elected to the International Committee which is to meet next Easter to draw up schemes for international amateur work. Since the formation of the International Union, Mr. Marcuse has been travelling in America and Canada. He came back with a message from the Canadian Radio Relay League, worded as follows:—

"Please convey our greetings to the Radio Society of Great Britain with congratulations on their achievements. We also congratulate the Transmitter and Relay Section on their wonderful success in the transatlantic tests and take this opportunity of expressing our desire for a stronger

affiliation between Great Britain and the Colonies for the general benefit of amateur radio."

Transmitting Permits

Very shortly after these events the Post Office began to issue their permits to transmitters with new and unexpected restrictions printed upon them. The one striking directly at the international co-operation of amateurs just described is numbered 7 on the printed permits. It reads:—

"Messages shall be transmitted only to stations in Great Britain or Northern Ireland which are actually co-operating in the licensee's experiments and shall relate solely to such experiments."

I will read to you what *The Electrician,* one of the most important electrical journals of the world, said about it:—

"A Curious Restriction. —The permits to transmit, which are now being issued by the Postmaster-General to wireless experimenters and amateurs, contain a condition and limitation which is likely to give a good deal of trouble and whose precise object is not altogether clear . . . . How is it to be ascertained that the energy transmitted is passing within the frontiers of Great Britain and Northern Ireland and no further? . . . . Again, what exactly is the aim of the restriction? If only experimental messages are sent there can be no objection to whoever will receive them, and in the possibility of reception in unexpected places lies a good deal of the use and interest of this class of work. But quite apart from these points, the imposition of such a restriction, except in so far as it relates to what is sent, seems to us unjustified, not the least because it may have a harmful effect on the development of radio communication."

I call attention to the words in this criticism:—"in the possibility of reception in unexpected places lies a great deal of the use and interest in this class of work." This is so obviously true that the Society got into touch with the Post Office in order to elucidate the matter. We are given to understand that the printing of the restriction on the permit was merely embodying a practice already recognised; and that each experimenter desiring facilities for foreign communications should furnish particulars of the experiments and evidence of an arrangement for co-operation by a foreign or colonial station or stations. Our comment upon this is that it is impossible to make arrangements for receiving from unexpected places and acknowledging the receipt.

An Example

I think the restriction may have been conceived without information of the methods necessary for carrying out this very valuable wireless range finding. For example, during the past few weeks very strong signals have been received in London from a powerful amateur station in the Argentine. The right thing for any English amateur to do would be to reply instantly and endeavour to get into touch on the same wavelength after making sure that he would cause no local interference. If he succeeded and made records of the variations of signal strength, he would have contributed something to wireless progress. But, according to the new restriction, he would thereby be endangering his permit. As *The Electrician* says:—"What is the aim of the restriction? If only experimental messages are sent there can be no objection to whoever will receive them." I agree. It makes no difference whatsoever whether a message is addressed by a Sheffield amateur to a man in the Shetlands or a man in Dublin, yet the latter would be a breach of the permit. It makes no difference because the same waves go forth in the same all-round way whatever morse call sign is put at the front of the message.

Protests

I cannot imagine that international amenities can be assisted by any restriction that asks a British amateur to turn a deaf ear to his brother amateur in other countries who is not under such a restriction and will not understand it. The Council have received so many protests from members all over the country that they have had to enquire under what Act of Parliament and for what national or other reasons this limitation of a licence-holder's liberty is imposed. They have found no answer and they have concluded that such a restriction would destroy one branch of research, would prevent the development of friendly relations between amateur workers in this and other countries, and would tend to isolate the British amateur from international co-operation with the rest of the active world.

Continental Amateurs

It may not be generally known that the volume of continental amateur transmission that can now be heard in this country from dusk to midnight is vastly greater than the whole volume of our own amateur transmission at all hours. At this point one cannot reiterate too forcibly that it was the amateurs who discovered the valuable properties of short waves across long distances. Up to three years ago the commercial companies and the experts thought that short waves were no use for long ranges. Then the amateur stepped in and bit by bit extended the range across which one could communicate with another. Two years ago, as a result of the Radio Society's transatlantic experiments, the incredulous ones looked into the matter. Then the engineers of the Marconi Company, by using larger powers and reflecting screens, developed the Beam system, which, it is hoped, will afford many parts of the Empire a service of high speed telegraphy. In view of these very recent triumphs of the amateur, this seems quite the wrong moment to introduce restrictions which will push the British amateur off this field of discovery and leave it to the amateurs of other nations.

The Wireless Telegraphy Act.

The restriction and the discussion have called great attention to the Wireless Telegraphy Act. The Act seems very clear and I propose to give you my reading of it. First notice that the expression "wireless telegraphy" is defined to mean any system of communication by telegraph without the aid of any wire connecting the points from and

at which the messages for other communications are sent and received. The main object of the Statute is to protect the State monopoly of the electrical transmission of messages or communications between individuals. A second object is to establish control over the sending and receiving of messages inasmuch as transmission by wireless telegraphy was thought to be a possible source of danger to the State in certain events, especially war. Another object is to obtain such control as will minimise the interference of one user of wireless with another. All these aims are just and necessary. They are to be obtained by prohibiting persons from establishing any wireless telegraphy station or installing or working any apparatus for wireless telegraphy except under licence from the Postmaster-General.

Two Important Provisos

Two very important provisos are made in the Act. The first, which governs the whole Act, is that "nothing in this Act shall prevent any person from making or using electrical apparatus for actuating machinery or for any purpose other than the transmission of messages." In other words, if the purpose of a piece of electrical apparatus is *not* the transmission of messages it need not be licensed. This provision is obviously a necessary one, for otherwise every piece of copper wire wound into a coil and every pair of metal plates fixed up as a condenser, would need to be licensed, which would reduce the Act to an absurdity.

The Second Condition

The second proviso is that when a British subject wants a licence for the sole object of conducting experiments in wireless telegraphy, that is, in communication to a distance, a licence shall be granted to him as his right. But he must prove to the satisfaction of the Postmaster-General that his sole object is to conduct experiments; that is to say, he must not have the intention to transmit messages for money, must not intend to interfere with other users of wireless maliciously, and must not intend to do anything dangerous to the State. This is the amateurs' Magna Charta.

Restrictions

The licence which the Postmaster-General must grant to the amateur may be "subject to such special terms, conditions and restrictions as the Postmaster-General may think proper, but shall not be subject to any rent or royalty." I think much of the trouble that has arisen comes from the last sentences. For example, they seem to have been interpreted to mean that the Post Office may restrict the licence to the use of a station for a few minutes a day between specified times and on a very low power, thus depriving the licence of nearly all utility. The phrase "terms, conditions and restrictions" has been applied to compel applicants to disclose completely the object and the method of their proposed experiments.

Experiments

Now there are some experiments for which the method can be foreseen and some for which it cannot. For most of them the method and the apparatus must be evolved as we go along. Hence the applicant for a permit to try experiments of this latter class is refused his licence—which is quite contrary to the spirit and the letter of the Statute. The ultimate consequence is that some surprising anomalies have arisen. For instance, at the beginning of the year the Council sent forward a select list of names of applicants of whose bona fides and competence the Council was confident.

Applications Refused

The list included among other experienced wireless amateurs one who has graduated in electrical engineering at a great College of the University of London. All the applications were rejected. At the same time the Council heard of licences being granted to inexperienced beginners with inferior qualifications. I am informed that the solution of this mystery is that some of the successful applicants for permits copy a few pages out of a technical treatise or published paper and present it as a description of their proposed research.

The Pre-war Transmitter

Another instance in which the Society has tried to assist is that of a pre-war transmitter in the North of England who has retired from business and is anxious to return to the study of the variations of signal strength produced by the atmosphere. His application has been refused although, he tells us, beginners in his neighbourhood, some of them his pupils in the art, have been granted permits since.

The Post Office Desire

Even in those cases where a problem can be delimited and a method tentatively suggested, the desire of the Post Office to weigh the scientific value of the experiment and method before granting the permit is unpractical. It is an axiom of science and invention that such adjudication is worthless. It is a responsibility that no man of science, no scientific body would presume to undertake. The unexpected happens and is valuable. In short, it is much easier to spot the winner in a handicap than to forecast the result of an experiment.

The Society's Station

While I am speaking of the Act I might refer to the enactment that the licence granted for experimental purposes shall not be subject to any rent or royalty. The experience of this Society in connection with its own experimental station is as follows. The original licence was required to cover three and a half months' operation and was granted on December 7 last. The licensing fee of £2 and a royalty of £2 10s. for a complete half year had to be paid. The permit restricted the use of the station to 15 minutes on any one night between the hours of 1 a.m. and 7 a.m., and the power was limited to 1 kilowatt. It is to be regretted that so severe a curb should be imposed upon altruistic scientific work. It is reminiscent of the dark ages. At the present moment the position is that the Society is prohibited from using its station, even for helping amateurs to tune their apparatus correctly, unless the Society consents to pay another £2 10s. in royalty for the remainder of the year.

A Similar Position

Perhaps the anomalies I cite above have grown up as the

result of a system adopted long ago and have not been brought plainly before the authorities. I think it will be universally agreed that the system ought to be revised so as to remove them. An analogous case and its remedy is to hand. It will be remembered that at the beginning of the broadcasting movement in this country the Post Office applied the Wireless Telegraphy Act to compel all broadcast listeners to buy their apparatus from a specified group of firms. The upshot was that the home constructor arose in his thousands and defied the regulation. The Post Office thereupon tackled the problem afresh and rectified the mistake.

The Present Difficulty

This is exactly analogous to the present difficulty with the amateurs, but in this case the regulations are hindering scientific discovery, are robbing the best men of opportunities for learning advanced technique, are diminishing our wireless prestige relative to other nations, and will ultimately react adversely on the output of invention and technical improvement. The remedy is easy; it is to recast the regulations in the light of the experience of other progressive countries. British transmitters would then attain the same measure of freedom and be put under the same obligations as their fellow amateurs in America, France and elsewhere.

A Year of Reorganisation

I have dwelt at some length upon the licensing anomalies because of the great importance of this matter from the national and scientific points of view; but the Council have had many other problems before them. This has been a year of re-organisation; and therefore a very arduous one for the Council, which has in fact held thirty-four meetings in the twelve months. Their work has resulted in many improvements. The first great improvement consisted in concentrating all the work of the Society in a central office and in appointing a Secretary. Next, a number of Standing Committees were formed to deal with much of the detail work of the Society. The amount of devolution can be seen from the list of names of these Committees:—The General Committee of Affiliated Societies, the Membership Committee, the Papers Committee, the Licensing Committee, the Publicity Committee and the Standards Committee. Full particulars of these Committees will be published in the Annual Report. Besides these there are permanent Committees of the two new Sections of the Society, namely, the Schools Radio Society and the T. and R. Section. Since January the Committees have altogether held more than forty meetings.

Activities

The activities of the above-named Committees are more or less invisible, but the scientific meetings of the general membership of the Society constitute an equally good record. During the twelve months there have been ten ordinary meetings with an average attendance of ninety, nine informal meetings with an average attendance of forty, and eleven meetings of the Transmitter and Relay Section with an average attendance of fifty-five.

Among the greater of the public efforts of the Society during the past twelve months I must mention the organisation of the transatlantic tests last autumn. Mr. Coursey's report was published in May last, and is familiar to all members. Another important piece of work was the transmission and reception tests conducted in an express train on the London and North-Eastern Railway, organised by Messrs. Child, Coursey and McMichael. Full reports of these tests have now been published, and the thanks of the Society duly tendered to all who had assisted.

The Society Badge

Another matter which has engaged the attention of the Council has been the choice of a badge for the Society and its affiliated Societies. In order to obtain suggestions, the Council offered a prize of £5, reserving the right to use any or none of the suggestions in any manner.

Prize Winners

A large number of designs and ideas were sent in, many of them beautifully executed. They will be exhibited at the Society's stand at the exhibition opening on Saturday. A Sub-Committee, consisting of Admiral Sir Henry Jackson, Mr. Campbell Swinton and myself, went through all the suggestions, and agreed that no one of them was exactly suited to our purpose. Finally, it was decided to combine some of the elements occurring in two of the best designs and to divide the prize. The winners are Mr. Frank W. Taylor, of 60, Cleveland Gardens, Barnes, and Mr. H. H. Townley, 26, de Crespigny Park, S.E. Many other of the competitors deserve prizes, but I can do no more than give them honourable mention, together with the thanks of the Society for their efforts. They are:—Messrs. Adeane of Shepherds Bush, Bampton of Salisbury, Bassett of Crofton Park, S.E., Bowes of Darlington, Brayshaw of Huddersfield, Church of Hendon, Clamp of Sydenham, Cooper of Acomb, Cumming of Yeovil, Farrar of Cardiff, Flinton of Scarborough, Francis of Barnet, Goundry of Barrasford, Harvey of Bristol, Helps of Bradford-on-Avon, Ibbitson of Sunderland, Larkin of Eltham, Loughlin of Salford, Marshall of Harrow, Mitchell of S. Croydon, Rowell of Gateshead, Sugarman of Abercynon, Wright of Portsmouth, and Wysehall of Rotherham.

The Marconi Direction Finder on American Vessels

The United American liner *Reliance*, which arrived at Southampton on September 24, is being equipped with a Marconi wireless direction finder. The range of the instrument is 100 miles without correction, and it covers all wavelengths from 400 metres to 1,000 metres. This ensures that accurate bearings can be taken with maximum efficiency over all the wavelengths used in maritime signalling. Most of the signalling between ships and between shore and ships is on 600 metres wavelength, and the transmission of special signals by beacon stations is usually on 1,000 metres, so that the Marconi direction finder is as suitable for assistance to navigation in open waters as it is when making landfall.

Mud

I PLEADED some time ago for something like standardisation of the small parts that we must all use for making up wireless sets or the small gadgets, upon the construction of which most of us spend so much of our time and money. Now I have another grouse, which concerns that indispensable material ebonite. Much of what we buy is very good indeed, but for all your care, you may occasionally be landed with a slab which is of no use for wireless purposes, though if you have not drilled it too full of holes it may be used to replace a missing slate upon your workshop roof. There is, I am told, a variety of the substance, which is known to the trade as "mud." On occasions, when a chunk of it has been planted upon me, I have found a very much worse name for it than that. The trouble is that it looks just the same as the genuine article, and that if you go through life with a trusting faith in your fellow human beings, you may very easily find a quantity of it has been palmed off upon you. You will not find it out at once, for, suspecting nothing, you will spend hours, even days, in marking out, drilling, making up and wiring your latest wireless set upon it. You will try the thing out, and it will not work. You will apply every known test to discover the seat of the trouble, and fail to find it. You will consult your friends, getting no help from them. Your plight will indeed be a pitiable one, until perchance the light dawns. You are a victim of mud!

Other Things as Well

And there are lots of other little things that make me want to arise at times and go out and slay somebody. Though I am by nature a gentle, easy-going soul, there are times when my strong passions are aroused and I feel like murder of the most unpleasant kind. Take the case of valve legs. I have a predilection myself for tapping these in, so that nuts need not be used on the underside of the panel. Thus is capacity saved. To revise an ancient proverb, take care of the micro-microfarads and the milliamps will take care of themselves. Very well, I go forth to a wireless shop and purchase, let us say, a couple of dozen valve legs, all of which come from the same box and look exactly alike. I run the gauge over one of them and find that it is screwed 5.B.A. This alone is sufficient to disturb one's equanimity, for I have never been able to discover any reason for the use of the odd B.A. sizes in wireless work. However, being a proud possessor of a drill of the correct size (if I could only find it) and of a 5.B.A. tap (which *ought* to be in that box over there), I eventually get down to it, and after some strenuous work twenty neatly-tapped holes appear on a large panel for the reception of the legs that will support five valves. Then comes the task of screwing in the legs. The first one goes in beautifully, and so does the second, but the third is unaccountably loose; it does not seem to be gripped by the threads, and when it is screwed home you cannot tighten it up at all. It is withdrawn. It is measured. It is 6.B.A., and so, on further examination, are about half those that I have purchased.

How it Happens

And there you are, you see. If only the first valve leg measured had been 6.B.A. things would not have been so bad, for it is possible to put a 5.B.A. tap through a 6.B.A. hole. But you cannot turn a 5.B.A. hole into a 6.B.A. by any process known to me. It is a perfect example of the perverseness of the lady known as Fate. The radio dealer starts it by mixing up anyhow his stock of valve legs and dishes out an odd lot to you. Then Fate, observing what is happening, chuckles up her sleeve and carefully places in your hand a 5.B.A. leg when she sees that you are about to measure the thread. She watches you drill and tap your holes with unholy glee. With fiendish ingenuity she makes you pick out 5.B.A. legs for the first two that you screw in, so that you may think that all is going well. It is always the third or a later one which is 6.B.A. Really, you know, Fate ought to be spanked. She ought to be old enough by this time to know better instead of going on like some silly flapper. Unfortunately it is always she who administers the spankings and you who receive them. You may grin and bear them if you are a stoic, but gnash your teeth and tear your hair should you be made of the same clay as most ordinary men.

For It

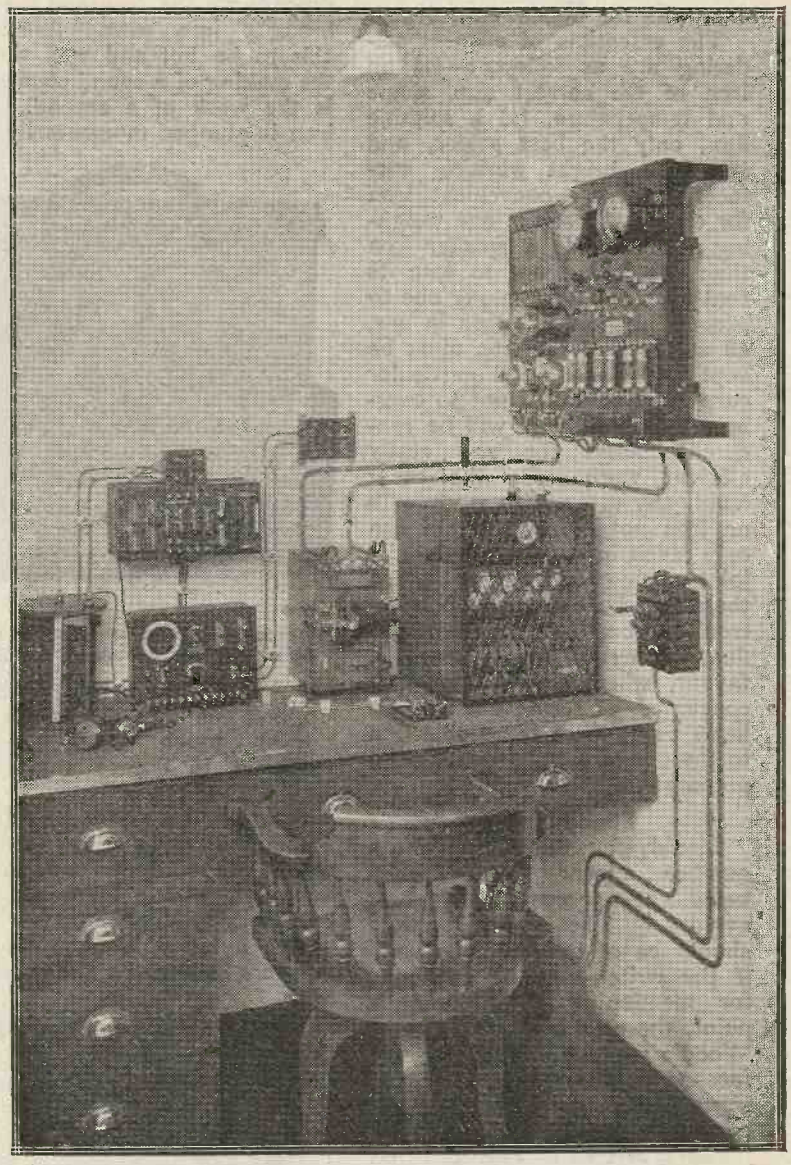
It is really amazing to notice how absolutely wrong things can go at times. You go to your workshop whistling gaily and feeling at peace with all the world. You start some small piece of work, using a setsquare and scriber and ruling a line. Then you lay these two down for a moment whilst you reach for the centrepunch, the hammer and the footrule. After making one or two measurements you become a little doubtful as to whether one of your lines is ruled quite correctly. The setsquare will remove all doubts in a moment; but where is the setsquare? About half a minute

ago you placed it upon the table straight in front of you, but it is not there. It is not upon the nail upon which it normally hangs. It has not fallen upon the floor. It is not under anything else. It is nowhere. If you are wise you will realise at this point that Fate is out to have a game with you, and you pay her out in her own kind by spoiling the whole show. "Well, I don't really need the setsquare," you say; "it will turn up some time. Meanwhile I will just light a pipe." You put your hand in your pocket to pull out your pipe, and there is the setsquare. The lady will now leave you alone for the rest of the afternoon. If, on the other hand, you begin worrying about the wretched thing, she will allow you to turn your workshop upside down before you find it. She will send you indoors in search of matches, and feeling that the day is rather warm you will leave your coat hanging up in the hall and go to the workshop in your shirt sleeves. You will behave like a perfect maniac, and Fate will laugh till she is fit to bust. Then you will decide to chuck it for the afternoon, and will reach to the peg on which it usually hangs in the workshop for your coat. Not there, of course. You try your wireless den; no coat. You go up to your bedroom, fail to find it, and don another. Late that night you come across it hanging up in the hall, and as you reach it down the setsquare falls out of the pocket and smites you on your pet corn.

Temporary Insanity

I have never been able to understand why it is one suffers on occasions from temporary insanity. Have you not many a time searched high and low for your pencil when it was in your hand all the time? Have you not looked everywhere for a much-needed drill only to discover at last that it was all the time safely grasped in the embrace of the drill chuck and waiting for you to use it? Have you never mistaken IS for OP in wiring up—a thing you could not possibly do in sane moments—and then spent days in wondering why the set would not work? You have done all these things, and so have I, and we shall all of us do them again in the future. I suppose that one must try to cultivate a philosophic calm, but it is a little hard to do so at times. At the moment, for example, I am searching for a stamp wherewith to post my manuscript. I bought no less than twelve this afternoon in a moment of extravagance, and placed them in the small drawer where stamps always live. They are no longer there, but I am not going to fuss about it, at least I think I am not; but why on earth people cannot leave one's stamp drawer alone but must be eternally taking the wretched things out when they know how important it is to you to have a supply always at hand I cannot think. It is a rotten, miserable shame, and here am I working like a nigger to catch the post and handicapped just because somebody who has come along to my drawer and borrowed a stamp has not the common decency to put the rest back after taking one. It is absolutely sickening. Quite enough to drive a man insane. If I can find out who it was I'll . . . I beg your pardon; let us say "as you were." I have just found them under my writing pad.

WIRELESS WAYFARER.



Our photograph shows a standard Marconi transmitter and receiver for shipboard use. Apparatus of this type may be seen at the Palace of Engineering, Wembley.

Practical Hints on Valve Set Troubles . . . .

By R. ROBERTS.

IT is hoped that the few notes to follow will be of assistance to amateurs who have built up valve sets from instructions given in these or other pages, and experience any difficulty in getting their completed products to function satisfactorily.

Soldering

One of the most frequent sources of trouble in amateur-built sets is in badly made soldered-connections. For some reason or other, soldering, in reality an extremely simple and even delightful operation, is to the average experimenter a painful, laborious process, to be got over with the utmost expediency.

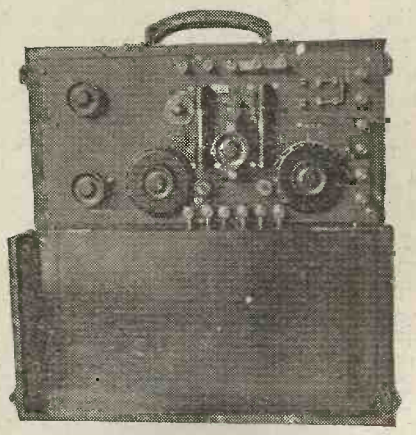
The essentials of efficient soldering are as follows:—(1) an iron of the correct size, shape and temperature, (2) a suitable flux, only the best solder, and (3) clean, bright working surfaces. A very convenient iron for electrical work is one weighing about 6 oz.; a smaller iron than this being apt to lose its heat too quickly, a larger one to become unwieldy. When in use, all surfaces of the iron must be kept well tinned, and particular care must be taken not to overheat the iron, or it will be rendered useless for any really efficient work. On the other hand, any attempt to work with an iron not sufficiently hot can only result in ragged, ineffectual joints being formed, at which there will be every likelihood of trouble occurring. In regard to flux, the writer is very much in favour, where electrical work is concerned, of resin; but if sparingly used, there is no objection to the use of a good commercial preparation.

Liquid Fluxes

Liquid fluxes, of which a number appear to be marketed at present, are best avoided. The solder used should be of good quality, and if the writer may be pardoned for mentioning so obvious a point, the next best thing is *not* Wood's metal. Finally, all surfaces to be soldered must be kept scrupulously clean—in this respect a card of small files will be found very useful—and all brass terminals, etc., will require careful tinning before it is possible to make an efficient connection.

Modus Operandi

The actual *modus operandi* of soldering is somewhat as follows: In the first place, a short length of wire is cut, the usual thing being a tinned copper wire of No. 16 or 18 gauge, stretched taut prior to use. The two points which this wire is required to bridge are now cleaned, tinned, and finally given a thin application of whatever flux is being used. The wire may now be held in the centre by means of a pair of pliers, its end dipped into the flux, and the iron brought into play. Assuming this to be hot and well tinned, the making of a sound connection is the work of a second. The iron is plunged momentarily into



A portable two-valve receiver made by a "Wireless Weekly" reader.

the flux, a little solder is picked up and run into the joint; the merest touch being usually sufficient to ensure a scientific weld taking place.

A point the writer would like to emphasise is, that once the knack of efficient soldering is acquired, wiring up a set is a considerably simpler matter than where a lot of nuts, bolts and washers have to be fiddled about with.

Some Frequent Causes of Trouble

Where a set refuses to function in spite of the soldering having been carried out in an efficient manner, one might proceed somewhat as under:—

In the first place, the wiring should be carefully checked over with the aid of the technical diagram, and thorough investigation made for any imperfect connections or wires crossing and short-circuiting. In any such overhaul it is a good idea to start with the aerial circuit and proceed systematically to the high-frequency and detector units, and thence, stage by stage, through the low-frequency amplifiers. Everything being found correct, it now becomes necessary to test out some of the components.

Condensers

Condensers, for instance, should be disconnected at one terminal and tested out for possible short-circuits, particularly the small fixed condensers used in various parts of the set for coupling the detector valve, shunting the primary of the first L.F. transformer, and so forth. A leak in one of these might be responsible for a good deal of trouble. Reactance units, transformer windings and inductance coils may also be tested out for breaks or short circuits; all of these tests being readily carried out by means of a small battery and a pair of telephones.

Failure to reveal trouble in any of the components will mean that the fault is extraneous to the set and must be sought in the external accessories, such as the H.T. or L.T. battery. Either of these connected up in the wrong manner might be responsible for the set not functioning, and both should be tested with a voltmeter.

Ebonite

A very frequent cause of trouble in amateur-built sets is

An article which many readers will find both interesting and instructive.

in improperly prepared ebonite panels. It should be pointed out that ordinary commercial ebonite is of no use whatever for wireless work until the outer polished surface has been removed. This may be done by rubbing the panel down, on both sides, with a coarse-grade emery paper, afterwards applying a touch of paraffin or turpentine. If this "matting" process has been omitted, it is strongly urged that the entire panel be dismounted and a fresh start made, as with unprepared ebonite there is little likelihood of ever getting the set to function efficiently.

Bad Contacts

Another common seat of trouble is in bad contacts made by valve legs and the pins of honeycomb coil and plug-in high-frequency transformers. Pins should be opened out slightly with a penknife, and when re-inserting in their various sockets it should be noted whether an effective contact is being made.

Other Points.

Other little points that should be looked for are: (1) See that for short wavelengths the aerial tuning condenser is in series with the inductance and in parallel for the longer wavelengths. A list was given last week in which were shown the wavelengths of some of the Continental stations. (2) Make certain there is no trouble in the 'phones or loud-speaker, burnt-out windings, or an incorrectly adjusted diaphragm. (3) Where H.F. transformers or reactance units are being used, see that these cover the correct range of wavelengths required.

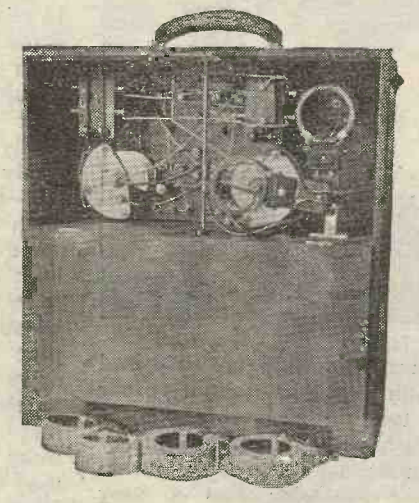
Distortion

Of all the various troubles met with in amateur-built sets the most frequent one is, however, distortion.

Very often this is traceable to the use of cheap components; an arch offender being the inferior low-frequency transformer. With an inadequate or badly-designed transformer distortion can be counted upon as a certainty.

For pure reception, the writer would recommend in the first stage a substantially - built instrument, with a ratio of not higher than $3\frac{1}{2}$ or 4 to 1.

For the second L.F. stage, a one-to-one ratio "power"



The interior of the receiver is as attractive as the outside.

transformer should be used, a really efficient component being obtainable for about £2, which may seem a lot, but is practically essential where distortionless loud-speaker reception is desired. Even when first-class transformers have been incorporated in a set, distortion is, however, sometimes experienced. This may be due to the IP—OP—IS—OS connections being wrongly made. The correct method of connecting most transformers is IP to plate or anode of the valve, OP to high-tension positive, OS to grid, and IS to low-tension negative. Small points, such as these, will be found to make an enormous difference so far as tone and clarity are concerned.

Where the amount of distortion is only slight, matters can sometimes be considerably improved by connecting a large fixed condenser of, say, 1-2 microfarads capacity across the loud-speaker and H.T. battery terminals; or almost the same purpose may be served by shunting the secondary of the last transformer by a 2-3 megohm leak.

Other Causes

Other causes of distortion are (1) too tight reaction coupling, the remedy for this being obvious, and (2) the use of the wrong type of valve.

In the opinion of the present writer, another absolute essential for perfect loud-speaker results is a suitable type of power valve for the last stage of low-frequency amplification. A number of these valves are now obtainable, and among them the B.T.H. B4 and the Mullard DFA1, both designed to operate on 6v L.T. supply at a filament consumption of only .25 of an ampere, are to be thoroughly recommended. These valves require an H.T. supply of 80-120 volts.

Elimination of Distortion

Finally, the elimination of distortion is very often merely a matter of adjustment. Particular care must be taken to get the correct values of H.T. on the various valves, and separate H.T. batteries are recommended for the H.F. and detector units and the low-frequency valves. The correct value of grid bias on the L.T. valves will also be found to make an enormous difference to the quality of the speed and music being received. Correct adjustment of the filament rheostats is a further important factor, and one too often overlooked.

As a concluding hint, it may perhaps be mentioned that where it is desired to obtain first-class reproduction and absolute purity of tone in preference to mere volume of sound, it is advisable to adhere strictly to a straightforward circuit arrangement. "Supers" and "reflex" circuits —good as some of the latter may be—are best avoided by the beginner.

Winter Preparations

NOW that the best season of the year for wireless reception has begun the set should be given a thorough overhaul so as to make it thoroughly efficient for the work which it will have to do during the long evenings. Here are a few of the points which demand attention. All terminals should be examined to see that their contact surfaces have not become dull or verdigrised. If the nuts are polished up with fine emery paper far better contact will result, with probably an increase in signal strength in many cases. Next see to the valves. You will probably find that their pins are dull. Polish them with emery-cloth or scrape with a penknife, and before replacing in the holders splay all the pins out a little with the blade of the knife. During the summer your variable condensers will most likely have collected a considerable amount of dust on the surfaces of the vanes. Clean out both fixed and moving vanes by working a pipe cleaner or feather between them.

Condensers

The presence of dust, hairs and so on between vanes is one of the commonest causes of noisiness in the set, though apparently few amateurs seem to realise this. The upper surfaces of panels will probably have been dusted in the ordinary course of events; but what of their undersides? Dust collects here as well, even when the panel is protected with a well-fitting cover, especially if during soldering operations a certain amount of greasy flux has been left on the ebonite. Clean over the under sides of panels, dusting also the wire. Examine carefully all connections screwed or soldered below the panel. Nuts have a way of working loose in the interior of sets, and when this happens connections may become bad and results will be very poor. Soldered connections, too, sometimes give way, and though they may appear all right there may be really only the poorest contact. Give each soldered connection a good pull. If anything is wrong the fault will be *felt*, even though it cannot be seen. Next look to the low-tension battery. See that the electrolyte in the accumulator is up to its proper level and that the terminals have not corroded.

Batteries

It is just as well to take the battery to the charging station yourself and to see the specific gravity of the acid solution tested by means of a hydrometer.

You may possibly be surprised on finding that it is about 10 per cent. too high. If the sp.g. is too high or too low the battery will suffer, since the acid solution in this condition has a very severe action on the lead plates. Lastly, run over the high-tension battery cell by cell with a reliable voltmeter to see whether there are any that are dead. In spite of a popular belief, high-tension batteries do not last for ever. Cells are very apt to give out after a period of hard work, and one "dud" cell in the middle of the battery may reduce the total voltage to something very small indeed. All cells which show less than two-thirds of their proper voltage should be short-circuited.

The Aerial

When you are doing the autumn overhaul do not forget your aerial. Many of those erected since last spring are very flimsy affairs likely to fare badly in the storms of the colder portion of the year. One sees these gimcrack affairs everywhere, and it can be only a question of time until such things are "earthed," possibly in rather an expensive way if they should happen to crash through a neighbour's greenhouse. Quite a flimsy pole will suffice for supporting the aerial wires if only it is properly stayed. If therefore your mast is of the willowy kind purchase a length of ex-Army telephone cable and rig up a few stays to keep it from swaying too much. Even a backstay alone is better than nothing, and will often preserve the mast from destruction in bad weather. Old masts which have been standing for some time should be examined at the point where they enter the ground.

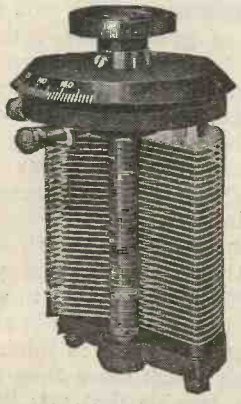
Masts

The best way of doing this is to remove the soil at the foot for a few inches and to try the wood with a bradawl. You may get an unpleasant surprise by finding that a stout-looking mast is really thoroughly rotten and likely to snap like a carrot when the next gale comes. Should such an unpleasant discovery be made there is no need to tear your hair or to burst into scalding tears. All that you have to do is to obtain a 6-ft. length of good pine with a pointed end and to drive it well into the ground close to the foot of the mast with a maul. You can then splice the mast to it with rope or wire, and may sleep soundly even when the wind howls, knowing that your mast is perfectly safe.

R. W. H.

Buying Wireless Components

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



A Dubilier variable condenser.

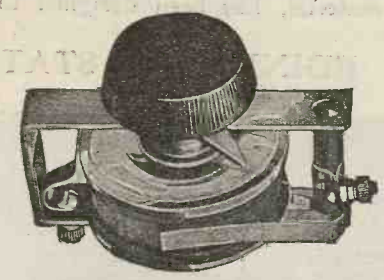
The Sterling "Dinkie" Loud-speaker.

PERHAPS one of the most difficult tasks which faces the constructor to-day is that of selecting really good components for the sets or pieces of apparatus that he intends to make up. With most of us the tendency to economise is a natural and strong one. But in wireless it simply does not pay except possibly for such simple things as terminals, valve legs and similar small articles. Even here one has to be careful, for if you order a dozen terminals of a cheap variety you will quite possibly receive, as I did the other day, eight of one sort, three of a second and one of a third! And I have actually had two valve legs in one dozen which were *solid*—that is, they had no holes in them for the pins to fit into. The golden rule is to get the best that you can possibly afford. If you are prepared to spend only a certain amount of money on the construction of a receiving set, then make a good single or two-valve receiver rather than a three or four-valve using cheap and doubtful components.

Condensers

There is, unfortunately, at the present time a very large amount of stuff of the poorest quality on sale. How bad some of these things can be you do not realise until you have the opportunity of testing them with accurate instruments. Then their performances come as an eye-opener. Some of the very worst components are the cheap fixed condensers that one frequently sees, all of which are "guaranteed" to be of a stated capacity. Not one in a hundred of them is actually anywhere near it. You may purchase two .0003 μF fixed condensers of this kind, one of which will have a capacity of less than .0001 μF, whilst the other may be anything from .0002 to .0004.

The points to look for in a fixed condenser are these: In the first place, a good finish is in this case *generally* a criterion of quality. Most of the cheap and nasty affairs have a kind of ragged half-finished appearance. See that the contact points are good and there is no wobble between them and the case of the condenser. The grid condenser *must* have a dielectric of the very best ruby mica of uniform thickness. As you cannot see inside the case of an ebonite-covered condenser, it is always best to buy one of known and reliable make, even if it does cost a few pence more than other kinds.



An Igranic Potentiometer.

Variable condensers again can be very good and very bad, though it is quite possible to buy cheap ones which will give perfectly satisfactory results. Here are the points to look for. Rotate the knob and see that the spindle which carries the moving plates is straight in its bearings. If it is slightly askew the capacity of the condenser will be "all over the place" and the condenser will not be of much use, even if its plates do not touch. Push and pull the knob to see that there is no play in the spindle. The moving plates should go round quite smoothly, but the bearings should be fairly tight. If you can spin the moving plates round you may be pretty sure that their contact is of a pretty chancy kind. The plates themselves should be of stout gauge, and the condenser should be so constructed that both those which are fixed and those which move are very tightly clamped on their rods. The point at which a fault is most likely to occur is in the contact between the spindle and the bush into which it fits. See that there is a good fit. An excellent type of contact is that made by means of a spiral of springy copper, but if this is fitted there must be stop-pins, otherwise a break is likely to occur.

Rheostats

If cheap fixed condensers are bad, cheap rheostats run them a very close second for sheer nastiness. Usually you will find that they have a thin flimsy winding not properly supported, and therefore bound to get out of shape in a very short time, formers made of very poor material—I have seen painted wood used instead of ebonite—and contact arms so designed that they are bound to work loose at frequent intervals. Go for a good solid-looking winding brushed by a contact arm which is firmly fixed to the spindle. If possible, see the rheostat which you are buying, or a similar one, tried before you purchase, and note whether it does dim the filament of the valve properly. Avoid anything which gives a harsh grating contact.

L.F. Transformers

Low-frequency inter-valve transformers, if they are bad, will utterly ruin the reception of

any set. The commonest faults in them are these. There may be too little wire in the primary windings; the core may not be sufficiently substantial, and the connections between the ends of the windings and the terminals may be so flimsy that they will break very readily.

The thing to choose is a good solid-looking transformer, not the kind of miniature affair which you can put into your waistcoat pocket and never notice it.

Not everyone, perhaps, realises the importance of having thoroughly good gridleaks. Of all the components in the set, the gridleak is perhaps the most difficult to make, for it is a very hard task to manufacture a high-resistance which will remain constant under all ordinary conditions. It pays distinctly when buying gridleaks to go for a well-known make. You may be rather surprised if in an access of recklessness you open an expensive gridleak to see what is inside it. You may feel for the moment that there is not very much for half-a-crown! But you must remember that the makers have discovered the secret of so encasing the "innards" that they are quite unaffected by heat, cold or damp. And you will find that if you try gridleaks of good make with a "megger" everyone of them is very close to the stated resistance. This is a great deal more than can be said of job line gridleaks whose resistance may be anything from a few thousand ohms to infinity.

Bowyer-Lowe valve disc.

The conclusion to which we come is that you get what you pay for. The saving of money in buying cheapjack parts is very small when you come to think of it, and it is much more than offset by the trouble that you have with your apparatus and the poorness of your results. The strength of a chain is that of its weakest link, and the quality of a wireless receiving set is that of its worst component.

□ □ □

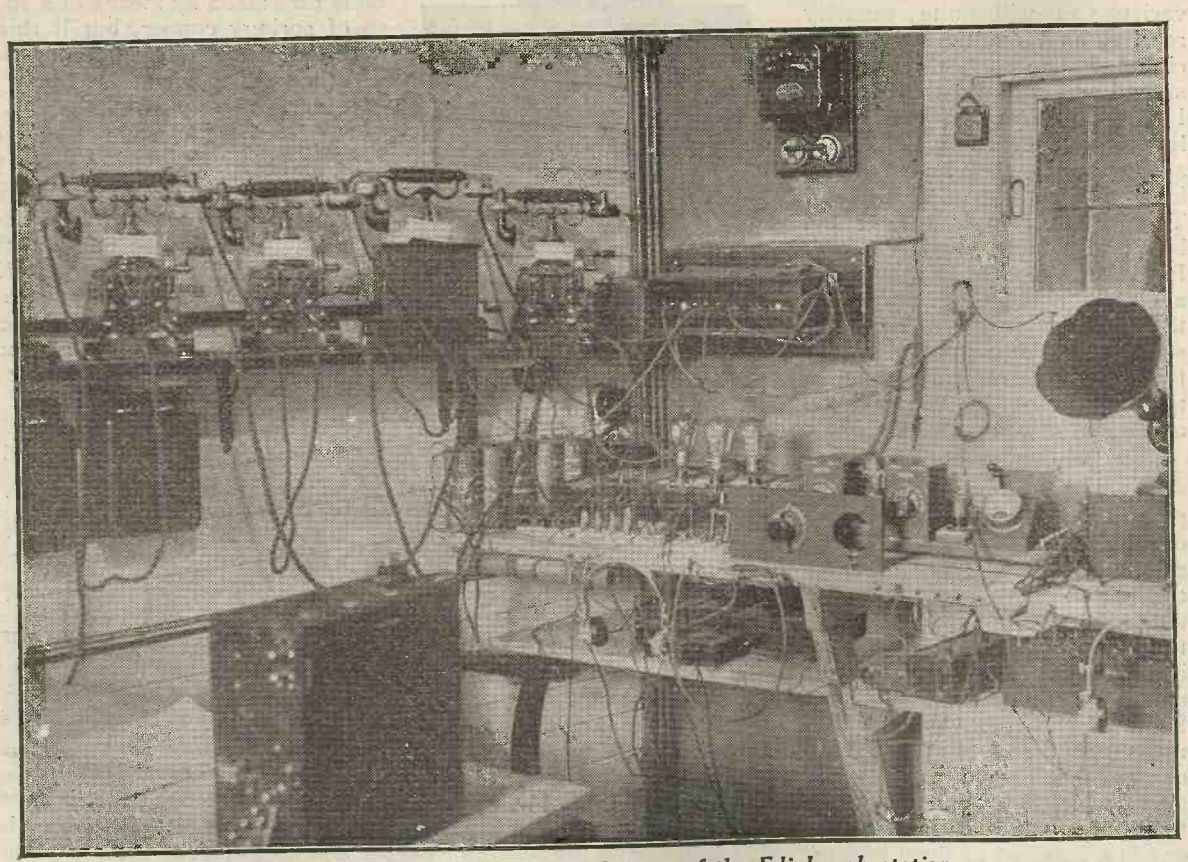
A Safety Disc for Valves

An interesting innovation which may be seen at the "All British" Wireless Exhibition is the Safety Disc which is being given away at the Mullard Stand.

This device, which consists of a disc of coloured insulating material, has been designed to prevent the filament pins touching any metal in the valve-holder until actually in contact with the filament supply sockets when they are safely home.

□ □ □

THE EDINBURGH STATION.



Our photograph shows the control room of the Edinburgh station.

Valve Notes

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

A New Variable Condenser

I HAVE been trying the new Fulstop variable condenser, and for general use in wireless circuits it can certainly be very strongly recommended. A great feature is made of the absence of hand-capacity effects, but the point which appeals to me most is the fact that a 360 degrees scale is provided. In other words, very fine tuning may be accomplished, because of the special gearing introduced into the condenser. This gearing works admirably, and to those who are prepared to pay a little more there will be the great advantages of fine tuning without the necessity for a vernier condenser.

A Vernier Policy

Continually I am coming across people who imagine that by using a small variable condenser of, say, .00025 μF, they are going to get very fine tuning and that tuning on weak signals will be easier.

This is far from being necessarily the case. I will readily admit that it is better to use a .00025 μF variable condenser than the lower range of a .001 μF condenser. Obviously, in the former case, one has a half-circle variation (180 degrees), while in the other case all the tuning must be accomplished on a sector of, say, 40 degrees. There is obviously no comparison.

Inductances

Let us, however, examine another aspect of the subject, and to do this we must consider the amount of inductance we have in the circuit. A given wavelength may be obtained by a small value of inductance and a comparatively larger value of parallel capacity, or it may be obtained by a large inductance and a very small capacity. In a wireless receiving circuit the capacity in parallel with the inductance is not merely the variable condenser, but also incidental capacities, such as the grid to filament capacity of the valve and the leads going to the electrodes of the valves and the self-capacity of the coils and similar factors, which all contribute to the capacity in shunt with the inductance.

Effective Tuning

It is generally accepted that the larger the inductance and the smaller the parallel capacity, the larger the potentials built up across the inductance. It is, of course, always desirable to have sufficient capacity to provide effective tuning, as otherwise the circuit would become virtually aperiodic. This aperiodic effect, however, is not so important when reaction is introduced, but it is important when reliance is placed simply on the ordinary selectivity of the circuit.

Variometer Coupling

If, for example, we use a large variometer for coupling one valve to another, the capacities across the variometer inductance are small, and such a circuit will not be selective. For example, when listening to broadcasting on, say, 400 metres, spark interference on 600 metres is often obtainable. If, however, we have reaction introduced into the circuit, either by inherent reaction or by some deliberate coupling, then tuning is sharpened up remarkably, and the fact that the parallel capacities are small makes little difference.

Tuning

To return, however, to the question of using small variable condensers, the object of using such small variable condensers is to enable a large inductance to be employed, and so enable an increase of signal strength to be obtained. At the same time, of course, it is expected that greater ease of tuning will be accomplished.

I want to point out, however, in these notes that working with large inductances and small capacities makes tuning considerably more difficult and not by any means easier, although, of course, I have admitted above that it is better to use a small variable condenser than a small

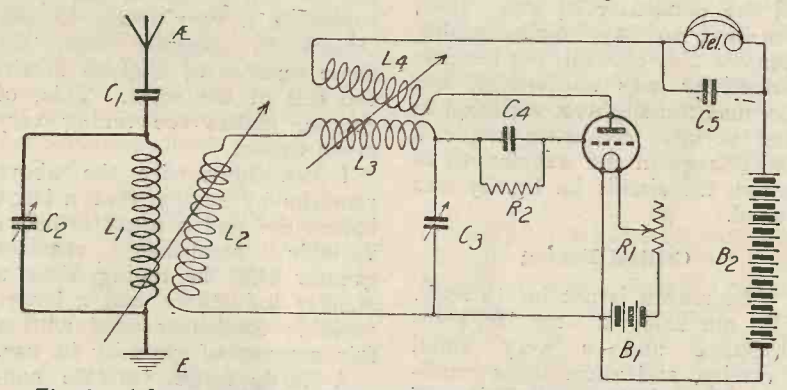


Fig. 1.—A loose-coupled circuit employing a "split secondary" for easier operation and adjustment.

portion of a large variable condenser.

Let us assume, for example, that we are receiving 2LO on a circuit of the kind shown in Fig. 1. It will be seen that loose-coupling is employed and that the aerial coil L1 is coupled to the grid coil L2, a reaction coil L4 being coupled to a separate grid coil L3 in the grid circuit. The aerial tuning is accomplished by means of the condenser C2, while C3 tunes the grid coil.

Incidental Capacities

In a circuit of this kind the incidental capacities may be kept small, and it is possible to use a large amount of inductance in the grid circuit and a corresponding small value variable condenser C3. In actual experiment it is found that 2LO on 369 metres could be received when L2 was a 60 coil and L3 a coil of similar size. The variable condenser used was of .0003 μF value, and it was possible to cover from 300 metres to 600 metres with only about one-third of the condenser in use. This, needless to say, made tuning considerably difficult, not because selectivity was so perfect, but because the slightest variation in the variable condenser made a big change in the wavelength to which the circuit L2 L3 C3 was tuned.

Critical Tuning

The reason is not far to seek. We are using a very large inductance and a very small capacity, and under these conditions the slightest variation of the capacity will make a big change in the wavelength. The wavelength of a circuit is proportional to the square root of the capacity across the inductance; consequently, if we multiply the capacity by four we will double the wavelength to which the circuit is tuned. If we assume, for the sake of simple explanation, that the variable condenser provides all the capacity across the inductance, and that the amount of capacity tuned by the condenser depends upon the number of degrees, then, if we are working on 5 degrees of the condenser and receive a station of, say, 300 metres wavelength, if we now turn the condenser round to 20 degrees, we should reach a wavelength of 600 metres.

If, on the other hand, we were to use a single inductance coil, say, a No. 50 plug-in coil and shunted by a .0005 μF variable condenser, we could cover this range of wavelength over the whole scale of the condenser, and consequently tuning would be very much easier.

We therefore have to bear in mind that by the use of a large inductance and a small variable condenser, especially when the latter is used at its lower values, tuning becomes a really critical operation.

Use of Square Law Condensers

This brings us, of course, to the subject of square law condensers, which have their plates so shaped that on the lower degrees the capacities are much smaller than in the case of an ordinary condenser. In other words, the capacity is not even approximately proportional to the number of degrees of the condenser used. A few degrees on the lower end of the scale represent a very much smaller change in capacity than the same number of degrees at the top end of the scale. This, of course, makes the tuning very much easier.

I can summarise the above remarks by saying that a large inductance and a small ordinary variable condenser requires greater skill in tuning than a smaller inductance and a larger variable condenser used with a fair amount of capacity in use.

A fairly large variable condenser will not give the same signal strength as a small variable condenser with a larger inductance. The advantages of both arrangements may be obtained by using a large inductance and a small square law variable condenser.

Inductances in Series

In connection with the Fig. 1 circuit or, in fact, in any circuit where two inductances are connected in series to give a longer wavelength, it must be remembered that larger inductances are required than if one single coil of a larger number of turns were employed. For example, two coils of 60 turns each will not give the same wavelength as a single coil of 120 turns. This point is frequently overlooked by experimenters who use coils in series, and the reason is because when a single coil is employed the turns act mutually on each other to increase the inductance. When we have two separate coils of 60 turns each, and these coils are separated, the total inductance is exactly twice that of a 60-turn coil, but if the two coils are put close together, or wound as one big single coil of 120 turns, we not only have twice the inductance, but also the added effect, or mutual inductance as it is called, due to one coil acting on the other and helping it in its inductive effect. We have an effect very similar to that in a variometer where the two coils are brought together so as to help each other. The inductance, then, is very much larger than the two inductances added together. The two coils in Fig. 1, L2 and L3, do not act on each other, and this arrangement is therefore similar to a variometer in which the two windings are wide apart or are at right angles to each other, in the case of a rotating type.

If, however, a single coil of 120 turns were employed, then we would have an effect similar to that in a variometer when the two coils were close together and assisting each other so as to produce a big increase in the inductance.

A Single-Valve Reaction Circuit

Fig. 1 itself is interesting as an example of a single-valve reaction circuit, which will combine selectivity with good signal strength. It will be seen that two separate couplings, L1 L2 and L3 L4 are employed, instead of the more usual three-coil arrangement. In the ordinary three-coil arrangement any variation of any of the couplings will seriously affect the others, whereas in the Fig. 1 arrangement, by separating the couplings, the effect is almost eliminated and the whole circuit becomes much easier to handle. This, however, does not mean that even with this circuit slight variations of either coupling will not necessitate a slight readjustment of the variable condensers.

Random Technicalities.

By PERCY W. HARRIS.

Some Notes of interest to the Home Constructor and Experimenter.

SOME time ago there was published in *Wireless Weekly* an article describing the tests which took place in the vicinity of New York to ascertain the difference in signal strength and the effect obtained by screening of high buildings. The results were very illuminating and showed quite conclusively that there were extraordinary variations in signal strength between a number of different points at equal distances between the broadcasting stations. I was reminded of this a few days ago when I ran home to Wimbledon in a friend's car, a portable set with loud-speaker being kept in operation the whole time. Outside Bush House immediately in front of 2LO's transmitting aerial (or, rather, immediately below it) the strength of signals was not surprisingly great, certainly no stronger than we were able to receive two or three miles away. Down the Strand signal strength was fairly constant, although in Whitehall we were obviously screened from 2LO. It must be remembered that we had but a small low aerial (not a frame, but a few wires strung underneath the hood of the car), and one would have thought that this would have been screened very considerably when passing high buildings.

* * *

Considerable variations of strength revealed themselves when running along the Embankment, and prior to this a run alongside some iron railings had completely cut off signals, not a sound coming in. As soon as we had passed these, signals came up again, and the only other "cut off" we experienced was when we found ourselves underneath an iron bridge. From Westminster onwards there were quite large variations in signal strength. At Putney and on Wimbledon Common signals were excellent. My companion informed me that in one small area on Wimbledon Common it is impossible to receive 2LO, although a few yards away signals come in at excellent strength. It is evident that we have still much to learn about the differences of signal strength in the vicinity of a broadcasting station, and the causes of these variations.

* * *

During the early hours of September 21 (in fact, just after 1 a.m.) I picked up fairly strong signals on a wavelength of about 120 metres, which I took to be KDKA owing to the peculiarities of transmission and that distortion which one learned to recognise so easily last year. After two or three items, which may have been gramophone records, I heard the announcer's voice, but could not identify the station. It was obviously not English, and sounded more like Spanish or Italian. The peculiar distortion was identical with that heard last winter from KDKA on 100 metres. Later, I learnt that the station is one operated by the Italian Army. I tried a few experiments while the transmission was on to see if any alteration of distortion could be effected in the receiver.

* * *

The particular receiver I use for this short wave work has the grid leak clips mounted on the outside of the panel, so that a quick change can be made. Two or three months ago Messrs. Dubilier kindly supplied me with a set of calibrated grid leaks from ½ to 5 megohms. I use these in preference to the variable grid leaks which cannot be properly calibrated. I found there was less distortion when using a high value of grid leak (for example, three or four megohms), and values below two megohms reduced signal strength quite 50 per cent. Five megohms, however, was too high for the particular detector valve used. I should say that the signals were strong enough to be heard without forcing the set up to the critical point of reaction. In all cases, however, the peculiar distortion was still there.

* * *

I am glad to see that two components for which I have pleaded for months are now generally available.

The first is guaranteed ebonite, free from surface leakage, and the second square law condensers, which at last are being made by a number of manufacturers. In future it will be increasingly difficult to realise that there was ever a time when strenuous advocacy of these components was needed, yet twelve months ago there was but one make of square law condenser, and not a single firm advertising its guarantee that the ebonite supplied was free from surface leakage.

* * *

Now that Esperanto has been officially recognised by the American Radio Relay League, interesting developments are likely. It is a good sound idea, and is easily learnt. I gained my own diploma in it as long ago as 1909, and was teaching it in London in that year. In the autumn of the same year I delivered in Esperanto, at the London Esperanto Club, a lecture on wireless, with experimental demonstrations. I believe at the moment I am the only English Esperantist with a transmitting licence, but this will soon be remedied!

* * *

Many people believe that gramophone records are made of ebonite. Actually this is not so, though they are nevertheless good insulators, and may be used to good account in small constructional work.

The ST75 Circuit on the Omni Receiver

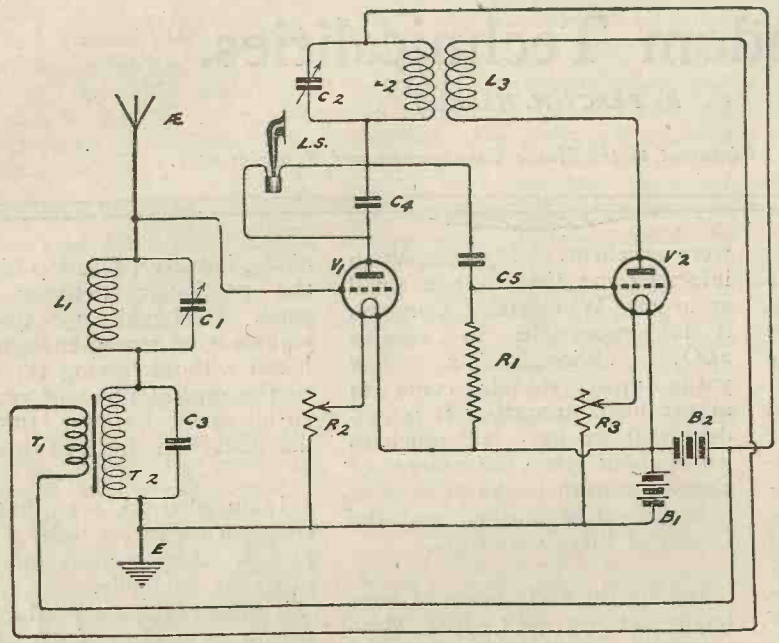


Fig. 1.—The ST75 Circuit.

DOUBTLESS many readers have wished that they could taste the sweetness of the reflex receiver without the attendant bitterness and instability of the crystal detector necessary in most reflex circuits.

Although it is largely true that the bother of crystal adjustment is greatly exaggerated, the damping effect of a crystal detector is a decided disadvantage in reflex working. The damping necessary across certain coils should be kept constant, but this, of course, is not consistent with correct adjustment of the cat's whisker.

The ST75 circuit employing a valve rectifier in place of the crystal is a means of overcoming these difficulties, and a very handy means where reliability is essential in the resulting receiver.

It is certainly true that with two valves at hand a much more efficient circuit may be devised if the crystal detector is introduced, since the detector valve in the ST75 has only one function to perform, but for stability this circuit will be hard to beat.

The theoretical circuit is shown in Fig. 1.

The incoming signals are amplified by the valve V1, the amplified currents appearing in the circuit L2 C2.

The high-frequency potential variations across L2 are communicated to the grid of the second valve V2 by means of the condenser C5, a grid leak R1 being connected across the grid of the second valve and the positive side of the accumulator.

This second valve acts as a detector, and an inductance L3, coupled to L2, is included in its anode circuit, in order to introduce reaction into the tuned anode circuit L2 C2. The rectified currents also pass through the primary T1 of the intervalve transformer T1 T2, the secondary of which is connected in the grid circuit of the first valve, which consequently acts also as a low-frequency amplifier. The loud-speaker, L.S., is included next to the anode of the first valve, the condenser C4 of .004 μF capacity being connected across it.

Connections

Using the Wireless Weekly Omni receiver, the connections required are as follows:—

51—50	26—25
49—29	31—46
30—52	46—47
51—34	39—45
42—49	45—23
50—12	31—19
52—48	27—35
30—38	43—40
37—29	27—14
4—23	6— 9
31—25	1—21
17—24	22—24
17—18	32—40

Operating the Set

The operation of this dual receiver is exactly the same as that of a standard 1 H.F. and detector circuit, the aerial tuning and anode tuning condensers being simultaneously varied until maximum signal strength is obtained. Reaction is introduced by coupling L2 and L3, and although there is no danger of causing outside interference, there is no advantage in using any more regeneration than is necessary just to overcome the losses in the circuit.

With certain valves the adjustment of R1 (35—43 on the panel) may be found critical for best results, and a little experimenting in this direction may be carried out.

The connections to the secondary of the iron-core transformer may be reversed, to see if better results are obtainable by this means. Disconnect 49—29 and 30—52, and connect

49—30
29—52

It may also be found that, with certain types of coils where the connections from windings to plugs are not in the standard direction, difficulty will occur in producing oscillations.

In this case, disconnect 6—9 and 1—21, and connect

6— 1
9—21,

when no difficulty in producing

Another circuit which may be experimented with upon this popular receiver.

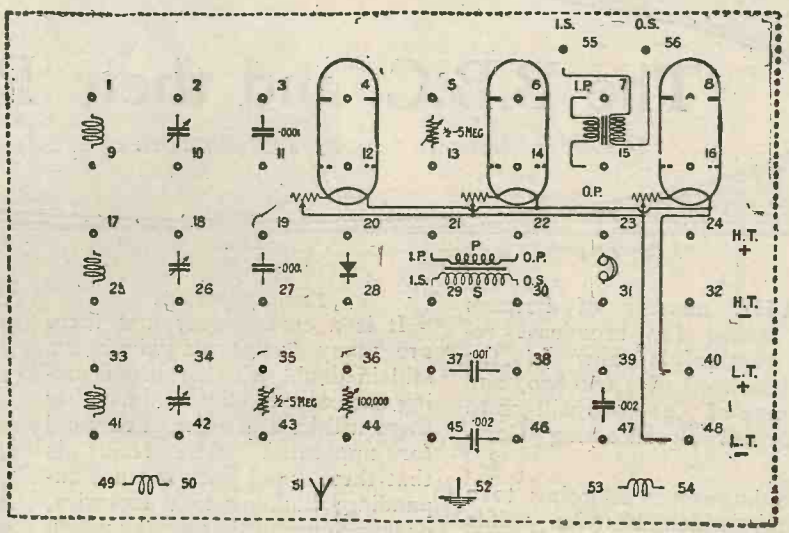


Fig. 2.—The terminal board.

oscillation and the usual advantages of reaction will be found.

The brightness of the filament of the detector (second) valve may be found to affect signal strength and stability.

A little experimenting in the correct value for the filament current for this valve, and also in the types of valves themselves, will sometimes cause the difference between good and bad reception.

A Handy Drill Container

ONE of the most convenient gadgets for the workshop bench that I have come across for a long time is a special cylindrical container for drills of Morse sizes from No. 1 to No. 60. This consists of a wooden body in which are made sixty holes to act as containers for the drills. It is fitted with two metal lids, both pivoted on a spindle running down the centre of the container. In the outer lid are three holes corresponding to the concentric compartments made for the drills. The inner lid has also three holes made in it, one of which can be made to coincide with a corresponding hole in the upper lid by moving a small knob. These three holes are marked 1 to 20, 21 to 40, and 41 to 60. To obtain any particular drill, say No. 16, one sets the figure on the rim of the outer lid against the pointer and puts the knob of the inner lid to the position labelled 1 to 20. The holes in the two lids then coincide with the hollow in which the required drill rests, and on the container being inverted it falls out into your hand. The description may sound a little complicated, but the container is delightful to use, for any drill can be obtained in a moment, and as all are kept covered up they are always clean and bright. Those who already possess sets of drills can obtain these containers separately at reasonable prices.

There is only one disadvantage to this type of drill container, which is that a drill should always be replaced after it is used, for otherwise one may have a medley of drills lying on the table. If these are of very small size some difficulty may be experienced in getting them back into their right places, since on fine drills there is no room for the numbers to be marked. If one always replaces the drill after use there is no trouble, but should one fail to do so the size can be found by putting it through the drill plate.

Constructors who do not possess complete sets of drills will find it most convenient to make a stand for such as they have, which can be done very easily. All that is required is a piece of hard wood about ¾ in. in thickness. A hole is then made with each drill in turn and the drills are inserted point uppermost, the size of each being marked in pencil against its hole on the wood. I use a stand of this kind for my taps, each size having three holes for first, second and third cut. For loose dies I use a stand made on the same lines, but instead of drilling holes headless nails are driven into the wood at regular intervals. These are passed through the middle hole of each die and keep it in its proper place.

R. W. H.

Broadcasting Alterations

We learn that on and after Monday, September 29, all the stations of the B.B.C. will revert to their winter schedule of times, commencing their programmes half an hour earlier, and that on Tuesdays and Fridays one provincial station will continue its transmission for half an hour after the closing of the other stations.

Chelmsford will radiate the programme of a provincial station upon one night in each week, and the 2LO programme upon the remaining evenings.

The fifteen minutes preceding the first news bulletin is to be filled in the case of the London station with a topical talk.

The B.B.C. and their Revenue

By THE EDITOR.

THE number of licences issued for broadcast reception is now in the neighbourhood of 1,000,000, and a revenue of £400,000 will go to the British Broadcasting Company.

This huge sum is going to a company which has its profits limited to 7½ per cent. The company is a public utility concern, and since it is the public which is contributing the whole of the revenue by a form of taxation they are intimately interested in the use made of these funds.

We do not know the full programme of the B.B.C. during the coming year, but we may, perhaps, be permitted to make one or two suggestions. It is, of course, very demoralising generally for a company to have its profits limited to a certain amount. The directors of the B.B.C. have already voted themselves sums of money as a reward for their hard work, and salaries of the B.B.C. staff have been raised. We do not question these matters because we believe that this expenditure was, and is, a justifiable one.

The Wireless Industry

We believe that the B.B.C. can do a great deal more to stimulate the wireless industry, which is by no means as great a one as it should be. The B.B.C. can assist by demonstration programmes which at present are only given on certain days. Moreover, we have constantly recommended that the B.B.C. should advertise their programmes just as any other entertainment organisation, and such advertisements will increase the ranks of listeners and will undoubtedly have a great influence on the development of the industry and the relief of unemployment in this country.

Encouragement

It is a curious fact that there are many businesses which are still in doubt whether broadcasting has come to stay, and whether there will be a permanent demand for apparatus. The result is that these timid ones are not expanding, building new factories, or launching out in the way which would be of national benefit. It should be the policy of the B.B.C. to try and instil the fullest confidence in broadcasting, and by its own bold action encourage others.

Much improvement could also be made in the purely local relay stations, the power of which is too small. Then again, we notice that it is the intention of the B.B.C. to transmit the same programme from 5XX, the high-power station, as from London. It may be desirable to send the programme from London to 5XX, but we do not think that it is at all desirable that the same programme should be radiated from 2LO and 5XX. There is no reason, with such an ample revenue behind the B.B.C., why an entirely separate and distinct programme should not be radiated from the high-power station.

Gramophone Recitals

Another point we notice is that gramophone recitals are being given, and we have some doubt whether this is being done as a matter of economy or whether it is done for the purpose of amusing those who have gramophone records. As we are only afflicted with these recitals at the less important times of the day, we are inclined to think that the first consideration is the chief one. It is interesting to note that American broadcasting stations are prohibited from radiating music produced from gramophone records.

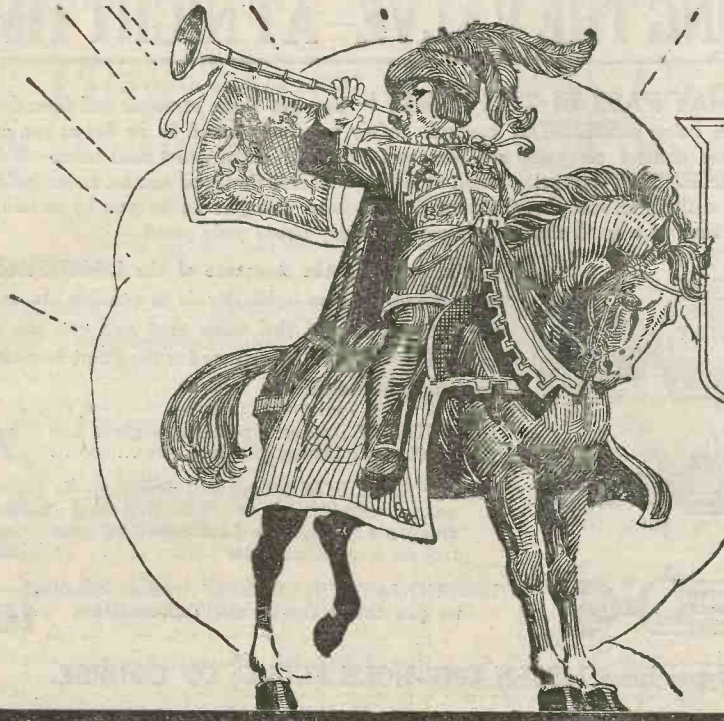
The Official Organ

We may be accused of self-interest if we criticise the policy of the B.B.C. in issuing their programmes in a form which competes with private enterprise. The *Radio Times* does not in any way compete with technical journals as regards circulation; it is purely and simply a programme paper. On the other hand, the wireless industry is spending some £50,000 a year with the B.B.C. whose paper, being purely a programme, does not contribute to the development of the industry, as is the case of the technical press. In other words, as regards advertisement revenue, which is the backbone of any publishing organisation, the B.B.C. are seriously competing with private enterprise, and this very largely by virtue of their exclusive programme and the exclusive publicity which they enjoy by announcements regarding the paper by radio.

N.A.R.M.

This serious competition with private enterprise is not consistent with the policy of a public utility company, and cannot be defended at a time when the revenue of the company is of the order of half a million pounds annually. The matter is a small side-line to the B.B.C., but it is of vital importance to wireless publishers.

The National Association of Radio Manufacturers, we understand, is in favour of wireless advertisements being excluded from the *Radio Times*, and private enterprise and the wireless public generally would benefit by the B.B.C. making a voluntary sacrifice of wireless advertisements in their journal.



Britain's Best Broadcasting Sets

GECOPHONE

(REGISTERED TRADE MARK)

NEW GECOPHONE Models for 1924/25

Crystal Sets
Single Valve Sets
Two · Valve Sets (Det. & L.F.) in Table and Cabinet Models
Two · Valve Sets (Det. & H.F.) in Table and Cabinet Models
Three · Valve Sets in Table and Cabinet Models
Four · Valve Cabinet Sets de Luxe
Five · Valve Cabinet Sets

For full range of GECOPHONE Sets and particulars, enquire of your local dealer, and ask for List No. B.C. 3425

1924/5 MODELS

NOW READY

In the construction of the new GECOPHONE Models it has been the aim to produce sets which combine the finest results with simplicity of operation and handsome appearance. The range of 1924/5 models has been considerably extended to meet every requirement. They embody to the fullest extent the same superlative qualities which have given the original GECOPHONE Model its unrivalled reputation.

If you desire — A Crystal or a 5-Valve Set
Long range, Maximum volume of sound
To use a Loud Speaker or Headphones
Cabinet or Table Models
To use Accumulator or Dry Batteries
To get the best value for money

and to ensure the maximum pleasure from broadcasting

THERE IS A GECOPHONE FOR YOU

Obtainable from GECOPHONE SERVICE DEPOTS, Electrical and Wireless Dealers, Stores, &c.

ALL BRITISH WIRELESS EXHIBITION
Royal Albert Hall, London, September 27-October 8
CALL AT STANDS Nos. 51 and 53
where the new GECOPHONE Models will be displayed

Advertisement of The General Electric Co., Ltd. (Manufacturers & Wholesale only).
Magnet House, Kingsway, London, W.C.2

LISSENIUM

IS YOUR LEAK RESISTANCE RIGHT? —

You can put a resistance in circuit whose value will be so inaccurate and fluctuating that the leak is useless. Though some circuits and valves are not so susceptible to variable grid control as others, it is reassuring to know that one has the means to control grid potential so that the correct value is obtained for any circuit or valve, or the particular conditions under which a valve may be working. With the LISSEN VARIABLE GRID LEAK fitted, the receiver will yield the utmost sensitivity which correct grid potential under all conditions implies.

LISSEN ONE-HOLE FIXING, OF COURSE **2/6**

LISSEN VARIABLE ANODE RESISTANCE, 20,000 to 250,000 ohms, same outward appearance as LISSEN Variable Grid Leak **2/6**

TO SMOOTH OUT LOUD SPEAKER DISTORTION—PUT A LISSEN VARIABLE GRID LEAK ACROSS THE SECONDARY OF THE LAST TRANSFORMER, OR ACROSS THE LOUD SPEAKER ITSELF. FIRST POSITION IS BEST. THE DIFFERENCE WILL BE VERY NOTICEABLE.

PARTS THAT PULL TOGETHER

Use LISSENAGON COILS for sharp tuning—for strong tuning.

Use LISSEN TRANSFORMERS and LISSEN CHOKE for fine tone and pleasing volume.

Use LISSEN H.F. Parts for extending range.

Use LISSEN TUNER for conveniently covering a wide wavelength.

DON'T MIX YOUR PARTS

A Receiver built with all LISSEN parts will give results which would never be possible if you used mixed parts.

LISSEN LIMITED

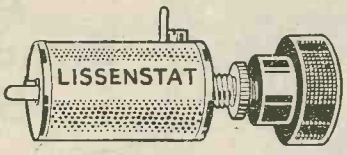
30-32, Woodger Rd., Goldhawk Rd., Shepherds Bush, London, W.12.

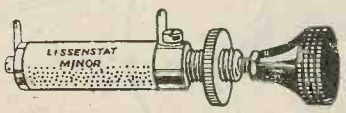
Telephones: 3380, 3381, 3382, 1072 Hammersmith.
Telegrams: "Lissenium, London."

PARTS WITH HIDDEN POWER —BUILD WITH THEM.

COAXING THE VALVE—AT NIGHT TIME

SIGNALS THAT PASS IN THE NIGHT!—You get them stronger and from farther away if you are using LISSENSTAT control. After you have tuned in as far as you can go with every other control on your receiver you can still do a great deal more—IF YOU ARE USING LISSENSTAT control. When at last you realise that you are on to an unknown station there is a thrill in the thought that it has been brought in to you by nursing the valve with the turn of a knob that stands out so simply above your panel.





The secret is in the structure of the LISSENSTAT and its composition—so critically is it possible to control electron emission of the valve that you can get right on to the very spot necessary for the finest detection of long distance telephony.

LISSENSTAT (patent pending)—gives the most acute tuning possible **7/6**

LISSENSTAT MINOR (patent pending)—is replacing many thousands of discarded and inefficient rheostats. Provides LISSENSTAT control at a popular price **3/6**

LISSENSTAT UNIVERSAL (patent pending)—with its protective device for dull emitters **10/6**

All types have LISSEN ONE-HOLE FIXING, OF COURSE.

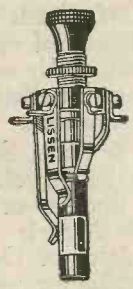
You can feel for fine detection—if you use LISSENSTAT Control.

USE A RADIO SWITCH

Many switches sold are undesirable for radio work—they have been designed from the purely electrical point of view, *which is not good enough for radio.*

LISSEN SWITCHES, on the contrary, have been designed primarily for radio, but they are useful also for other switching purposes. You just gently pull or push them, and you hear them make with a reassuring "click"—and you know they are free from capacity effect.

WHAT LISSEN 5-POINT SWITCH DOES



a. Switches off one stage of L.F. without touching the filament control—a separate switch for each stage.

b. Connects the telephones to the plate of whichever valve it is desired to use, and at the same time switches off the L.T. current from the unused valve.

c. Cuts out a stage of H.F. in the same way as it does L.F. (we do not recommend any switching in H.F. circuits where it can be avoided, but where it is decided to use a switch, this is the switch to use).

d. Will also disconnect both the H.T. and L.T. batteries, and short the aerial to earth so that the receiver can be left adjusted ready for switching instantly into commission next time.

With diagram. Price **4/-**

LISSEN REVERSING SWITCH

Particularly useful when the LISSEN 5-point switch is used for cutting out one stage of H.F. When a H.F. stage is cut out, and reaction is being taken off the aerial circuit, it is necessary to reverse the reaction coil connections for each H.F. stage cut out, and this new LISSEN switch conveniently does it. Can also be used anywhere when it is necessary to reverse the connections of a battery, a coil, or a condenser, for instance. VERY USEFUL FOR COMPARATIVE TESTS. With diagram **4/-**

TWO OTHER LITTLE SWITCHES.

LISSEN 2-way switch - - - **2/9** LISSEN Series-parallel switch - **3/9**

How every Crystal User may become a Valve Expert

By E. REDPATH.

Some further constructional details of a Single-Valve Flewelling Receiver, together with some notes concerning its operation.

Components Required

One ebonite panel, 9 in. x 5¾in. x ¼ in. thick.

One containing box to suit, 4½ in. deep inside.

Eight terminals.

One two-coil holder with extension handle.

Four valve sockets.

One filament rheostat.

One variable condenser (capacity 0.001 or 0.0005 μF), with single-plate vernier for fine adjustment.

One grid condenser 0.0003 or preferably 0.0002 μF.

One variable grid leak, about 1 to 5 megohms. (This must be smoothly and continuously variable. That shown in the photograph is a "Microgrid.")

One fixed condenser 0.005 μF (McMichael).

Details of Operation

At the first few attempts to operate practically any super-regenerative receiver, there are certain to be loud howlings and whistlings in the telephone receivers. Accordingly, until some experience is gained the set should be used only upon a frame aerial, which may consist

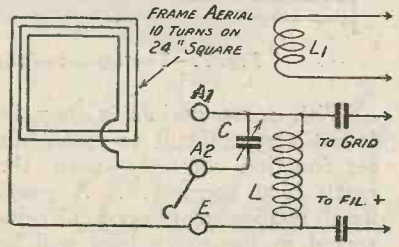


Fig. 5a—Showing method of connecting a frame aerial to the receiver.

of a temporary arrangement of 10 or 12 turns of wire upon a rough frame. Alternatively, a "loop" aerial, consisting of a single turn of cotton-covered wire suspended round a picture rail, may be used. To use the set upon the outdoor aerial before experience has been gained in its operation will be almost certain to cause considerable interference to neighbouring receiving stations. The method of connecting the "frame" or "loop" aerial to the receiving set is shown in Fig. 5a. The aerial coil L may be either a 35-turn or 50-turn plug-in coil of the honeycomb type, whilst the reaction coil L1 should be a 75-turn or a 100-turn coil.

When all external connections are completed, set the variable condenser to zero approximately, bring the reaction coil fairly close up to the grid coil, and vary the grid leak until a howl or whistle is heard, upon which make further adjustment of the grid leak until a steady and extremely

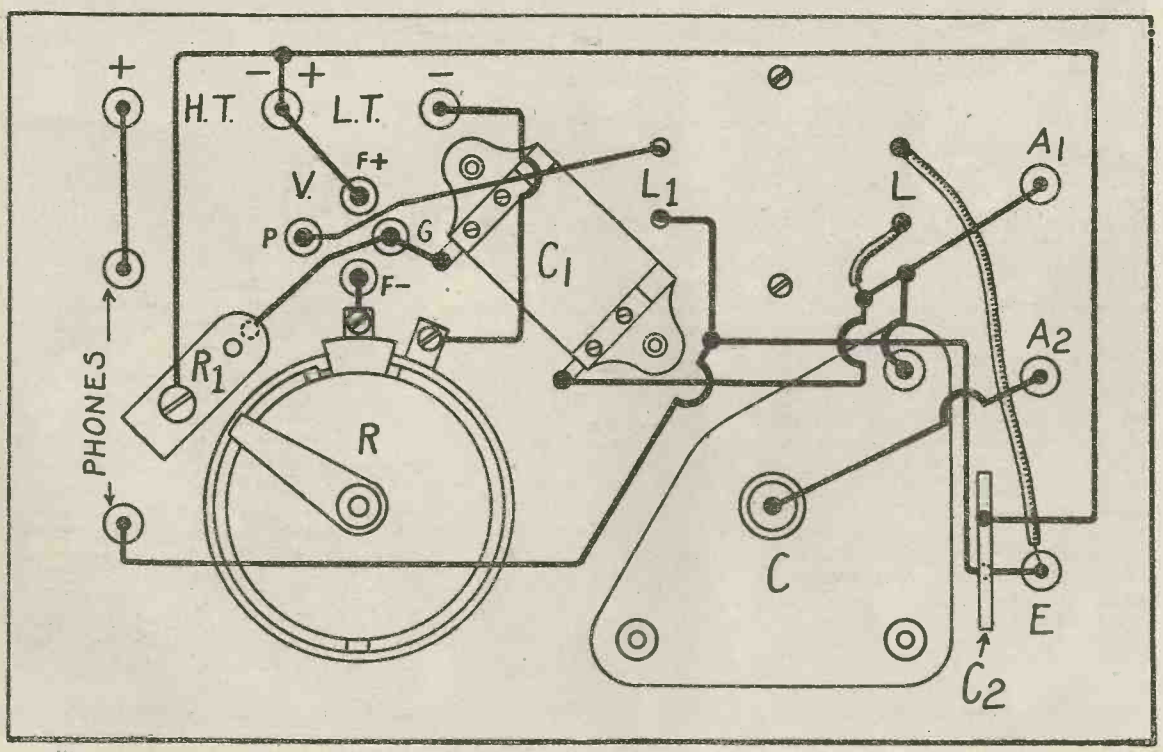


Fig. 6.—Practical back-of-panel wiring diagram.

high-pitched whistle is heard in the telephones. Search for signals by rotating the variable condenser slowly, meantime making slight adjustments to the grid leak in order to retain the audible whistle of the quenching oscillation.

If a small frame aerial is being used, and no signals are received, rotate the frame 90 degrees and try again. At distances up to 10 miles from one of the main British broadcasting stations quite good signals should be received upon a frame of the dimensions specified.

When the receiver is subsequently connected up to the regular outdoor aerial for trial, *preferably at a time when no broadcasting is in progress*, the preliminary experience on the frame aerial will be found extremely helpful in determining the adjustments which will enable the "whistle" to be eliminated by raising the pitch of the note until it disappears. This must be done, as otherwise the whistle will be received by neighbouring stations. If necessary, loosen the reaction coupling and readjust the variable grid-leak.

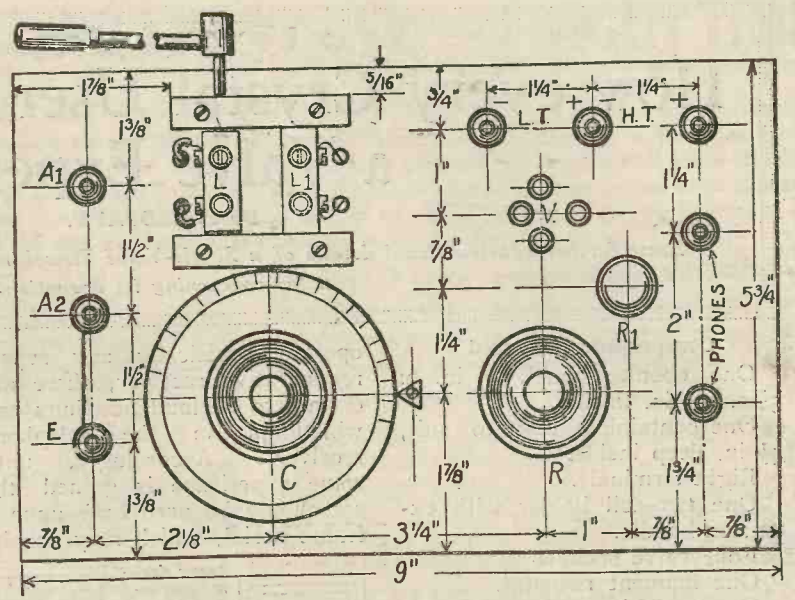
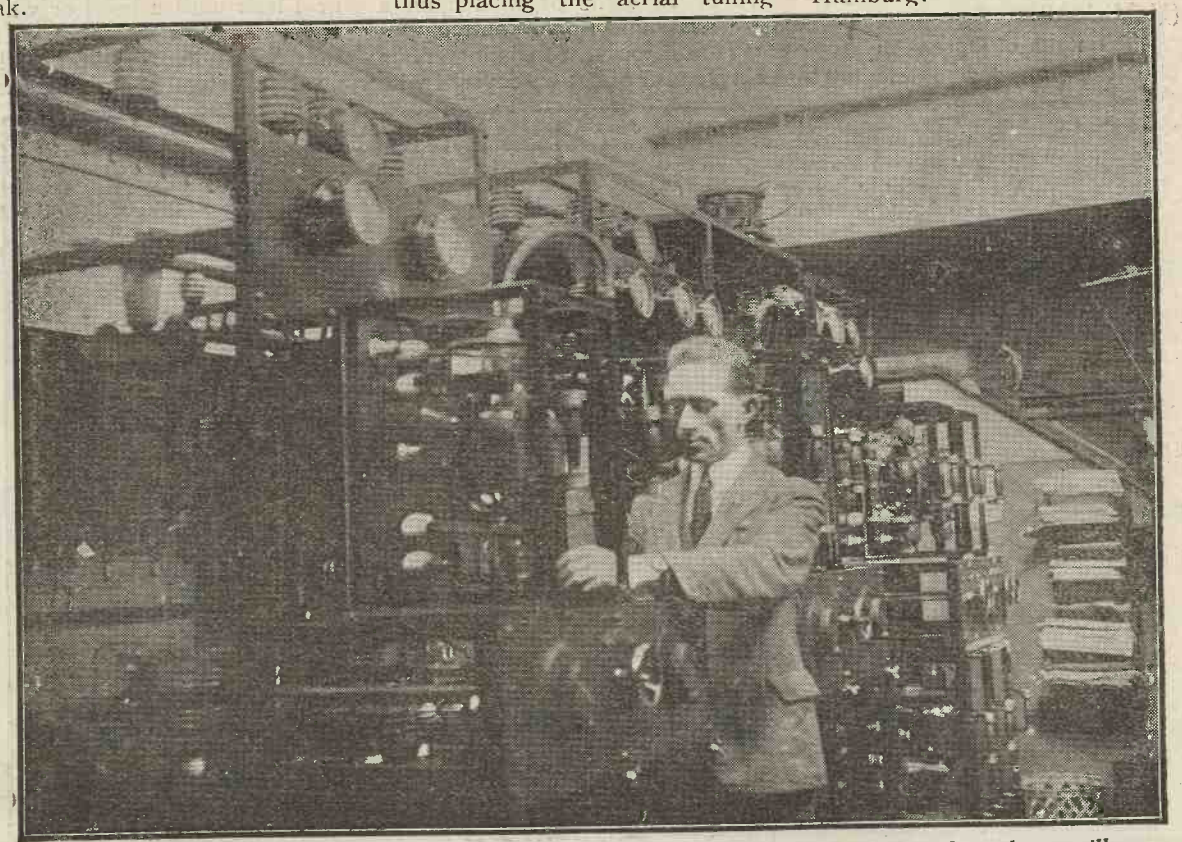


Fig. 7.—The layout of the panel showing dimensions.

With some aerials it may be found very difficult to make the set function correctly with the earth lead connected. A small fixed condenser (0.0003 μF) inserted in the earth lead will be found to facilitate matters.

With a fairly large three-wire aerial connected to terminal A2, thus placing the aerial tuning condenser *in series*, and the usual earth connection, the writer had no difficulty in obtaining very clear speech, etc., of reasonable strength in two pairs of telephone receivers from practically all the British broadcasting stations, also from the "Petit Parisien" station, Madrid and Hamburg.



Our photograph shows Mr. R. W. S. Murch, of the Glasgow station, standing at the independent oscillator.

Get the Valve in the Purple Box!

—and ensure perfect reception. Remember that valve sets are only as good as the valves used in them.

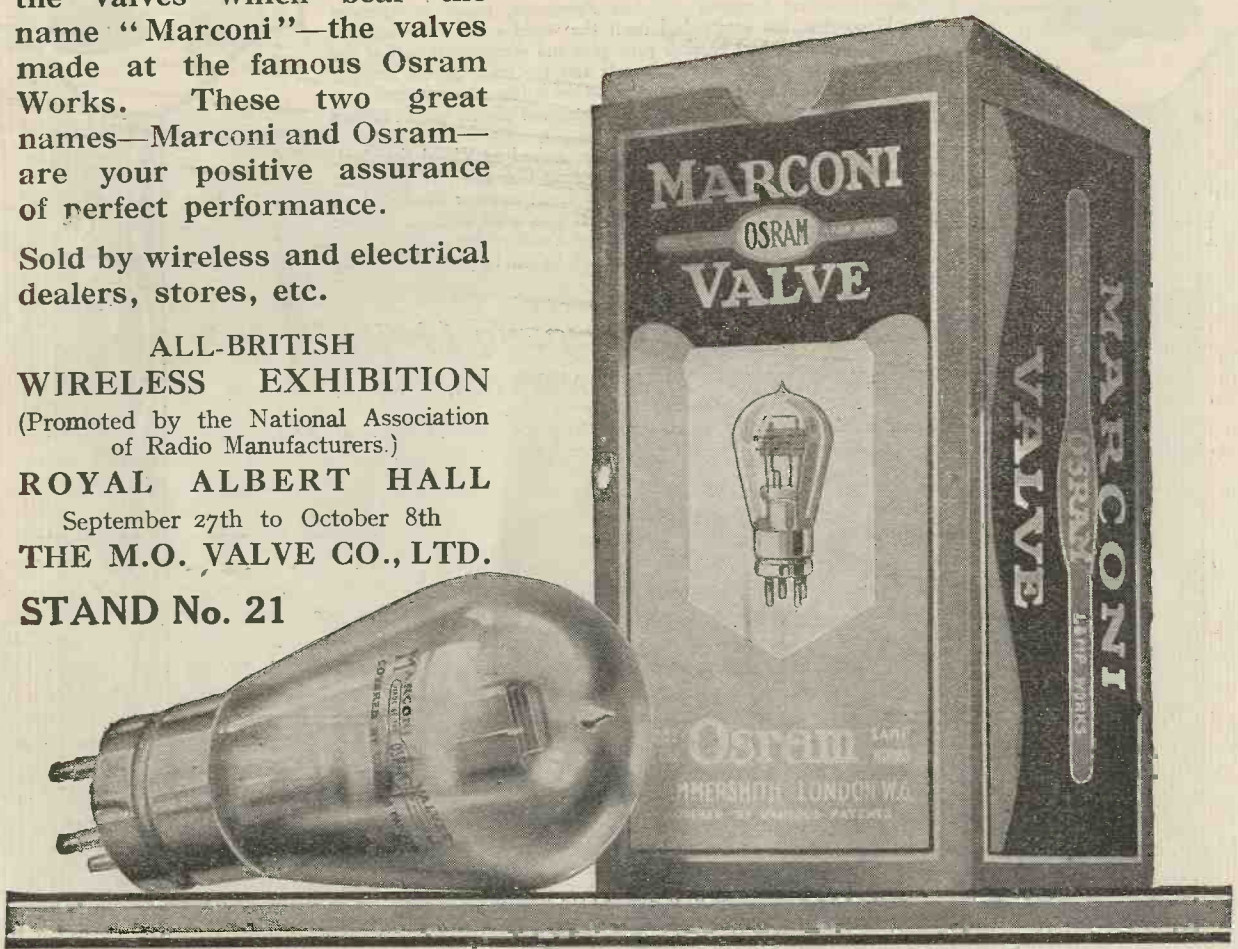
MARCONI VALVES

MADE AT THE OSRAM LAMP WORKS

are the valves sold in the familiar purple box. They are the valves which bear the name "Marconi"—the valves made at the famous Osram Works. These two great names—Marconi and Osram—are your positive assurance of perfect performance.

Sold by wireless and electrical dealers, stores, etc.

ALL-BRITISH
WIRELESS EXHIBITION
(Promoted by the National Association of Radio Manufacturers.)
ROYAL ALBERT HALL
September 27th to October 8th
THE M.O. VALVE CO., LTD.
STAND No. 21



Announcement of The M.O. Valve Co., Ltd.

Handy B.A. Screw Gauges

A VERY useful B.A. screw gauge can be made at home with very little trouble. It consists simply of a plate made from sheet brass 3/16-in. thick and measuring 3 in. by 1½ in. The dimensions can be reduced considerably if desired, but it is not advisable to do so, since if gauge plates are made very small they are so easily mislaid or lost. The plate is marked out as shown in Fig. 1, tapping holes for the even-numbered sizes being made along the top row and for odd-numbered sizes along the bottom row. If you do not possess a full set of B.A. taps the best plan is to drill the holes tapping size and to have them threaded for you by the handyman at an electrical shop. This job will be quite an inexpensive one, and the cost will be amply repaid by the usefulness of the gauge which enables you to discover in a moment the size of any particular screw.

A nut gauge is an equally useful accessory for the wireless bench. Fig. 2 shows how it can be made from a 3-in. length of round brass rod ¼ in. in diameter. If a lathe and a set of B.A. dies are available the constructor will have no difficulty in making the gauge for himself. Those who are without these appliances must have recourse again to the handyman referred to above. It is not possible to make a single-nut gauge for both odd and even sizes, since a

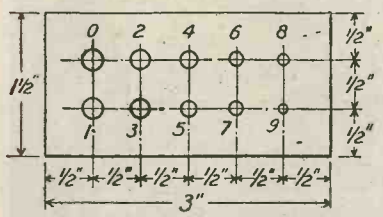


Fig. 1.—The B.A. screw gauge plate.

3 B.A. nut, for example, will not pass over a 4 B.A. thread. Separate gauges should therefore be made for the odd and even sizes. Reference to the drilling table shows us that the tapping size for 2 B.A. is the clearance size for 4 B.A., and so on right down the table, hence a 4 B.A. nut will pass over a 6 B.A. thread, 2 B.A. over 4 B.A., and so on. The same happy arrangement applies to the odd sizes.

D. O. R.

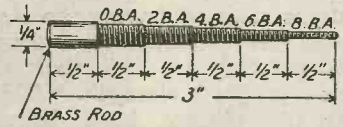
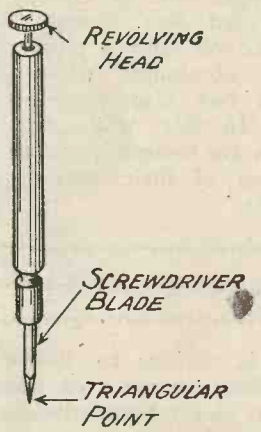


Fig. 2.—The B.A. nut gauge.

Marking Out Panels

THERE are many different opinions as to the best method of marking out ebonite panels. Some hold that they should be marked lightly with a scriber on the upper surface, others that the under surface should be dealt with. Most writers condemn the use of the lead pencil for marking out purposes on the very sound ground that if graphite is left upon the surface of the ebonite it may provide paths between undesirable points for high-frequency currents, and so lead either to an absolute refusal to work on the part of the set when finished, or to its bringing in very weak signals. Again, should the polished surface of panels be removed and a semi-matt finish be given to them before or after marking out? Those who advocate that polishing should be taken in hand first recommend that marking out should be done on the underside with the scriber, and this is quite a satisfactory way of going to work. There is much to be said for and against each method.

Having made up a very large number of sets of different sizes, and being engaged almost daily in constructing small components, the writer has come to the conclusion that the best method is to use a lead pencil for marking out (this sounds like a terrible heresy!), to do this part of the work first, and to drill the panel before removing the polished surface; he prefers also to mark the upper side of the panel. The way in which a piece of ebonite is dealt with is as follows: It is first of all squared up. For this purpose the ordinary small bench set-square is often not big enough, and a draughtman's T-square is used instead when necessary. The edges are roughly trimmed, and the panel is then marked out with a sharp-pointed pencil. The centres of all holes are next centre-punched, a very fine punch being used to ensure accuracy. When especially fine and accurate work is in hand the centre-punch is discarded, and in its place a most useful and easily-made little tool is employed. It is made from a jeweller's screwdriver, such as can be purchased for about a shilling from any good tool shop. This, as it stands, is a most handy little tool for fine work. At the top of the handle, which is about 3 inches in length, is a revolving head. The



The scriber.

fine screwdriver blade is fixed into the screw grip at the other end. To use the tool one places the first finger on the revolving head, inserting the blade into the nick of a screw. The handle is then revolved with the thumb and second finger. To convert one of these screwdrivers into a tool for accurate marking out, cut off the flat part of the screwdriver blade and file it to a triangular point. In marking out, the point is placed at the intersection of two fine lines which indicates the position of the centre of the hole to be drilled. It is held as before, the forefinger exercising a light downward pressure. As the handle is turned with the thumb and second finger the triangular

point cuts into the ebonite, making a small perfectly circular hollow without any "lip." This method is, I believe, used by instrument makers, and it certainly enables absolutely accurate marking out to be done.

When the centres have been marked drilling is done. It should be noted that it is very difficult to get a large drill exactly into the small pit made by the centre punch or the tool just described. It is recommended therefore that whenever holes ¼ inch or ⅜ inch in diameter have to be made for the spindles of rheostats and so on, a smaller drill should be run in first for some distance, so that it makes a depression into which the big one can be centred without difficulty. Drilling having been done, the glossy surface is removed from both sides of the panel, medium emery cloth being used for the underside, whilst the upper side is treated first with *used* fine emery and is finished off with a piece of the finest obtainable glass paper which has also seen previous use. In this way all pencil marks are removed, and there is no fear of their causing short circuits.

Better Days for Wireless

IT is curious to notice the sudden entrance of what we may call autumn wireless conditions. In the spring-time there is quite a gradual change as the days lengthen out, as the ground becomes more parched, and as the trees become more and more thickly covered with masses of foliage. We find our range slowly decreasing, and when we try to tune in many stations which during the winter we could pick up readily, they become harder and harder to find, whilst the strength of those which we do get suffers in many cases a considerable diminution. By the time that high summer is with us most of us are reduced, so far at any rate as really good broadcast reception is concerned, to only one or two of the nearest main stations.

But the change back again from summer conditions to the better times of autumn and winter seems to occur much more rapidly. There is nothing gradual about the process. We find quite suddenly when searching round one evening that an old friend lost for several months has come back again. Further searching discloses the fact that we can now pick up any other stations without having to increase reaction coupling, and we find that they are little short of their proper strength. This year the change back began about August 15, and, once started, it went on with amazing speed. There was one slight setback about August 20, but from that time onwards conditions grew swiftly better and better. Before the end of the month I found that there was hardly a degree on the dial of my A.T.C. which would not bring in something between 300 and 500 metres. Strangely enough, selectivity improves, too, as range extends. This is due probably to the lowered resistance of the earth connection as the ground more and more nearly approaches its winter degree of dampness. Anyhow, I find that I can now separate with ease stations so close together as Breslau and Glasgow.

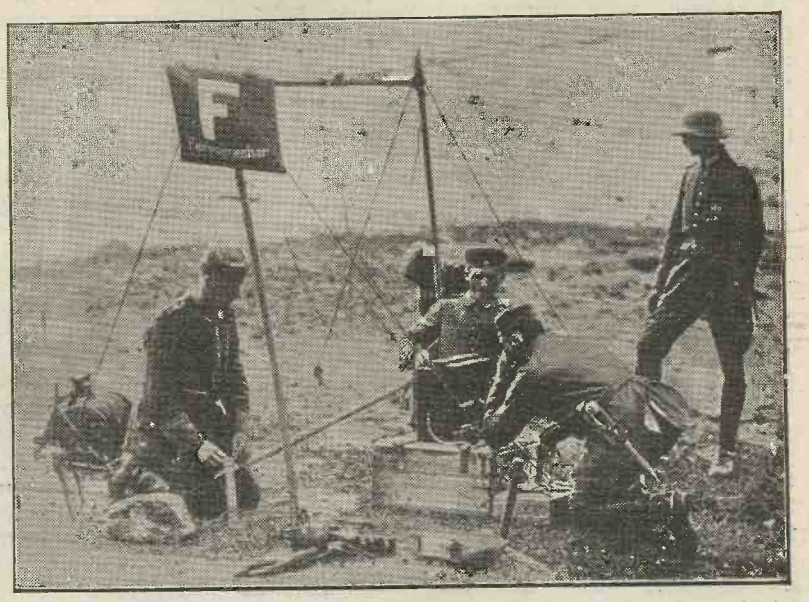
Real autumn conditions are with us now. Reception is first-rate, and atmospherics are seldom bad enough to cause much trouble, even on the higher wavelengths. Now is the time for any who have not so far taken up wireless to do so without delay, for we have before us the seven or eight best months of the year from the wireless man's point of view.

L. W. N.

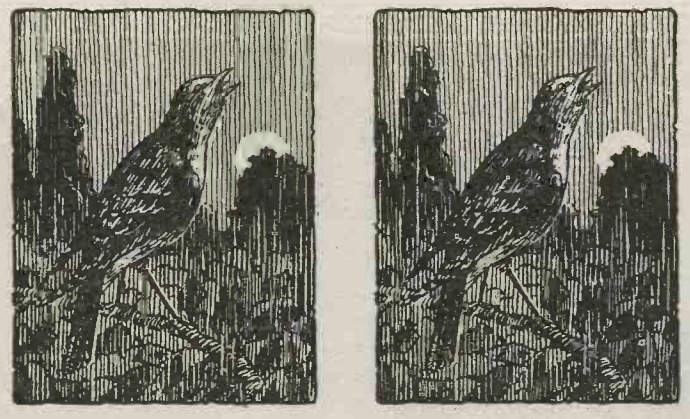
Condenser Values

We are given to understand that, through an oversight in the advertisement of the Lighting Supplies Co. (Finston Fixed Condensers), the capacity was shown as 0.001 μF to 0.005 μF in our issue of September 24. This should have read 0.001 μF to 0.0005 μF.

GERMAN ARMY WIRELESS



Our photograph shows signallers of the German Army Corps of Signals and their apparatus at the annual manœuvres.



Interpretation "to the life"

THE process of broadcasting is an eventful one . . . between the singer and your headphones several pretty drastic transformations take place. The most entrancing music is nothing but a wave length when it leaves the transmitting station. And that's all your aerial cares about it. An aerial is only interested in oscillations. It rests with the detector to find what the waves are saying and to interpret. But even then it's not the actual singing you are listening to. Only a copy. With an Ediswan Valve you would probably not notice the difference. That is one of the advantages of a really good valve.

Ediswan Valves are highly sensitive and operate with a complete absence of noise. They are the outcome of 30 years' experience.

Ediswan Valves will bring the best out of your wireless set—get some on the way home and enjoy a better programme from to-night onwards. All dealers sell them.

THE EDISON SWAN ELECTRIC CO LTD.
QUEEN VICTORIA ST., LONDON E.C 4.

The first valve ever made was produced in the Ediswan laboratory

EDISWAN VALVES

162-6

Wavemeter Troubles

THE buzzer type of wavemeter is exceedingly popular among amateurs, and justly so. It can be bought at very reasonable prices, whilst those who like to construct their own apparatus can make wavemeters of this kind very easily. In spite of its simplicity, a well-made buzzer wavemeter gives extraordinarily fine and accurate readings for all wavelengths in a band which it is desired to cover.

Most users of the buzzer wavemeter will have had experience at one time or another of a rather peculiar form of trouble. The buzzer is switched on, and gives out its characteristic singing note, but the instrument refuses absolutely to radiate. Even if it is held within an inch of the A.T.I. no sound at all will come through in the receivers. The first time that this happens one is inclined to wonder whether there is not something wrong with the set itself. But doubts on this score can be set at rest by tuning in a signal. The fault lies not in the receiving set but in the wavemeter. It can be remedied as a rule by making a very slight adjustment to the tuning screw of the buzzer. What actually happens when the buzzer refuses to radiate is rather difficult to say, but it seems likely that arcing is taking place at the contacts of the buzzer. The best method is to place the meter with the buzzer running two or three feet from the A.T.I., and to make adjustments with a fine screwdriver with the instrument in this position. It sometimes requires a little patience to obtain both the high-pitched note that is so much to be desired and good radiation in combination with it.

If the buzzer is absolutely out of adjustment those who are not used to it may find it rather a difficult problem to tackle. I remember once with my first buzzer wavemeter spending a couple of heated hours without being able to get more than the most fleeting and ragged buzz from it. Here is the best way of going to work. Switch on the buzzer; then turn down the small screw whose point makes contact with the reed which serves as armature until the two are just touching. Slacken off the tuning screw which will be found at one end of the buzzer. Now turn the contact screw very carefully down, tapping the wooden case whilst you do so, until some kind of note is obtainable. Then tighten up the tuning screw and work one screw against the other until you have got a note of the highest possible pitch. It will very likely be found that when a high note is achieved the buzzer will not start by itself when it is switched on. In this case slacken the contact screw by a fraction of a turn, which will usually set matters right. If it does not the buzzer can always be started, provided that the adjustment is approximately correct by tapping the case of the wavemeter after switching on.

To obtain accurate readings with the buzzer wavemeter, always place it at some distance from the receiving set. If the two are close together you will hear the buzz quite a long way on either side of the real wavelength, and you then have to trust to your ear to tell you the point at which it is loudest. By far the better method is to put the wavemeter at such a distance from the A.T.I. that its note is just comfortably audible when the set is sharply tuned to the wavelength indicated. When this is done very fine readings indeed can be obtained, for there is no difficulty in detecting the point at which the buzz is most distinctly heard.

N. O. P.

Ancient and Modern

ONE has begun to wonder a little of late, says a *Wireless Weekly* correspondent, whether wireless valves are as good now as they were, say, two years ago. In many respects they are undoubtedly better, for owing to improved manufacturing processes it is now possible to turn them out so well matched that if a valve of a particular make is burnt out we may be quite sure that a new one fitted in its place will perform in just the same way. The vacuum, too, of modern valves is probably a good deal better than it was in those that we used to use. New methods of pumping and the use of the magnesium "getter" have made it possible to produce a vacuum which is very hard and at the same time very lasting. Three years ago I purchased half-a-dozen valves of a certain make, not one of which burnt out until it had given well over a thousand hours of good service. That is an excellent record; here is the sequel. In May last I bought four of these valves for use on a five-valve set, the last valve being a small-power valve. They were most carefully used, the filament potential being kept as low as possible and the anode voltage never exceeding 60. One of them burnt out within three weeks of its installation and another was dead by the end of July. Valves are certainly cheaper to buy now than they were then, but they are dearer in the long run if this is a fair example of their life.

A Low-Power Radio Transmitter

Part I.

By K. ULLYETT

IN the two portions of this article it is intended to describe the construction and operation of a low-power radio transmitter suitable for the amateur who is taking up the more interesting and extensive side of his hobby.

The circuit diagram is shown in Fig. 1, and it will be noticed that the set is designed for use with an outdoor aerial. Should, however, the operator be the owner of a "dummy aerial" licence, an auxiliary circuit consisting of resistance and capacity may be shunted across the tuning inductance as shown in Fig. 2.

The Aerial System

The aerial system—consisting of aerial, tuning inductance and earth—though by far the most important item in a transmitting station is, strangely enough, the most neglected portion of the set, in most cases. For short-wave work a vertical cage aerial is the ideal radiator, but as many difficulties are encountered in the construction of such a type, most amateurs have to content themselves with the usual inverted L or T type aerial. This, needless to say, should be as high and unscreened as possible, but for short waves the length should not greatly exceed 50 feet.

Insulation must be carefully attended to, especially at the free end, for there the highest potential exists.

The lead in should be short and should come as directly as possible to the aerial series condenser.

This latter is generally found necessary in order to reduce the natural wavelength of the system to the licensed limits, and if used, should have a capacity of about 0.001 μF. Unless the very best make is used losses will be introduced which seriously reduce efficiency, so that if it is found possible to work on 200 metres without it, it is decidedly better to omit the series capacity.

Aerial Tuning Inductance

The A.T.I. consists in the present instance of 36 turns of No. 16 bare copper wire wound on an ebonite former 4 in. in diameter, tappings being taken every three turns to a strip containing 13 valve sockets.

All leads are soldered and well spaced, in order to reduce losses due to capacity effects.

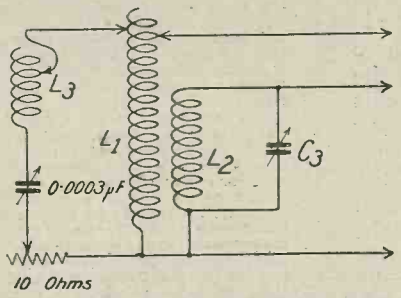


Fig. 2.—A "dummy aerial" system.

If it is not desired to use an input higher than about 5 watts, it is unnecessary to use copper strip for the inductance. The turns of wire are spaced ¼ in.

The aerial ammeter should be carefully chosen. Until some few years ago "hot wire expansion" types of ammeters were exclusively used, mainly for their cheapness. They are, however, very unsatisfactory in operation; expansion type instruments also possess the very serious objection that their high resistance makes it difficult to obtain a true reading.

As an alternative a thermo-couple instrument, of which a commercial type is now available, may be used. The resistance of the aerial ammeter must be low.

It is safe to say that in 99 per cent. of amateur stations, the

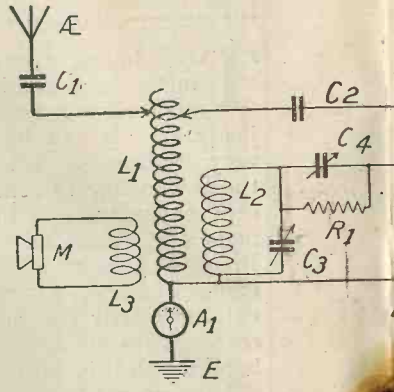


Fig. 1.—The circuit diagram

counterpoise is the most efficient earthing system possible.

In the second part of this article the aerial system will be discussed more fully and the merits of the counterpoise pointed out.

Six wires suspended about 4 ft. from the ground in fan formation directly under the antenna form a very efficient earthing system. The earth lead must, of course, be very carefully insulated.

The ohmic resistance of the whole antenna system must be kept as low as possible if maximum radiation is to be obtained.

The Plate Circuit

The plate circuit may be divided into two parts :—

(1) The oscillatory side, consisting of blocking condenser and A.T.I.

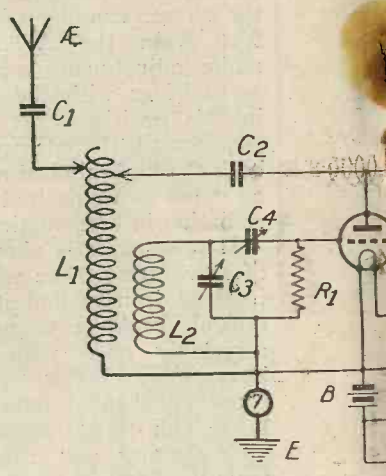
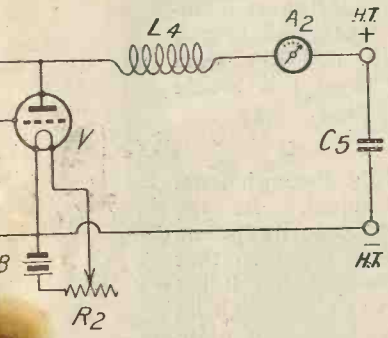


Fig. 3.—Method of adding



...f the low-power transmitter.

(2) The high-tension side, consisting of radio-frequency choke, condenser, and plate voltage supply.

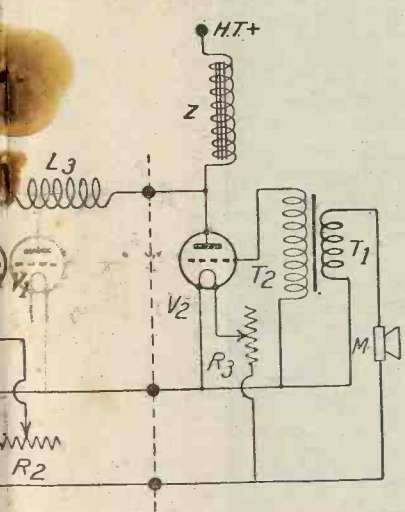
The blocking condenser in the oscillatory side should have a value of about 0.002 μF, but deviations from this value may be made, as the condenser is only intended to prevent a short-circuit for the H.T. For this reason it should be very well insulated and tested to at least twice the voltage it is desired to use for high-tension.

Although the D.C. plate supply may have a fixed voltage, fluctuations may be expected in the oscillatory circuit of considerably more than this value.

The A.T.I., the second component in the oscillatory circuit, has been described before, but it may be mentioned that, although the anode tap on the A.T.I. is not essential to efficient working, yet it is a decided advantage where measurements of efficiency, aerial current, etc., are to be made.

The high-tension side of the plate circuit is usually the *bête noir* of the amateur transmitter.

The choke L4 is designed to prevent radio-frequency oscillations from leaking back into the anode supply. It may conveniently consist of 300 turns of No. 24 d.s.c. copper wire wound on an ebonite former 1½ in. in diameter. Tuned rejector chokes are sometimes used, but are tricky in operation. The choke coil must be carefully insulated from earth, and also within itself, as a considerable difference of potential may occur between the ends of the winding.



...oscillator with choke control.

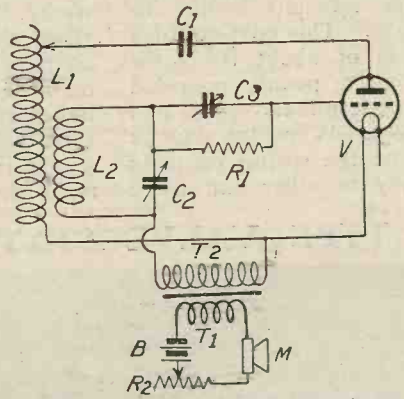


Fig. 4.—Grid control method of modulation, using a microphone transformer.

If the amateur has access to the public supply mains, these may be used as a source of anode voltage. If not, a high voltage battery consisting of large dry cells or small Leclanché cells is the only cheap substitute.

Experiments in Morse transmission may be conducted in the use of a T.V.T. unit worked from the filament accumulator. Considerable hum would most likely be introduced, even if the supply were rectified and well-designed filter systems were used.

The condenser C5 (value about 2 μF) somewhat smooths out the supply, and is an aid to efficient operation.

An article which will make especial appeal to the beginner in radio transmission.

As it is placed directly across the anode supply, its insulation must be carefully attended to. Lamps may be placed in series with this capacity to prevent damage by a "short."

The Grid Circuit

The part of the transmitter, C4, R1, C3, L2, although the easiest in construction, will cause the greatest difficulty in operation.

The grid coil L2 may consist of 50 turns of No. 20 d.s.c. wire on a 3-in. diameter former, and the coupling between it and L1 may be varied by sliding (after the principle of the loose-coupler) or by rotation, as in a variometer. This latter method is conducive to the best results.

The variable capacity C3 (maximum value 0.0005 μF) is not essential, but it greatly facilitates control of oscillation.

The grid condenser and leak (C4, R1) need careful alteration before best results are obtained. For this purpose C4 should be variable (maximum 0.001 μF), and R1 may consist of a variable water resistance; the usual variable grid leaks used in receiving circuits could not stand up to the current, and variable wire-wound, non-inductive grid-leaks are rather costly.

A little careful experimenting with values for C4 and R1 will greatly improve efficiency, and generally the highest values give best results.

Filament Circuit and Valve

The values for low-tension and filament supplies depend on the type of valve in use. For very

low powers, a hard R valve with 6 volts on the filament and 200 on the anode will yield surprising results, but the life of the valve is seriously shortened.

There are many suitable types of lower-power transmitting valves on the market with four-prong fittings, and there is little to choose between the different makes.

The Telephony Absorption Circuit

The original transmitter from which these data are derived was designed solely for the purpose of experimenting in values for components and measurements of efficiency, aerial and anode current, etc., and so a telephony modulating device was scarcely necessary.

The simplest type of control, i.e., aerial absorption control, was fitted, but is used only on rare occasions, most work being done on a non-radiating aerial.

The microphone M is the standard G.P.O. solid back type, and the absorbing inductance consists of 15 turns of No. 22 d.c.c. copper wire on a 3-in. diameter former, coupled loosely to the end of the tuning inductance L1.

If the amateur is more ambitiously inclined he may add the modulating unit shown in Fig. 3 or use the grid control system as shown in Fig. 4.

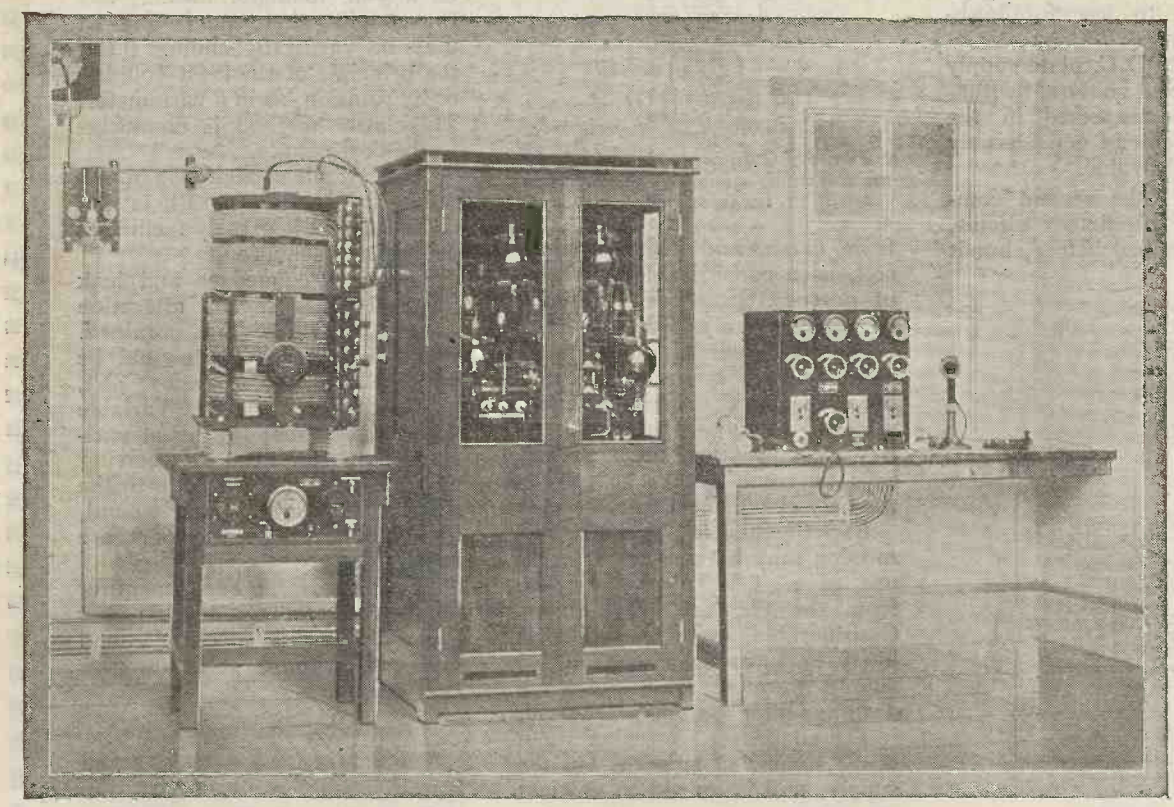
Plugs and Jacks

ONLY a few constructors nowadays make much use of plugs and jacks, though these provide the most convenient way of varying circuits, cutting out valves at will, and so on. Excellent jacks can be obtained from those who deal in disposal goods, and one firm has recently put on the market a simple little contrivance specially made for wireless use. This consists of a round base of about the same diameter as a penny, provided with two terminals and two socket holes. When the plug is not inserted the spring contacts come firmly together and there is a path straight through from terminal to terminal. As the plug is pushed home its points force the contacts apart so that current now passes through the leads attached to it. Though its uses are many I do not quite agree with the makers who recommend it as an automatic earthing device for the aerial. The idea is that when the plug is pulled out the aerial earths itself and there is then no need to worry. This is all very well, but when the plug is inserted the contacts are only a very short distance apart, and there is an undesirable capacity between them which is likely to result in a loss in signal strength and to make the tuning rather flat.

Many amateurs will wish to carry out experiments and tests in efficiency rather than to burn out the ammeter with badly distorted telephony, and these members of the "ether-shaking" community will find the data given in Part II of this article especially interesting.

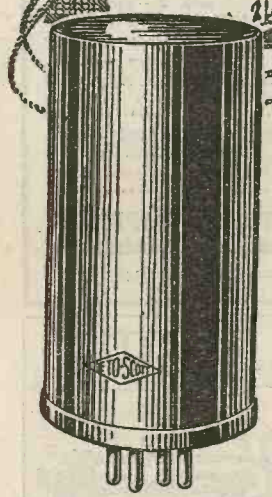
□ □ □

A COMMERCIAL TYPE VALVE STATION.



The compactness of a modern valve transmitting station is well illustrated in the above photograph showing a combined wireless telegraph and telephone station. Only the tuning and transmitting controls are exposed. (Photo. Marconi's Wireless Telegraph Co., Ltd.)

Guaranteed AMPLIFIERS



¶ Send for a copy of Peto-Scott's large Catalogue of Wireless Components and note how much you will save by dealing with one of the oldest firms in the Radio Industry. Price 3d., complete with unit Folder, Unette pamphlet and other literature.

For all wave lengths over 1000

MULTI-WAVE AMPLIFIER

Used in the "P.W." 24-Valve Set

The wonderful 24-Valve Set just used in an attempt to receive Mars by the Editorial Staff of POPULAR WIRELESS *used Multi-wave amplifiers. This Receiver is now on view at Selfridge's in Oxford Street, W. In "P.W." issue of Sept. 6th, the Editor said, in reference to the 24-Valve Set: "Preliminary experiments proved disappointing; but when we substituted resistance Coupled Transformers for aperiodic Transformers and embodied one or two new ideas of Mr. Dowding's, the Set functioned excellently, and it was calculated that we obtained full efficiency from 16 H.F. Valves, which on the whole is a very excellent average."*

FOR high-frequency amplification over 1,000 metres there is nothing to beat the resistance coupling method. It brings in distant stations easily and clearly and requires absolutely no tuning at all. The Peto-Scott Multi-wave Amplifier, introduced just over a year ago, has been the most successful amplifier of its kind, and with the opening of 5 X X at Chelmsford there is even a greater demand for it. If your set has a stage of H.F. amplification just plug in the Multi-wave Amplifier in place of the ordinary H.F. Transformer. Immediately your Set (using the correct Aerial Inductance, of course) is available for all Stations above 1,000 metres. Without further expense all such stations as Chelmsford, Radiola, Eiffel Tower, Berlin, and all other Continental Broadcasting Stations on the high-wave band come within your reach.

The Multi-wave is made in two types. No. 1 for use where one stage of H.F. amplification, and No. 2 for use where two stages (or more are used). In such cases, No. 1 is always used after the last H.F. Valve as a coupling between that valve and the Detector Valve.

Remember, every Multi-wave is fully guaranteed to give you perfect satisfaction. It is a Peto-Scott exclusive design, produced entirely in our own works and manufactured from the highest grade of ebonite. In future, do not fuss with a number of transformers to cover a wide band of wave lengths, but invest in a Multi-wave which is guaranteed to function equally well over all wave-lengths between 1,000 metres and 26,000 metres.

No. 1 .. .. **8/6** No. 2 .. .. **12/6**

MAX-AMP L.F. Transformer

"a great little Transformer"

The sound test for a good L.F. Transformer is what the experts say. After all, a technical man equipped with measuring instruments and a big experience in the Radio field is better able to pass a judgment on a Transformer than anyone else.

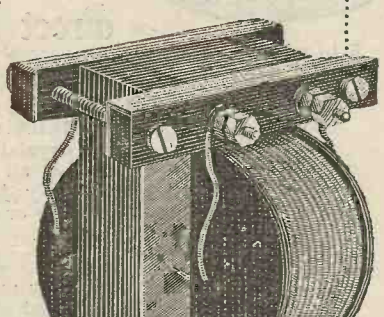
For instance, he would not be unduly biassed by the small size of the Max-Amp. Read, therefore, what the scientific expert on the staff of "Amateur Wireless" said in his candid report (issue dated October 27th, 1923):—

"As the severest test of all, the Peto-Scott and a large and very expensive Transformer, which is used as a standard for gauging the performances of others, were connected to a four-pole two-way switch. This enabled either to be thrown into action in a moment, so that their performances could be properly compared. To my intense surprise, the Peto-Scott actually gave a greater degree of amplification than the standard Transformer, and that without any kind of distortion or harshness."

After such an unsolicited expert opinion it is small wonder that an immense number of Max-Amps. are in daily use, giving complete satisfaction to their owners.

Remember every Max-Amp. is fully guaranteed for one year. If at any time during that period it fails to give the fullest satisfaction, you may return it to us for replacement with a new one or your money will be refunded in full.

Its standard ratio is 5½ to 1, but a Unidyne type is sold with a ratio of 10 to 1. Both are sold at the same price in coloured sealed cartons.



18/6

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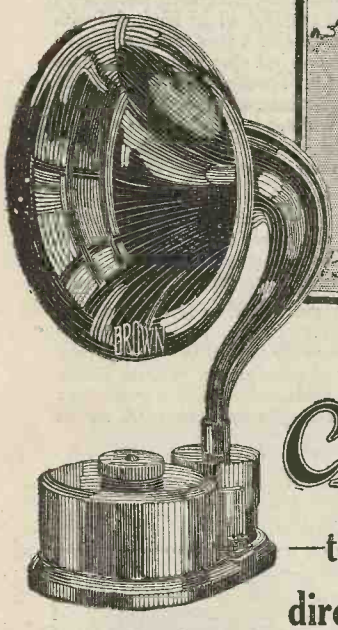
It will pay you always to watch WIRELESS WEEKLY *Advertisements.*

¶ *This Map shows the effective working areas of the Crystavox—the only Loud Speaker in the world capable of operating direct from a Crystal Receiver. If you live within any of the circles—and if your Crystal Set will respond to the simple test described below—you can use a Crystavox Loud Speaker.*



Exhibited at our Stand at the Albert Hall Exhibition.

CRYSTAVOX

—the only Loud Speaker working direct from a Crystal Receiver

THOSE fortunately living within easy range of a B.B.C. station require nothing more than a good Crystal Set and a Crystavox. In return they will receive all the pleasures of Broadcasting at an absurdly low price—a few shillings every six months or so for the replacement of a small dry battery.

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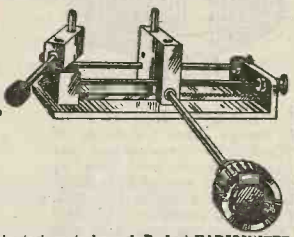

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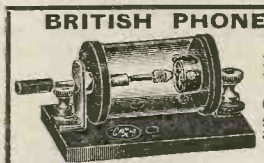

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WIRELESS WEEKLY.
Vol. 4. No. 22. Oct. 1, 1924.

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The Marconi Osram D.E. 5 B. Valve

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

In view of the great interest being shown in these new valves, we publish below our test report, together with some interesting characteristic curves.

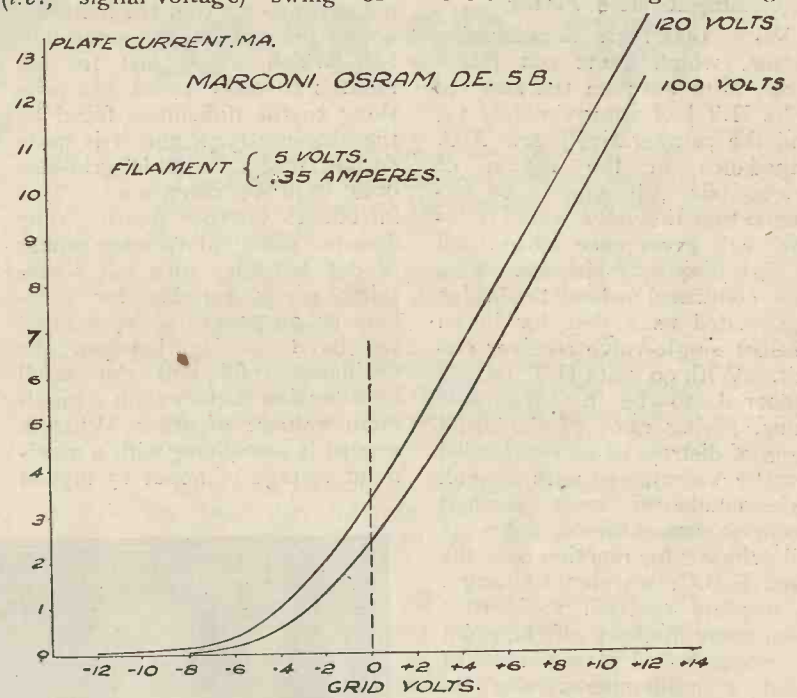
A SPECIMEN of the new Marconi Osram D.E. 5 B. valve, a dull-emitter valve of the type which is best operated in conjunction with a six-volt accumulator, has been submitted to an extensive test by members of the " Radio Press " staff.

This valve is more particularly designed for use in low-frequency amplifiers of the resistance-capacity coupled type. For this purpose, as there is no build-up of signal-voltage through the use of a step-up transformer, a high (theoretical) voltage amplification ratio is desirable in the valve, in order to compensate in some measure for the inherent inefficiency of this mode of coupling. In the D.E. 5 B. this high amplification ratio is attained by the design and arrangement of the electrodes, a fine-meshed grid being used, and this being mounted close to the filament, so giving a close control of the electron stream. It is a fairly large valve, and has a large flattened box-like anode, and a looped filament supported at the centre of the loop, the fine-mesh grid being also rigidly held, the whole forming a stiff and mechanical-looking structure. The bulb is only partly obscured by the metallic mirror-film which has become customary in valves. It is not noticeably microphonic in use.

Characteristics

On determining the characteristics, it was noted that at the rated filament voltage the filament required .35 amperes, the nominal rating being .22 amperes 5 volts. A fair emission was recorded at 4.5 volts and .32 amperes; but the curves were taken at the former rate. Saturation was not reached with 120 volts H.T. with 14 volts or more of positive grid-potential. The anode voltage specified by the makers, 100 to 120 volts, was used in the test. It was noticed that at both 100 and 120 volts plate-potential the characteristic gave a long straight portion to the right of the zero-grid volts line, but comparatively short and tending to curve slightly on the left of that line. Hence, at this value of H.T. there is not a great deal of room for grid-voltage (*i.e.*, signal-voltage) swing of any magnitude, and any grid-bias applied must be limited accordingly. In practical trial this was confirmed, only some 1.4 to 3 volts grid-bias being needed, and signs of rectification becoming noticeable if really strong signals were applied through the medium of an efficient step-up transformer coupling. Evidently a substantially higher value of H.T. supply should be available if the valve is to be used to amplify signals which are already of some strength.

With the value of H.T. and anode resistance specified (100 to 120 volts and 100,000 ohms respectively), the valve was tried, in comparison with a standard R valve of fairly high amplification-ratio, and following another R valve as rectifier; in comparison, qualitatively from the point of view of tone and fidelity and quantitatively by actual measurement of the audio-signal voltages obtained across the phones—with several L.F. transformers and a choke-capacity coupling. A marked increase of signal strength was noted over the standard R valve in all cases, most noticeably in the case of resistance - capacity coupling. With a coupling condenser of approximately .01 μF capacity and a grid-leak of .5 Ω to the L.T. minus, better signals resulted with a 70,000 ohm anode resistance in the place of the 100,000 ohm anode resistance, and reaction was easier to obtain.



Characteristic curves of the D.E. 5 B. valve.

Tone

The tone was pure and free from distortion, though, of course, the amplification could not compare with that obtained, together with excellent quality, when a good L.F. transformer was used. The deflection of the microammeter recording the signal strength obtained, with a certain steady medium audio-frequency signal applied directly to the grid of an R valve and amplified in one L.F. stage with this valve, was actually three times as great with the transformer coupling as with the resistance capacity under the conditions named, though the latter was considerably higher than with valves not explicitly designed for this work.

Amplification Factor

With the high amplification factor, which came out (at a mean value between 100 and 120 volts H.T.) of approximately 13, and the comparatively low A.C. impedance in the region of 21,000 ohms, it was to be expected that the valve would oscillate with great ease when used in high-frequency circuits. This was confirmed when the valve was tested as a detector in an efficient single-valve receiver circuit. With 90 volts H.T. (which appeared to be a favourable value, giving none of the usual signs of distress of an overloaded detector valve), and with a small series condenser, most excellent reception was obtained, a No. 35 coil sufficing for reaction over the usual B.B.C. wavelength range, or a plate reaction variometer when some distance off the point of resonance. A plate current of about 2 milliamperes was recorded; under these circumstances 2LO came in at moderate loud-speaker strength on a by no means ideal or high aerial at 35 miles on the single valve.

Oscillation

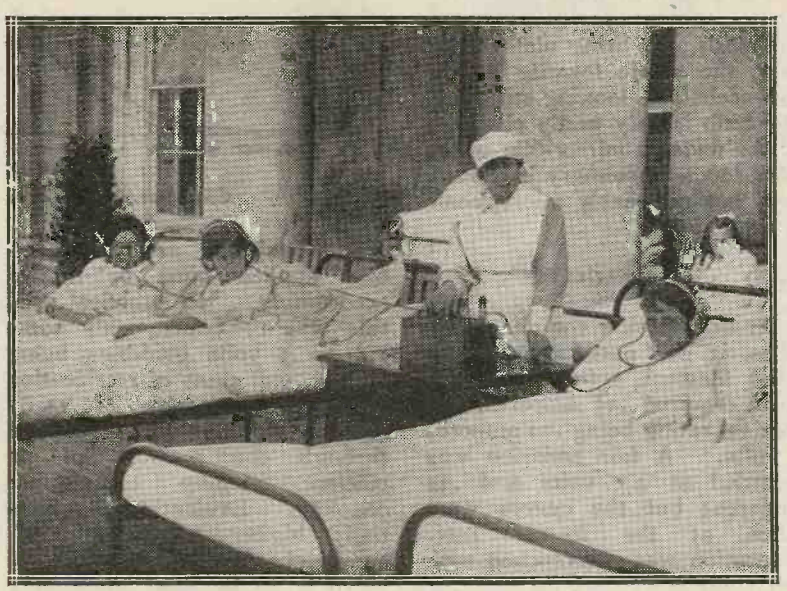
On account of the great ease of oscillation and the appreciable internal capacity which is the price of a high amplification-ratio combined with a low impedance, the valve is not suitable for H.F. amplification on the shorter waves, though, of course, for long waves, which approximate more closely to L.F. conditions, it can be used.

For resistance-capacity amplification of signals which are not of great intensity already, for loud signals in a single-valve receiver, and particularly for an efficient first-stage L.F. amplifier with transformer coupling, this D.E. 5 B valve evidently has great possibilities.

A Long-Felt Want

I HAVE always thought it rather curious that so very few ready-made sets are fitted either with a fixed grid-biasing battery for the note-magnifying valves or with terminals to which such a battery may be attached. The aim of makers who turn out sets of this kind is very largely to make them as simple as possible, but it does not seem to me that the inclusion within the cabinet of a small battery which would last for six months or more could add anything to the difficulties faced by the absolute tyro, and it is quite certain that a suitable grid-bias does improve reception. This introduces another point. Why does not some enterprising maker of dry batteries turn out something really suitable for grid-biasing purposes? At present we have nothing between the flashlamp refill and the small high-tension battery with a maximum voltage of 36. What is needed is something with a maximum voltage of about 15 tapped at every 1½ volts. The battery could be quite a small thing, for since the current taken from it is almost infinitesimal, very small cells will stand up well to the work. One can, of course, place two or three flashlamp refills in a specially made case and take tappings at every 1½ volts; but it is rather a nuisance to have to do this, and now that the usefulness of the grid-biasing battery is so generally realised, one feels that there would be a very ready sale for the suggested 15-volt unit. It might even be better to make, say, 9-volt units, for there are few valves which require a much higher grid potential than this with anode voltages up to 100. If this were done, two of the tapped batteries could always be wired in series when higher voltages were required. I am quite sure that many more people would make use of grid batteries if only there was some simple trouble-saving device of this kind readily available.

M. U. P.



The utility and appreciation of wireless in hospitals is demonstrated by the above photograph which shows patients listening-in.

57·58·59-up!

THE Seconds tick by in the silent chart room and down in the Southern Pacific the navigator shapes his course by the unfailing accuracy of his chronometer.

How would he fare if his shipowners had tried to economise by installing cheap alarm clocks in place of chronometers?

And yet frequently enough we find instances of people getting inferior results from their wireless sets because they have attempted to economise on condensers.

There is no economy in this really, because sooner or later they have to take out the "just as good" and substitute an article of sound manufacture.

We do not say that all cheap condensers are necessarily bad; you may be lucky and get a good one, but if you buy a Dubilier you bet on a certainty—you get a good one *every time.*

Naturally if we are to maintain such a high standard our products must be slightly more expensive than those which carry no guarantee, but we are convinced that in the interests of true economy you should specify Dubilier.

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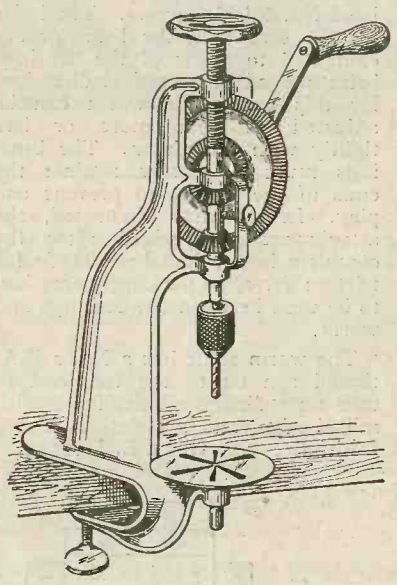
E.P.S. 71.

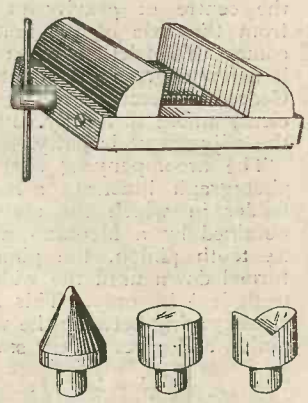
Bench Tools

IF I were asked what was the most useful mechanical contrivance that the wireless constructor can install in his workshop I should have no hesitation in naming the bench drill. The hand drill is a most useful little appliance, and even if you possess a bench drill, it should not be discarded, for there are many pieces of work in difficult corners which can be done by it alone. But the hand drill has certain drawbacks. To begin with, it is most difficult to make sure that all the holes drilled are perfectly vertical. Again, if you have to make large holes such as those $\frac{3}{8}$ in. in diameter for the bushes of condensers, selector switches and so on, it is not at all an easy matter to avoid making them oval instead of round, since there is naturally a slight swaying movement of the hand that holds the top of the drill; and drilling a hole of this size, even through $\frac{1}{4}$ in. ebonite, is pretty hard work. With a bench drill the work becomes very much easier.

The bench drill is by no means an expensive appliance. Mine cost exactly £3 12s. 6d., which included an excellent vice and three most useful centres. The choice of the drill is not at all an easy matter, for nearly every type has some drawback from the wireless constructor's point of view. What he wants is a machine which will take drills up to $\frac{3}{8}$ in. and which will allow holes to be drilled at least 4 in. from the edge of the material. Now, there are a great many bench drills which will not take a $\frac{3}{8}$ in. drill even though they may be stated by the makers to do so. The jaws of the chuck will expand sufficiently wide to grasp the drill, but in many cases the distance between the table and the drill when at its highest is too small to allow the drill to be inserted. Drills of this diameter are all of one standard length, and short ones can be obtained for some curious reason only in complete sets. Make quite sure, therefore, that the machine which you select is capable of taking a $\frac{3}{8}$-in. drill by seeing one actually inserted. Be sure, too, that the distance between the upright member and the centre of the table is sufficient to allow holes to be drilled at least 4 in. from the edge of the material.

The next point to consider is the question of the feed. There are three kinds of feed—lever, automatic and hand. In the first of these there is a metal bar fixed to the top of the frame and to the rod engaging with the spindle of the drill. The right hand works the crank handle and the left presses the drill down by means of the lever. For fine work this is probably the best of all feeds, since one can regulate the pressure applied to a nicety. Unfortunately, there are few machines with this type of feed which will both take a $\frac{3}{8}$-in. drill and allow holes to be made at a sufficient distance from the edge of the work. In machines of the automatic feed each revolution of the crank handle gives a partial turn to the feed screw. Two speeds are generally provided, but as drills are designed as a rule for metal work, neither is very suitable for drilling ebonite. Further, if various drills between 4 B.A. tapping and $\frac{3}{8}$ in. are used, one would really require at least half-a dozen different speeds for the automatic feed. There remains the hand feed. In machines fitted with this movement the spindle is pressed downwards by means of a screw at whose head is a wheel that the left hand actuates. Though not nearly so handy as the lever feed is, it is probably the best type for the amateur, since drills so fitted can be regulated to a nicety.





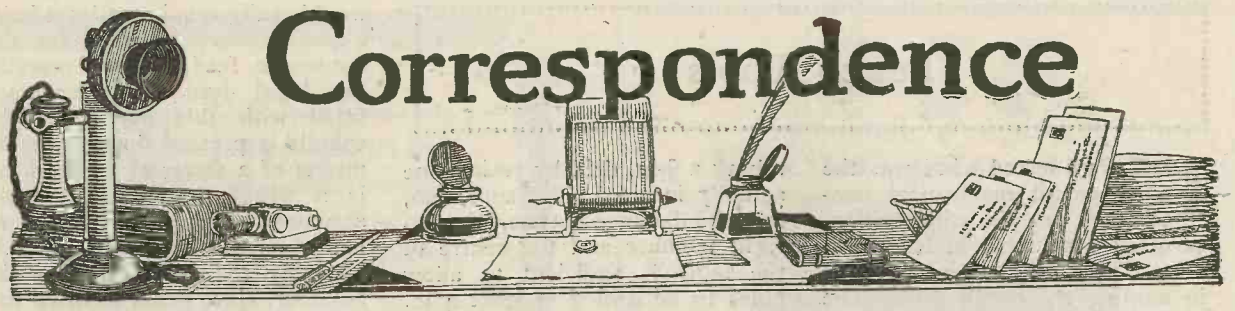
Illustrating a typical bench drill, a useful vice and centres.

The Drill Table

The drill table should be of good size, and it is desirable that it should have a hole right through its middle. It should also be provided with suitable attachments for a drill vice.

With a bench drill and a good vice one can do quite a number of jobs that are really not the function of the drill at all. For instance, if an end-milling tool $\frac{1}{8}$ in. in diameter is purchased, grooves can be cut in ebonite to take bare wires. Again, the bench drill can be used quite effectively for small turning jobs if a pointed centre is provided. Work is gripped in the drill chuck, its lower end being punch-marked and rested upon the point of the centre. Then by placing the tool in the vice one can accomplish respectable turning. Small round parts which are slightly oversize can be run down quite easily by placing them in the drill chuck and using either a file or a piece of emery paper.

W. H. R.

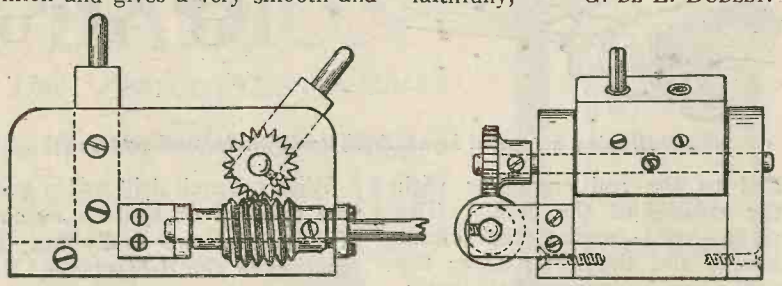


Correspondence

AN ANTI-FRICTION COIL-HOLDER

SIR,—Those who use home-made inductance coils will have found that for the larger sizes—400 and upwards—the ordinary coil-holders are no use when it is required to have coils movable in a vertical plane. The majority of coil-holders depend on friction (spring washer) to hold the moving coil in position. The weight of the larger home-made coils combined with the distance of the centre of gravity of the coil from the axis of the holder overcomes this friction when the coil is a few degrees out of the vertical. Geared movement even is not sufficient, unless so tightly coupled that the adjustment is jerky.

The accompanying sketches and photograph illustrate a home-made holder in which the movement is obtained by a Meccano worm and 24 tooth pinion, the pinion being turned down until the width of the teeth is $\frac{1}{8}$ in. only. This allows of close gearing between the worm and pinion and gives a very smooth and



Diagrammatical sketch of the coil-holder.

critical (equivalent to micrometer) movement of the coil, with no backlash. The illustrations are self-explanatory, but for those who may wish for details the following is a brief description.

The shaft carrying the pinion passes through the moving coil-holder and side pieces of the frame and is of brass rod turned down at one end to fit the hole in the pinion (or this sized rod may be used throughout). To fix the shaft in the holder a No. 8 B.A. screw is passed right through from front to back of the holder and the axis of the shaft. Two grub screws were first used for this purpose, but they had to be screwed up so tight to hold up against the weight of the coils that the ebonite broke away.

The worm is carried on a piece of the same brass rod as used for the pinion shaft. The worm shaft works in two bearings. In the case illustrated these consist of one plain flat piece of 3-16 in. brass and one angle piece of the same thickness. These are each attached to the side of the frame by two cheese-head No. 6 B.A. screws. The holes for the screws in the bearings are elongated to allow of the bearings being moved in a vertical direction. By this means the worm can be adjusted to gear more or less tightly with the pinion. The bearings must fit closely against the ends of the worm, to prevent end play. In the case illustrated, the attachment was added after the complete holder had been made for friction drive, so packing pieces had to be used between the bearings and worm.

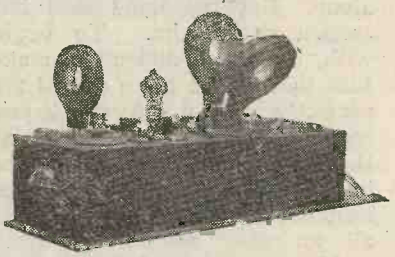
The worm shaft has a No. 2 B.A. thread run on to the free end to take an ordinary ebonite knob with milled edge, and a locknut.—Yours faithfully,

G. DE L. DUDLEY.

RECEIVING 5XX

SIR,—With reference to your reader's letters regarding the new station, 5XX. This station can be received here (although situated between two ranges of Welsh mountains) consistently at "good" loud-speaker strength, interpreting "good" that music and speech can be heard with perfect clearness in the hall, even when the receiving room door is closed. The actual signal strength is approximately 75 per cent. of that of our local station, 5WA (12 miles distant).

The B.B.C. have, without a doubt achieved their object, and to myself the new station is an excellent standby when the local station's programme is not to my liking. Comparing signal strength with Radio-Paris, 5XX would appear to be quite double the strength of the foreigner. As your correspondent states, the modulation is perhaps not so good as that of the other main stations, but taking into consideration the large power being handled



The coil-holder suggested by Mr. Dudley, mounted upon a set.

great credit is due to the B.B.C. and, incidently, Capt. P. P. Eckersley.

D. V. BRIGGS, A.M.I.Rad.E.
Pontypridd.

WBZ

SIR,—With reference to Messrs. D. & R. G. Smith's enquiry about the American station WBD (?), Boston, I beg to enclose a letter received from the Westinghouse Electric Co. in reply to a complaint made regarding the announcement of their call sign. I could only distinguish "WBZee" after being pronounced about six times (loud-speaker strength).

WBZ is not very difficult to tune-in when conditions are suitable, and is equal in strength to WGY, New York, on some occasions.

The station below WBZ's wave may be KDKA on 326 metres, not so strong as the above and generally a little distorted, or KGO on 312 metres. I have heard dance music from KGO, but never from KDKA, although they may have transmitted such.—Yours faithfully,

NORMAN HARVEY.
Thornton Heath.

DEAR MR. HARVEY,—It is with pleasure that we enrol you as one of the distant listeners to our radio broadcast programmes, and we wish to thank you for your letter of April 14, commenting on the programme we broadcast on Saturday, April 12.

WBZ is owned and operated by the Westinghouse Electric and Manufacturing Co. at Springfield,

Mass., and we broadcast each evening between the hours of 5 and 10.30 p.m. Eastern standard time, which is five hours slower than Greenwich mean time, on a wave length of 337 metres, or 890 kilocycles frequency.

We shall be pleased to receive your comments on any of our future programmes which you may pick up.—Yours very truly,

A. S. EISENMANN.

Radio Station WBZ.

A.C. MAINS FOR FILAMENT HEATING

SIR,—I have just read with great interest Mr. Fox's article in your August 13 issue on using the A.C. mains for filament heating.

To my mind, far too little use is made of the mains, and in the many places where the supply is direct and of a useful voltage, viz., 230, or thereabouts, the requisite filter can be made up much cheaper than purchasing an H.T.120 volt battery suitable for running one or two power valves. With unlimited plate current at a high voltage and resistance capacity coupling a really fine job can be made of the loud-speaking end of the business. The current cost is negligible.

Users of dull emitter valves are usually cautioned (and rightly so) not to exceed the voltages specified by the makers; but all the same, I have run a "B4" power valve for 14 months on 230-volt mains, and to-day it is as good as ever, and is in use every evening.

Many strange statements concerning wireless appear in the daily Press, and one such in a recent column struck me. It was to the effect that the famous "Neutrodyne" circuit can be used only with bright valves. Some information on this point might be welcome to a great many readers of *Wireless Weekly* who, like myself, have tried this circuit and not made very much of it. At present I am comforting myself with the thought that the three .06 valves I tried were the cause of failure.—Yours faithfully,

Edinburgh. S. H. MILNE.

[Practically all the Neutrodyne receivers in the U.S. use dull-emitter valves.—ED.]

A READER'S EXPERIENCE

SIR,—No doubt you will be interested to know about a crystal set I have recently assembled. It has quite a usual circuit, made up with a basket coil, tuned by a .0005 variable condenser.

With this set 2LO came in, though very faint, and in changing over to my regular set I detached the earth, but instead of this cutting out the transmission entirely, it made but very little difference. I then found that by attaching the earth wire to the aerial terminal and dispensing with the aerial altogether, the strength was somewhat increased. By connecting the aerial terminal to a gas-pipe in the same room as set, and using this as substitution for above earth, results were slightly louder; compared with normal results from the regular set, this last strength was little over half as loud. The foregoing tests were carried out in a semi-basement room. I then took the set to the top floor, where I connected a gas earth to aerial terminal as before, with the result that the strength was increased to at least that obtained from the other set.

This is by no means a freak, for it works any time, and as I have never read of a similar occurrence, I thought perhaps you might like to know.—Yours faithfully,

R. CYRIL J. CHAPMAN.

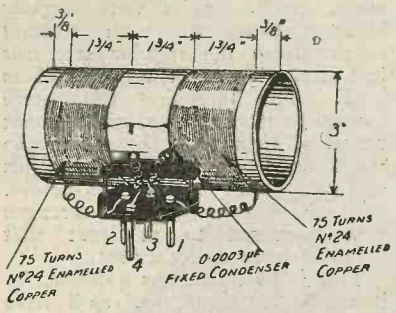
S.W.9.

A NOVEL LOADING COIL

SIR,—I enclose herewith circuit diagram and sketch of a loading coil and fixed condenser in the form of a plug-in coil suitable to tune a crystal set with variometer which

already covers wavelengths up to 600 metres to the Chelmsford Station, 1,600 metres, which may be of interest to your readers.

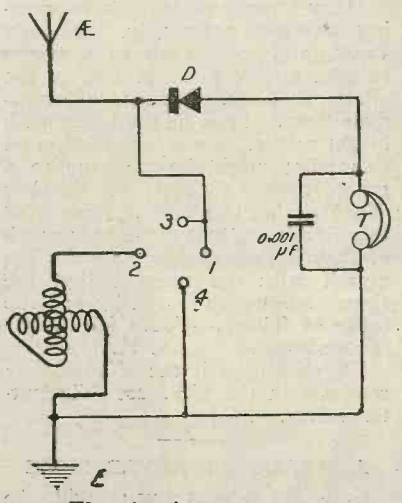
It consists of a combination of a loading coil and fixed condenser (which reduces the somewhat large number of turns necessary in the coil) which can be plugged in in a moment, avoiding switches, etc.



The loading coil suggested by Mr. Forwood.

The plug-in "combination" is made up of a cardboard former 6 in. long and 3 in. diameter wound with 150 turns No. 24 enamelled wire in two sections of 75 turns each.

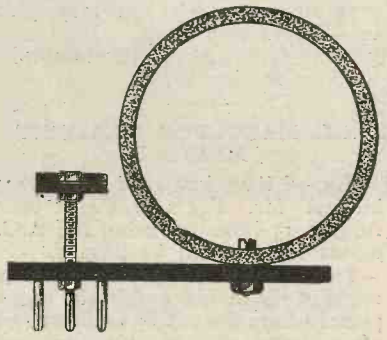
For convenience the .0003 fixed condenser may be placed inside, as I have not found any ill-effects from this arrangement. A small piece of ebonite about 1½ in. square is fitted with the valve legs spaced as for a valve, so that the "combination" can only be inserted one way into the sockets corresponding on the set. Two legs, 1 and 2, pass



The circuit arrangement.

through the former and are nutted on the inside, thus securing the base; 3 and 4 need only be secured to the base itself.

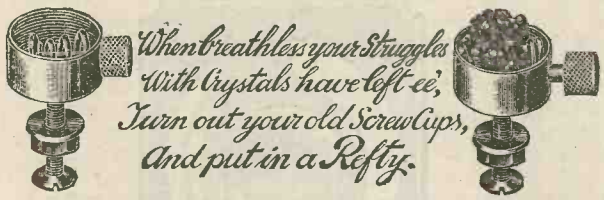
Nos. 1 and 2 are the two ends of the coil and 3 and 4 the condenser. In fitting care should be taken to fix in the correct order, as it will be seen that 1 and 2 valve legs must be nutted up before the condenser is fixed, as it comes on top of the nuts. The countersunk screws securing condenser are sunk on the outside of the former, and the winding can pass over these, covering



A side view of the loading coil.

them up, thus economising in the space occupied by the windings.

On referring to the theoretical circuit diagram, it will be seen that the action of inserting the "combination" adds a loading coil across sockets 1 and 2 and the condenser across 3 and 4, and it is only necessary to provide a short-circuiting plug for insertion in 1 and 2, when



WHEN YOU SHOULD FIT

The WatMel

VARIABLE GRID LEAK.

Patent 206098

5 to .5 Megohms ... 2/6
50,000 to 100,000 Ohms 3/6
Other Resistances to suit any circuit.

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WatMel

ON EVERY GRID LEAK.
BEWARE OF IMITATIONS.

Extract from a letter published in Sept. issue of MODERN WIRELESS.

"I was unable to obtain a Watmel Grid Leak when constructing this set, but have fitted one since, as without it the set was unworkable." J. D. S.

While the ordinary fixed grid leak is not *totally* inefficient the constantly varying strengths of energy which is applied to the grid render it incapable of correct functioning under *all* conditions.

The ability to vary the difference of potential between the grid and the filament controls to a vital degree the electronic flow to the plate. Incorrect adjustment of the potential may act as a "stone-wall" to a great percentage of the electrons.

There is but one definite and positive method of control—you should fit it—Watmel—

ALWAYS.

IMPORTANT NOTICE
to users of Variable Grid Leaks

The Watmel Wireless Co. wish to notify the trade and public that their Variable Grid Leak Patent Application No. 206098 was contested in the Comptroller's Court, and on Appeal; in both instances the Patent Grant was upheld and costs awarded.

It is the aim of this Company to protect traders', customers', and also its own interests by securing Patent protection for the novelties in its specialities, as it is these novelties, invented by experts and exhaustively tested, which are the Hall Mark of all Watmel Products.

All goods of our manufacture bear this mark. It is your only guarantee. WatMel

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Established 26 Years.

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REWOUND to any RESISTANCE & MADE EQUAL to NEW.
PRICE QUOTED ON RECEIPT OF INSTRUMENTS.
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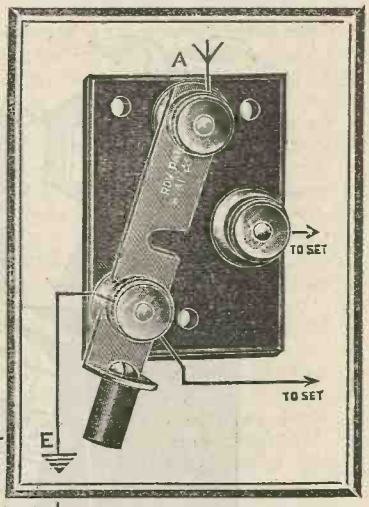
will protect both your home and set. All metal parts are of ample proportions and are heavily nickel-plated. The terminals are of a patented improved type and carry the spring switch contacts which ensure perfect electrical conductivity.

Mounted on solid ebony base with three fixing holes. Price 3/-



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This useful accessory may be fitted to any tuning device in order to obtain fine vernier adjustment. The mechanism is simple and robust and there is nothing to get out of order. It is designed to fit ¼" spindles, but with a liner will fit ⅜" spindles. Price complete with liner and 180° scale 6/-

Small devices which make a *big* difference

There may be no need to tell *you* what a difference attention to details makes in wireless, but we would bring to your notice these small Igranic Devices which make that difference. It is because Igranic craftsmen—both designers and engineers—devote such care to details in producing Igranic Components, that we say "you will build a *better* set" if you use Igranic Devices. Igranic Components include: Honeycomb Coils, Transformers, Vario-Couplers, Biplug Coilholders, Triplug Coilholders, Filament Rheostats, Battery Potentiometers, etc, They are obtainable of all reputable dealers, and carry a six months' guarantee. **Write us for List Z.248.**

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VERNIER FRICTION PENCIL

Designed for use with variable condensers, variometers and similar apparatus to convert the plain instrument into vernier type. For fine adjustment the pencil is inserted in the bush—so that the rubber ring engages with the bevelled face of the dials—and rotated. By sliding the clip attachment towards the brass pin a pencil may be converted into an anti-capacity adjuster. Price complete with clip, spare rubber ring and 3 Bushes 2/-

Louden VALVES

10/-

Silver Clear

Here is the Trade Mark by which Louden Valves are known. It was chosen because it represents the essential feature of Louden Valves—Silver Clear reproduction.

There are very good reasons why the open spiral anode of the Louden enables such clear reception to be obtained, but the best of good proofs is to buy one to-day and fit it to your set.

From the moment you switch on you will notice that your reception is clearer than it was before.

You may have become so accustomed to the "breathing" noise of your set that you do not notice it. When you fit Louden Valves you will most certainly notice its absence.
You will realise why we say that Louden Valves are Silver Clear.

The plain Louden for detecting and Low Frequency Amplifying.
The Blue Louden for H.F. Amplification.

Filament Volts 4.8-5.
Filament Amps 0.4.
Anode Volts 40-80.

FELLOWS WIRELESS

Manufactured throughout in Great Britain.
All Loudens are Silver Clear and free from "mush."
The current consumption is very low and the life long.

E.P.S.2.

ADVT. OF THE FELLOWS MAGNETO CO., LTD., PARK ROYAL, LONDON, N.W.10.

it is required to receive the short wavelengths covered by the variometer, the condenser being automatically removed.

When wiring up it is advisable to connect Nos. 1 and 2 sockets only temporarily until it is ascertained which is correct to bring the turns of the loading coil in the right direction relative to the variometer. They can then be secured permanently, and the sockets being arranged as for a valve, it will then be impossible to fit the "combination" with the coil reversed.

I find this fitting brings in Chelmsford very well indeed at about 18 miles, its only fault being its size, and I intend to make up a basket coil on the same lines with condenser and four legs.—Yours faithfully,

STANLEY M. FORWOOD.

Loughton.

"RANDOM TECHNICALITIES."

SIR,—As an enthusiastic gramophonist as well as a wireless devotee I am unable to refrain from making a protest against the statement made by Mr. Percy W. Harris in your paper under the heading "Random Technicalities" to the effect that nothing "can be worse for trade than to have to demonstrate to likely customers a receiver which can only produce as gramophones can," and that "the potential customer will obviously remark that it is no better than a gramophone."

Mr. Harris' knowledge of wireless matters is, of course, undisputed, but I venture to suggest that when he commences to criticise gramophone reproduction he is entering a realm largely unknown to him, as, were it otherwise, I feel confident that he would never have given utterance to the statements referred to above. The chief gramophone companies have, during the past few years, made vast strides towards perfection, and I am quite prepared also to concede that given equal artistic ability before the microphone and the gramophone recorder, supplemented by careful adjustment of the receiving set in the one case and proper management of a really good gramophone in the other, there may be little to choose between the results obtained from either source. This state of affairs is, however, rarely obtained. Before the microphone the singer delivers his song, and it has gone forth to the world; he may not have been in good voice, he may have made minor mistakes, but there is no remedy. With the gramophone, however, the position is entirely different, for one can rest assured that none of our leading companies will rest satisfied with a recording until it satisfies the very high standard of excellence which they have set themselves, and unless the execution of the particular item is as near perfection as is humanly possible.

I would, therefore, impress upon Mr. Harris the fact—and it is undoubtedly a fact which he may prove for himself by visiting any of the leading companies—that the gramophone de luxe of the present day is no longer a mechanical contrivance to be sneered at but a real musical instrument, whose reproduction can at any time equal and often surpass the best that can be obtained from wireless. So far from *real* gramophone reproduction acting as a deterrent to prospective wireless customers, Mr. Harris may be interested to learn that many of my gramophone friends have refused to take up wireless solely because of the inferiority of its reproduction as compared with that which they obtain from their own instruments.

So far as concerns the wireless gramophone concerts, I agree that they do not show wireless reproduction at its best, but neither do they by any means do justice to what we gramophonists expect from our own instruments, and I suggest that the solution of the matter is that the demonstrator at the B.B.C. studio is

not getting the best out of the instrument or that the latter itself is not up to present-day standard.

I hope you will pardon the length of this letter, but I also hope that it may perhaps lead Mr. Harris to modify his opinion on this subject. So far as concerns the turning away of customers, my own experience goes to show that this is not due to any lack of quality in the transmissions but rather to the ignorance of those responsible for wireless demonstrations in our stores.

With best wishes for the continued success of your two periodicals, both of which I have from No. 1,—Believe me, yours faithfully,

EDWARD A. BROCKWAY.

Mr. Harris's reply:

I am still unrepentant. With regard to gramophone matters, I am not inexperienced, having visited and supervised the preparation of gramophone records in big recording studios. I also possess a good modern gramophone, and have written technical articles on reproduction, so that I feel competent to pass an opinion.—P. W. H.

RADIO IN N.S.W.

SIR,—Doubtless you will be interested to hear that this Division of the Wireless Institute of Australia has now incorporated with it practically the whole of the clubs in New South Wales, and is the mouthpiece for all amateur wireless matters (political and technical) for Australia.

We now have our own club room, and excellent facilities for displaying wireless literature. — Yours faithfully,

PHIL RENSHAW,
Hon. Secretary.

Sidney,
Australia.

TECHNICAL EDUCATION IN WIRELESS

SIR,—I have read with great interest the article on the first page of your issue of September 17, 1924, and, although I am in general agreement with the statements made, I cannot refrain from pointing out a marked exception. In our courses at the Borough Polytechnic, the technical instruction in wireless is in the hands of Mr. G. W. Sutton, B.Sc., who is a well-known amateur transmitter fully familiar with the latest practice and engaged in test work for the trade. Comparatively little attention is given in our courses to obsolete practice; much more is heard of the valve method of transmission than of spark, arc, and high frequency alternator methods. Reception circuits which have attracted a considerable amount of general attention, such as your S.T.100, have been tried out and critically examined for volume and distortion. Members of the classes are familiar with the characteristics of the valves upon the market. And, generally, in our classes considerable time is devoted to discussion and to practical testing in the laboratory. Ample opportunity is given for discussion of up-to-date circuits.—Yours faithfully,

J. W. BISPHAM,
Principal.

S.E.1.

"DORKING AND DISTRICT RADIO SOCIETY"

SIR,—I beg to inform you that the above Society has just been formed, and will hold its first meeting on October 6.

Major G. C. Garrick has been elected President of the Society. Readers interested are advised to communicate with the Secretary of the Society at High Street P.O., Dorking.—Yours faithfully,

A. J. CHILD.
Hon. Sec.

Dorking.

Autumn Leaves

Standing at my window the other evening watching a gusty wind whirling the dead leaves round my sundial, I was forced to admit that our short summer was over. All too short it seemed to me; just a few bright days and before we knew where we were autumn had set in with winter unpleasantly close—well, not altogether unpleasantly. I rather look forward to long winter evenings. It's a restful change from being harried by the children to go and play in the garden, as they insist on my doing when it's light till ten.

Fellows Volutone.
£4 : 10 : 0
Fellows Junio".
£1 : 17 : 6

In the winter they seem perfectly satisfied to sit and listen to the perfect tunes of the Volutone giving them Miss Nobody Special's latest bedtime story or the first part of the evening concert. The Volutone also is powerful enough to enable them to talk without disturbing the concert; in fact, it's proved itself a positive blessing, and at a price well in keeping with the Fellows' policy of

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FELLOWS WIRELESS

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Advt. of The Fellows Magneto Co., Ltd., Park Royal, London, N.W.10

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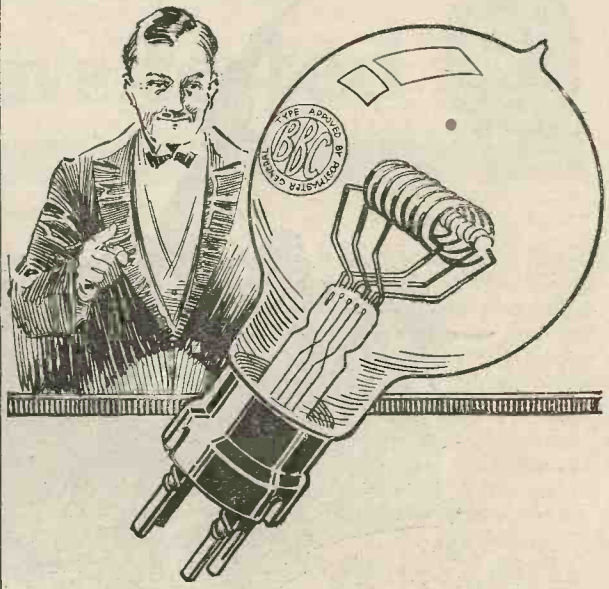

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But more than this amount will be given back to you in twelve weeks by the saving in current! Let us work it out. Using 30 Amp-hour Accumulator and an "R" Valve with average current consumption of .75 Amps, one charge of the Accumulator lasts	33⅓ hrs.
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And the cost is only	2/-
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But using Penton Low Consumption Valve your Accumulator requires charging only twice in twelve weeks at a cost of	4/-
Thus you clearly save the cost of eight charges—a saving of	16/-

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PENTON LOW CONSUMPTION VALVES

Type H.E.4 for 6-volt accumulators. Plate voltage 40. Filament current ·15 amp. Filament volts 5.

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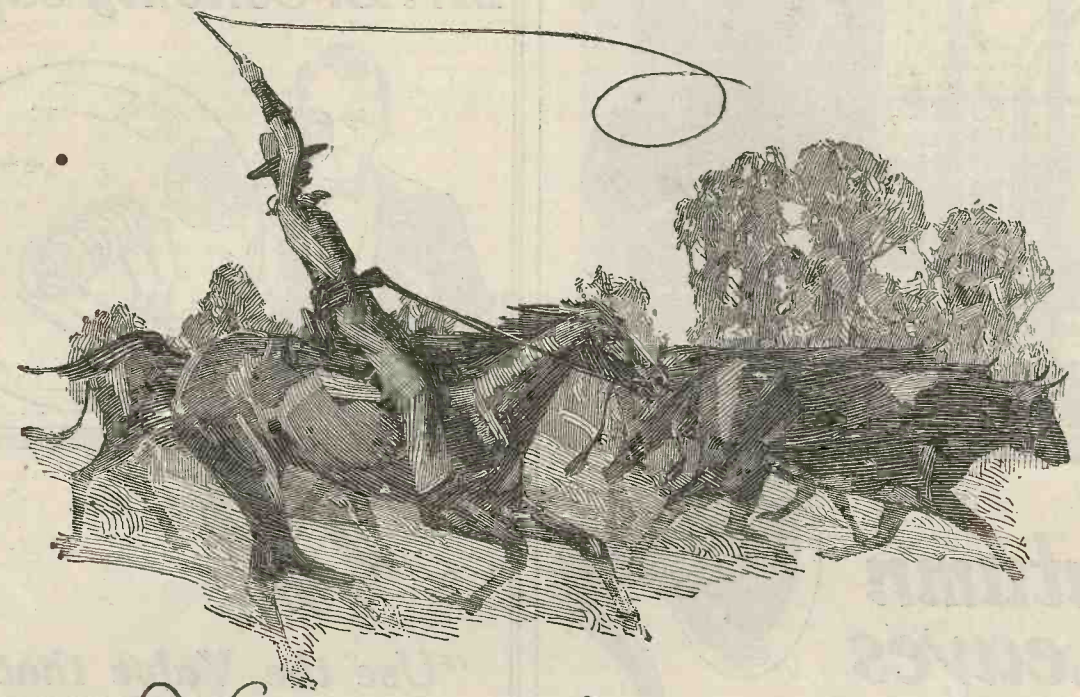

The great "round-up"

NOT only out in the Wild West, but in every home where Cossor Valves are being used, a great "round up" is continually taking place. Instead of cattle, though, electrons are the victims.

In a valve, as doubtless you know, the filament, when heated, gives off an electron stream which flies off to the Grid and the Anode and causes the Valve to function correctly. If the filament is broken or the accumulator (or dry battery) so exhausted that it cannot provide the energy sufficient to light the filament, then practically no electrons are given off and the Valve refuses to operate.

Obviously then, as the electron stream is the critical factor in valve reception, the greater the quantity usefully employed the better the valve.

In the ordinary Valve the filament, running through the centre of the tubular Anode, is exposed at each end and a proportionate amount of the electron stream leaks away without being put to any useful purpose.

But look at the Cossor—see how its arched filament is almost concealed by the hood-shaped Anode. No electrons can escape from here—it is a really effective "round up" of electrons every minute of the time the Valve is in use.

When you buy your next Valve, therefore, see that it is a Cossor: no other valve can give you such a long life, such an immense volume of pure tone, and such all-round-reliability, and it is these sterling qualities which have been responsible for the immense demand for Cossor Valves during the past few months.

PRICES.

BRIGHT EMITTERS.

P1. For Detector and L.F. use ..	12/6
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DULL EMITTERS.

W1. For Detector and L.F. use ...	21/-
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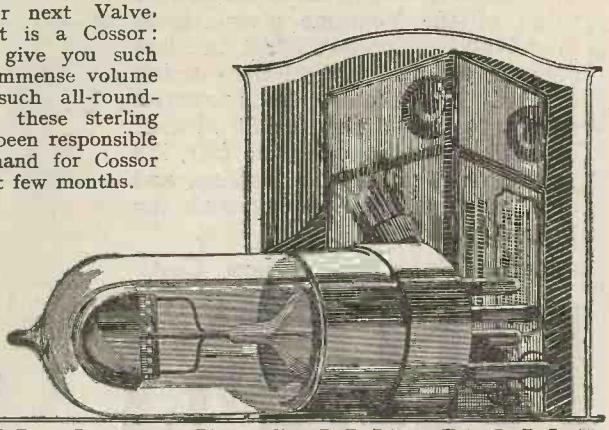

Cossor

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Valves

G.A.1482

It will pay you always to watch WIRELESS WEEKLY *Advertisements.*

Apparatus we have tested

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

Marconi "Ideal" L.F. Transformers: High Ratio

SINCE the publication of our report on the new Marconi "Ideal" L.F. intervalve transformer, low-ratio type, we have been given an opportunity by the makers of putting to a thorough test the two high-ratio types of the same series: the 4 to 1 and the 6 to 1. These are uniform in appearance with the low ratio (2.7 to 1) instrument already reported on, and have the same substantial build and high finish; as with the latter, they are completely enclosed. The makers recommend these high-ratio instruments for use after valves of comparatively low impedance, such as L.S. valves, the primary windings being adjusted for these conditions; though the 4 to 1 ratio one can be used, if desired, after an R type of valve if the maximum practicable build-up (without appreciable distortion due to inadequate primary impedance) be required. Practical test in reception of broadcast telephony, under optimum conditions as to H.T. value and grid bias, with standard R valves and with bright-emitter valves of the L.S. type (small-power valves, *i.e.*) confirmed these recommendations. With an R valve as detector and with the 4 to 1 ratio instrument, followed by a small power-valve with ample H.T. and proper grid-bias in order to avoid valve-distortion, the degree of amplification actually attained compared favourably with that given by any first-class transformer the writer has measured; whilst no noticeable transformer distortion accompanied this great build-up. With the 6 to 1 instrument the effect, though powerful, was rather harsh and unpleasing.

Using these instruments as they were particularly designed to be used, *i.e.*, in a second stage of L.F. amplification and following valves of low impedance, the performance was observed and com-

pared with that of other instruments in a three-valve receiver having a sensitive and selective reaction-circuit with an R valve as detector, followed by the low-ratio Marconi transformer controlling an L.S. valve, a second L.S. valve being coupled up by the second-stage transformer under test. A single 70-foot aerial, 20 feet high, in a fairly good position on high ground (though screened by trees) was used, in Essex, about 35 miles from both 2LO and 5XX.

With the direct London transmission the greatest difficulty was experienced in handling the relatively enormous audio-frequency energy resulting, even with over 200 volts on the plates of both L.S. valves, and grid-bias of over 10 volts: apart from overloading the loud-speaker it was impossible to get the last stage entirely free from the distortion, which results from overrunning the valve characteristic. The noise was, of course, overpowering at close quarters. Since 5XX comes in loudly at that point on a single valve without a tuning inductance, it was not practicable to try the set on this transmission. Every main B.B.C. station (including Aberdeen) came in at good loud-speaker strength, together with several relay stations. The nearer ones were uncomfortably loud in the immediate neighbourhood of the loud-speaker. Turning to the Continental stations, a succession were tuned in after dark on the loud-speaker at good strength, Breslau, for example, being audible at 100 yards (measured) in the open with the loud-speaker turned out of the window, the German announcer being understandable at a distance of many yards. Petit Parisien was particularly noisy, as well as another French-speaking station on just over 460 metres. Finally, after Hamburg had finished heterodyning him, Madrid came in excellently. On the longer waves Eiffel and Königswusterhausen were read comfortably on the loud-speaker, and on the short, Brussels at excellent strength.

On the whole we preferred the 4 to 1 instrument in this position, the tone being just noticeably better and the build-up but little inferior. It is evident that, given the proper equipment to handle the great signal voltages attained with these instruments, really efficient audio-frequency amplification by transformer coupling, without noticeable distortion, is within reach.

Polished Ebonite

From Messrs. Peter Curtis, Ltd., comes a sample of polished ebonite in which there is not the usual treacherous surface which may prove partly conducting. Actual trial confirmed the claim that this ebonite panel can be used without further preparation, preserving the polished surface throughout the constructional work—which, of course, necessitates considerable care in protecting it from accidental damage—and giving a finished panel of good appearance and excellent insulation-resistance. A further polish can be obtained if desired, by buffing after all constructional operations are completed.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

S. G. W. (ROMFORD) asks In the absence of a convenient main water pipe, what alternative earth connection can be used?

(1) An old galvanised iron bath or bucket, perforated with holes, should be buried a foot or two beneath the surface of the soil, underneath the aerial and as close to the "leading-in" point as possible. A stout copper wire should be soldered to the upper edge of the bath or bucket, which should be almost filled with cinders or preferably broken coke. Three or four bucketfuls of water should then be poured in and the earth shovelled back. (2) A corrugated, galvanised iron sheet (as large as is available) should have a stout copper wire soldered to one corner, the plate being buried on its edge until the upper edge is 6 or 8 inches below the surface of the ground. The hole in which it is placed should be about half filled with cinders or broken coke, water should be poured in and the earth replaced and stamped down. (3) If sufficient space is available, two (or more) long lengths of bare copper wire, not necessarily new, may be buried some 6 or 8 inches beneath the surface of the ground, underneath and in line with the aerial wires. The two wires should be brought together where they emerge from the ground (as near to the leading-in point as possible) and may be twisted together to form the earth lead.

J. K. (BELFAST) asks What is a Lightning Arrester?

As applied to wireless, a lightning arrester is essentially a minute gap between the foot of the down-lead and the earth-lead. The theory is that high-tension currents such as those due to lightning discharges, or even the "return currents" from earth due to a nearby cloud inducing a charge in an aerial, will jump across the small gap rather than traverse the highly inductive

winding of the receiving set, which is connected to opposite sides of the gap. The received currents, on the other hand, are too feeble to jump the gap and must of necessity traverse the receiving apparatus.

K. R. (LIVERPOOL) states that he intends to devote himself to Transatlantic reception during the coming winter, and asks What is the best time for attempting long range reception ?

When the area between the transmitting and receiving stations has been in darkness for as long as possible. This usually means, of course, that a short time before sunrise is the most promising hour.

J. C. (LEEDS) asks whether the small dimensions of an Aerial can be compensated by making the down lead and earth connection in the form of a spiral ?

We have heard of quite good results being obtained upon valve receiving apparatus used in conjunction with a portable spiral aerial with the ordinary straight type of down-lead. The aerial in question consisted of about 100 feet of No. 16 S.W.G. phosphor-bronze wire, wound in the form of a spiral about 18 inches in diameter, and was primarily intended for portable work out of doors or for indoor use where an orthodox outdoor aerial could not be erected. In all cases the earth connection should be of stout copper wire and should be as short as possible.

G. F. A. (HORNSEY) asks the following questions :—(1) Whether it would lessen the efficiency of the aerial if a " lead in " was taken from each end as shown in his sketch. (2) With reference to a circuit in " MODERN WIRELESS," whether it makes any difference if the rheostat is connected in the negative filament lead of the positive filament lead.

(1) You should not attempt to attach two receivers to the same aerial. The aerial may be broken in the centre, if desired, by insulators so as to form two separate oscillatory systems, and a " lead in " may then be taken from each end. (2) With reference to the circuit you mention, it does not greatly matter whether the filament resistance is in the negative lead or the positive lead, but the former arrangement is best adopted as a standard.

F. T. Mc.D. (QUEEN VICTORIA ST.) is about to instal a receiver in his house which looks on to an Electric Railway, and his aerial will be upon about the same level as the overhead electric wires, and within 100 yards of the same. He asks whether he is likely to experience much interference.

You should make every effort to erect your aerial at right angles to the power line, otherwise we are afraid you are very likely to get a considerable amount of interference if you are using a valve set, particularly if you use much low-frequency amplification.

Brandes

The Name to Know in Radio

Result of 16 years' experience

What is "Matched Tone"?

What is the particular advantage of the "*Matched Tone*" feature? How can we claim a distinct superiority amongst so many good headphones? Well, the ordinary method of matching the two receivers by ear obviously has its disadvantages, the sense of hearing not being sufficiently developed for detecting dissimilarity in the various tone degrees. Brandes receivers are matched by specially constructed apparatus which has been installed at our Works after long years of experiment. When tested by ear, it is found that sound in one receiver cannot be matched with another by a margin of eighty degrees. By our apparatus we are able to match the corresponding note in each to within five degrees. . . . *Ask your Dealer for Brandes.*

25/-

British Manufacture

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All Brandes products are obtainable from any reputable dealer and carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied.

Matched Tone

TRADE MARK

Radio Headphones

It will pay you always to watch WIRELESS WEEKLY *Advertisements.*

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Their publications constitute the bridge over which the Radio Press have carried half a million readers to wireless success. They have the absolute confidence of the wireless public, and a full appreciation of their responsibility is the secret of the success of this great enterprise.

"I keep six honest serving men
(They taught me all I knew),
Their names are What and Why and When
And How and Where and Who."

KIPLING.

AND Radio Press can offer you, too, some honest serving men who will do their best to teach you some of the principles of Radio. The Library shown below contains some of the most entertaining and instructive Wireless Books ever published.

Whilst it is perfectly true to say that some progress can be made without the aid of books, yet a great deal of wasted labour may be avoided by making use of the experience of such well-known authorities as John Scott-Taggart, F.Inst. P., A.M.I.E.E., Percy W. Harris, G. P. Kendall, B.Sc., and the others whose names are so familiar to regular readers of Radio Press publications.

If you are thinking of building a new Set this Autumn, you cannot do better than invest in one of the many constructional Books or Envelopes available in this series. You will find that every step is explained so clearly that Set building becomes absurdly simple.

On the other hand, you may not be getting the results you should—perhaps you are ignorant of the elementary principles of broadcast reception—then one or two books on the valve will provide you with much useful information, and set you on the road to proficiency.

Examine these Books at your Wireless Dealer's or Bookseller's and commence your Wireless Library now—you will find it a most profitable investment. All Radio Press Books can be supplied direct (postage 2d. per volume or 3d. per envelope extra).

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Wireless Weekly, 6d. Net Wednesday October 8th, 1924

Wireless Weekly

and the Wireless Constructor.

Vol. 4.
No. 23

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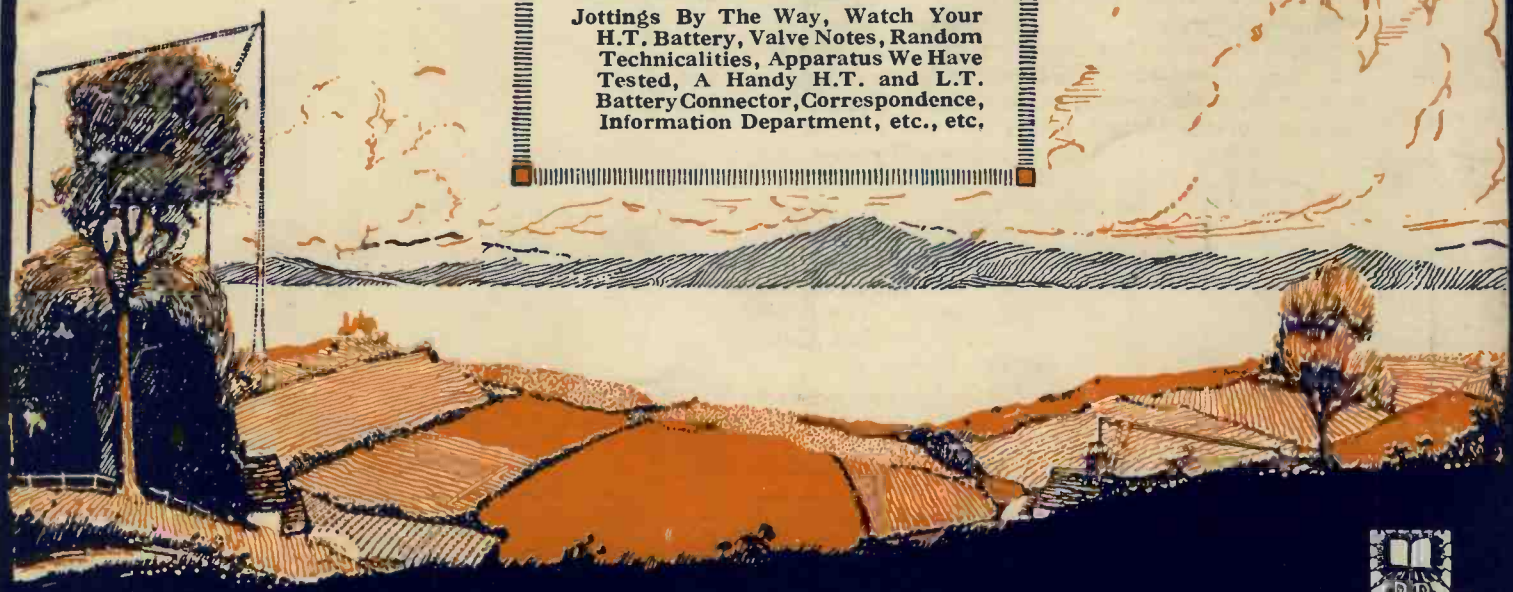

Post Office Hypocrisy

New Burndept Wireless Apparatus with special features.

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THE Anti-Phonic Valve Holder eliminates the microphonic noises associated with dull-emitter valves, and prolongs the life of any type of valve by protecting the filament. It consists of an outer insulated shell, which screws rigidly to a panel, or base, and a valve holder which " floats " on springs inside the shell. There is no capacity between the sockets as there are no nuts on them. The risk of short circuits is eliminated owing to special construction. A special arrangement prevents the straining of the springs when a valve is inserted or withdrawn. The advantages of fitting Anti-Phonic Valve Holders to sets, especially portables, are very obvious.

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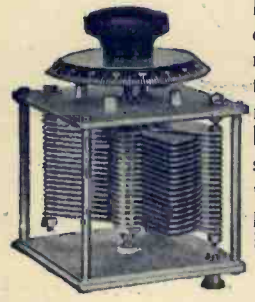

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Post Office Hypocrisy

GENERAL indignation has been aroused by the growing tendency of the Post Office to impose restrictions on wireless transmission, and, although wireless transmitters are only a small section of the experimental movement, yet, nevertheless, they represent an extremely important section, and they will be backed to the full by all who have any interest in experimental progress.

It is with great satisfaction that we notice that the Radio Society is now tackling the problem of Post Office interference. The mutual admiration society, which has hitherto existed between the official amateur association and the Post Office has broken down, and although a prominent official of this Government department admitted to a Press representative that he "greatly admired Dr. Eccles," we are glad our President is getting down to solid facts.

Put bluntly, the British Post Office has consistently placed obstacles in the way of experimental progress, and the Radio Society's protests have been as water on a duck's back.

After the war, the Post Office maintained for an unnecessarily long period onerous restrictions as regards wireless reception. In August, 1922, they strongly opposed any broadcast transmission at all in this country, but after much trouble the Radio Society obtained from them a half-an-hour transmission from Chelmsford each week, by means of continuous waves. **"It is regretted that it has not been found possible to agree to the inclusion of wireless telephony in the arrangement,"** reads a letter dated August 19, 1922. Here was an important radio society humbly requesting some co-operation from the British Post Office, who, however, regret that they cannot even permit a few minutes telephony to be broadcast.

This is a typical example of a consistent Post Office attitude, and it seems positively ludicrous when one considers the extent of broadcasting to-day.

Then, of course, we had the deplorable situation about experimental licences. The writer of this editorial was a member of a small deputation to the Post Office to obtain an alleviation of the harshness with which the Post Office were refusing experimental licences, the only licences at that time which enabled experimental wireless work to be done. To-day, three quarters of a million people are making or using home-made apparatus. *There is no logical reason why licences should not have been issued at that date.*

The only result of this very important conference with the Post Office was that a memorandum was issued afterwards remarking upon the great courtesy of the Post Office officials and their sympathetic attitude. Be it noted, however, that this sympathetic attitude did not result in any extention of licences.

We then had the summer of 1923, which nearly wrecked the wireless industry, and which created more antipathy towards the Post Office than that department has ever experienced. Long delays and the appointment of a committee (whose work was futile, and whose final recommendations were totally ignored) were regarded with grinning complacency by permanent officials of the Post Office, whose callousness in this matter will live long in the memory of every experimenter who wanted a licence and every experimenter who had a licence, but had even the smallest amount of public spirit.

Fortunately for experimenters, powerful manufacturing interests, and a Post Office visit to the U.S.A., obtained for them what the Radio Society had vainly pleaded for.

This recent history shows what attitude the Post Office has taken in the past, and also it shows how absolutely unnecessary the restrictions at the time were. The same niggardly spirit of the Post Office is as manifest to-day as it was in 1922 and 1923.

Let us look at some of the statements of Post Office officials in the past, and we will see how charmingly reasonable they are before meetings of the Radio Society. At the second Annual Conference of Wireless Societies, in 1922, a Post Office official regarded with horror the idea of membership of a Radio Society being necessary before

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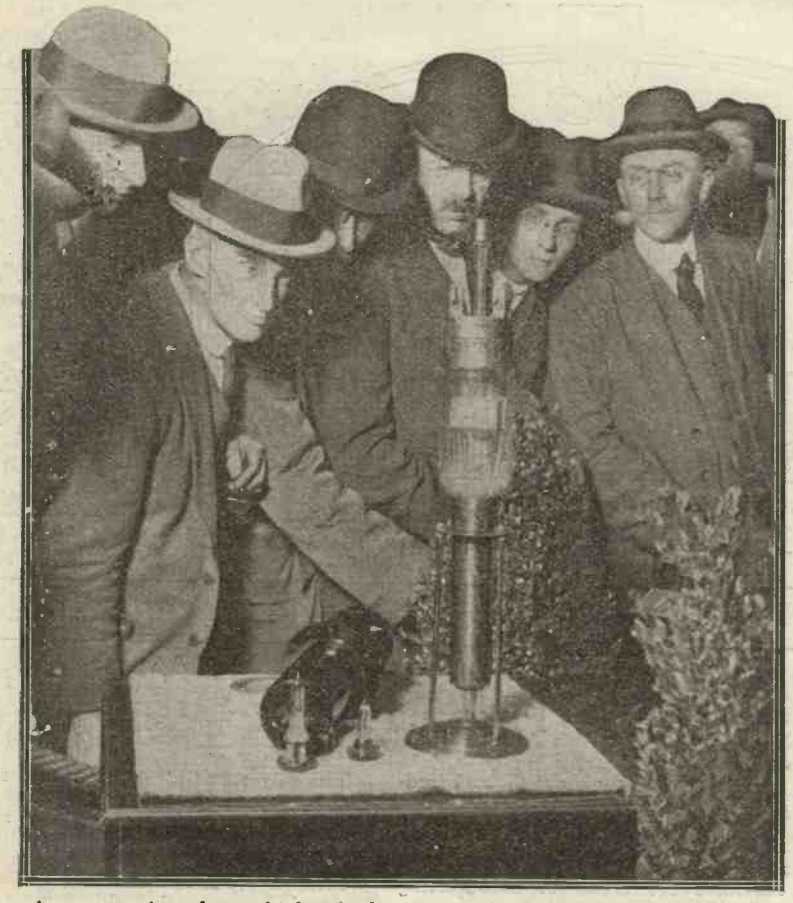
Our Impression of the Exhibition



A contrast in valves which may be seen at the Exhibition, the large one being a ten kw. water-cooled transmitting valve.

THE first impression on entering this year's Wireless Exhibition at the Albert Hall is one of the sanity and commonsense of the whole affair. In previous shows the stands have often alternated between the sublime and the ridiculous—on the one hand we have had monuments of cabinet work of the one or two hundred guinea varieties, watched over by immaculately dressed young men who stand out gracefully against a background of velvet and luxury, while on the next stand one could see mountains of condensers, dials, knobs, and what not. This year there is none of this annoying disproportion. All the stands are of the same size, and the scheme of decoration chaste and effective; the whole industry seems to have "come down to earth," and now caters for the man who is really interested and who does not mind spending a few pounds so long as he gets good value.

The organisers of the Exhibition are certainly to be congratulated upon the artistic layout, although the disposition of the stands in circles makes it difficult to tour the Exhibition as a whole and not miss sections of it.

The Exhibits

The exhibits themselves can, of course, be divided into two main headings of complete sets and components. In the general design of sets there seems to be considerable improvement in the last twelve months, and it is gratifying to see how some of the larger firms have realised that it is not beneath their dignity to make a good set at a reasonable price. Armstrong supersonic heterodyne receivers are beginning to make their appearance, and we particularly noticed those of the Western Electric Co. and General Electric Co. respectively. The Western Electric instrument is very compact, and contains seven valves (all "peanuts"), used successively as first detector, oscillator valve, three stages of intermediate frequency, second detector valve, and one stage of transformer-coupled note-magnification. The set is exceedingly compact, and to obtain this compactness it has been necessary to shield every stage with a metallic casing.

The General Electric Co.'s supersonic heterodyne is rather more conventional in appearance, being made up in a large cabinet with all the valves projecting in front. The British Thomson-Houston Co. also have an instrument which we believe works on the super-heterodyne principle.

Among the "straight circuit" sets an interesting instrument is exhibited by Burndept. In this the aim of the designer is to give a set which is exceedingly simple to work for the man who is just taking up the art, but is so adjustable that later, when he learns more about it, the necessary flexibility is made available. There

A compact 5-valve receiver by Metropolitan-Vickers, Ltd.

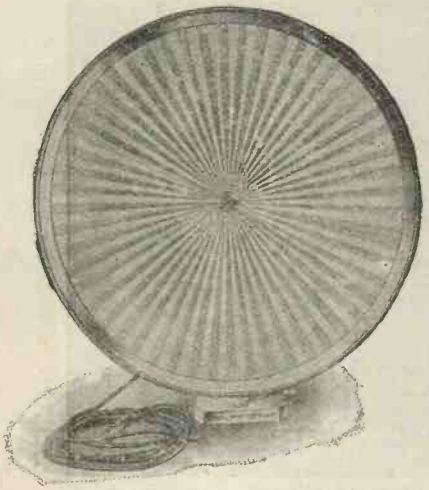
A few notes on this year's Wireless Show

are two stages of tuned high-frequency, stability being obtained by stabilisers working on a novel principle. Range blocks with fixed loose coupling between the aerial and the closed circuit are provided, and a switch enables both high-frequency stages to be cut out, so that all tuning can be conducted on one dial, when the set is near enough to a broadcasting station for good reception to be obtained without high-frequency stages. The more experienced listener can substitute for the range blocks a three-coil holder, thus getting the benefit of variable coupling and reaction as desired. Stages of low-frequency amplification are, of course, provided.

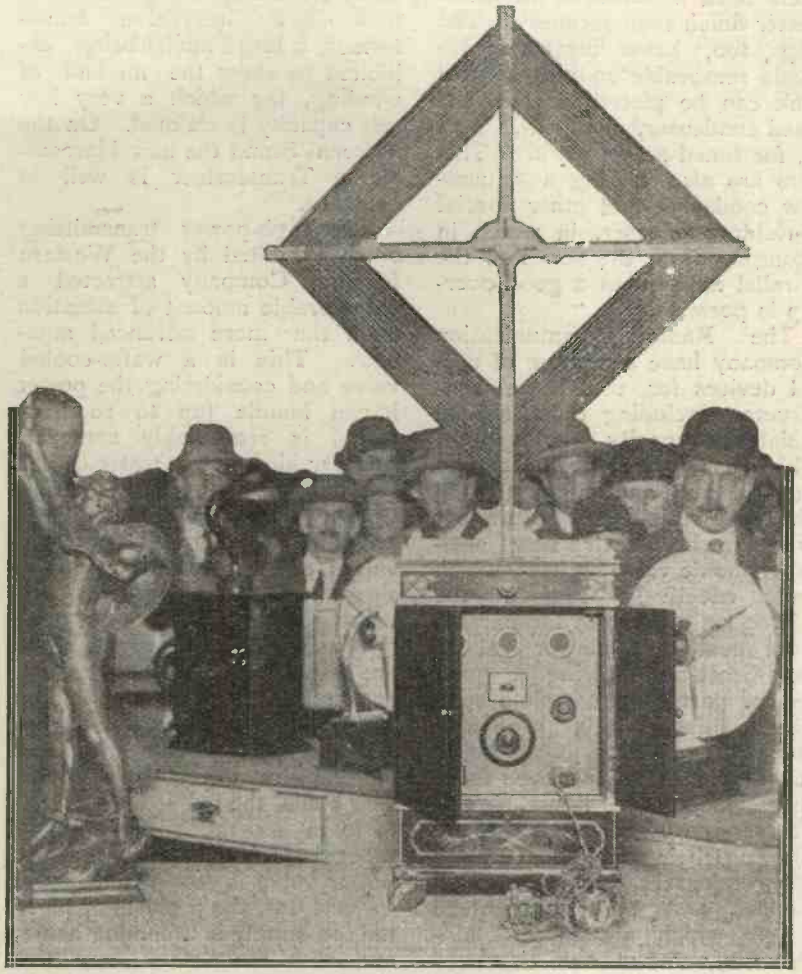
The Sterling people have a good range of receivers, including reflex sets using small frame aerials. Among other reflexes shown are the Marconiphones, the Ediswan TwoVee, certain sets by Metropolitan-Vickers.

Loud Speakers

Loud speakers of all kinds are an outstanding feature of the show. The large Marconi loud speakers, the invention of Capt. Round (used to broadcast to the public in the Hall) are remarkably faithful in their reproduction, and should do much good in removing from the minds of the general public the impression that loud-speaker reproduction is a metallic-sounding and "trumpety" affair. So far as loud speakers for the home are concerned, these exist in great variety, but as they all have to be taken "on trust" (there being no demonstration of any one of them), the public is quite unable to make comparisons of anything but external appearances. So far as the horn varieties are concerned, practically all the manufacturers are adopting about the same shape, the horns being decorated in all kinds of colours, and some with the most bizarre patterns. Because it does not comply with the general uniformity of design, the Sterling Primax loud speaker stands out from the others in great contrast. This loud speaker has a pleated diaphragm over a foot in diameter which distributes the sound without any horn. One of the most beautiful exhibits this year, and certainly the one which has attracted the most attention, is a graceful bronze figure holding aloft a Primax loud speaker, the diaphragm of which has been finished in a bronze colour to match the statue. It is illustrated in one of our pictures.



The Primax Loud-Speaker.



A handsome frame aerial receiver, ornamented with Japanese lacquering, on the Sterling stand.

Great interest is being shown in the various unit systems, although there are no special novelties this year. The Polar Block method, the Cosmos Radiobrix, and one or two others attract most appreciative audiences whenever demonstrations are given. The leading valve manufacturers are, of course, showing their products. In the smaller components Dubilier have several interesting new lines, with new mouldings for

their fixed condensers, of much better finish than formerly. The clips, too, have improved; are made removable so that a grid leak can be placed across the fixed condenser, or in series with it, for tuned anode work. This firm are also making a square-law condenser and other special variable condenser, in which in changing from the series to the parallel adjustment a good overlap is possible.

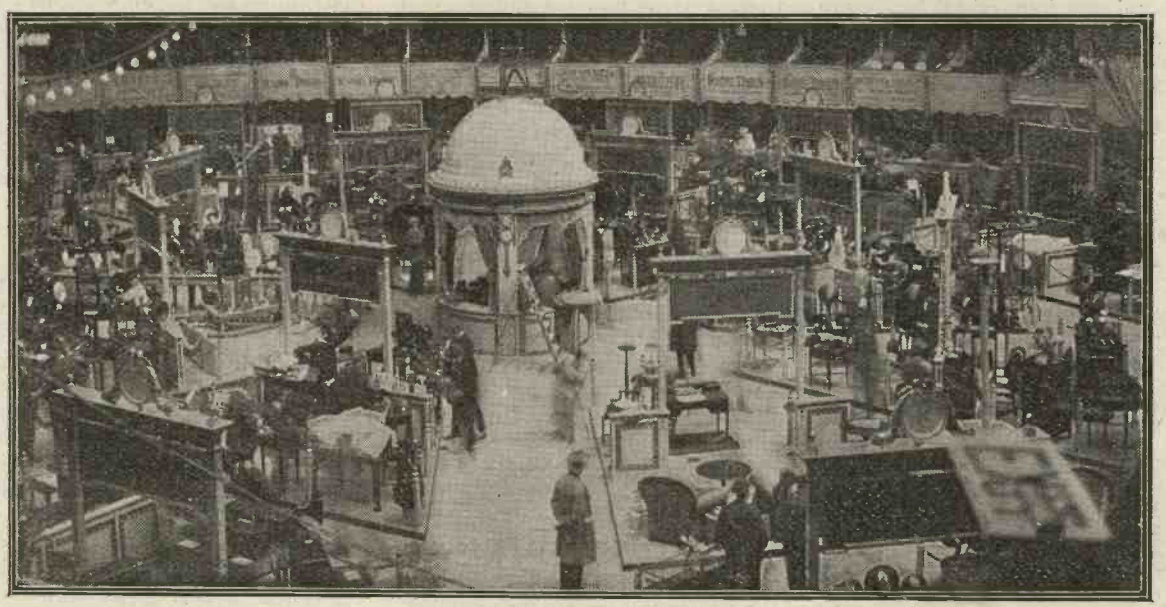
The Radio Communication Company have a number of useful devices for the home constructor, including their special resistance-capacity coupling unit, which has been very carefully thought out, and a new dual filament resistance. Burndept are showing their new anti-microphonic valve sockets, which quite effectively remove the microphonic troubles inseparable from most dull emitter valves. Peto-Scott are showing a good line of parts and complete sets. Their Pilot panels are also attracting attention, these being cut, finished, and engraved for a very moderate figure. The Bowyer-Lowe Company are showing their well-known square law condensers, both single and double, and their guaranteed panels, which are also obtainable cut, polished and engraved for any Radio Press Set. Ready-cut and polished panels are also being exhibited by the British Ebonite Company.

Radio Instruments are, of course, making a big show of their new intervalve transformer, a large model being exhibited to show the method of winding, for which a very low self capacity is claimed. On the Marconi Stand the new Marconiphone Transformer is well in evidence.

The high-power transmitting valve exhibited by the Western Electric Company attracted a considerable amount of attention from the more advanced amateur. This is a water-cooled valve and considering the power it can handle (up to 10 kilowatts) is remarkably compact. Another high-power water-cooled valve is shown by the Marconi-Osram people, while Mullards are also showing high-powered valves of their well-known designs. The Cossor firm are making a big feature of the "Wuncell." Although there are few outstanding novelties in accumulators, the well-known makers of storage batteries are showing their regular lines, and judging by the crowds round their stalls, the public are anxious to learn as much as possible about these devices. Now that the power valve is coming into more general use, the problem of high-tension supply is becoming acute, and with multi-stage amplifiers the drain on an ordinary high-tension battery of the dry-cell type is very serious. High-tension accumulators are now obtainable at the quite reasonable price of one shilling per volt, and whilst this, of course, seems a high first cost (much higher than dry cells), the maintenance cost is extremely low. The man who is now in a habit of purchasing a sixty-volt dry battery every few months should certainly consider whether it is worth his while to pay three or four pounds for one of the equivalent voltage accumulators. If you consider it on a two-years' basis, it will be found in many cases that the high-tension accumulator is cheaper.

Accumulators of low ampere-hour capacity are also being shown for dull emitters. We are glad to see this, as many people have been grossly overloading dry cells for filament lighting, and expecting to get from them far more than they can possibly give. A large number of very useful components, well made, are exhibited by Messrs. McMichael, while the multitudinous uses of "Clix" are being publicly demonstrated.

It is certainly gratifying to note that the industry has settled down on sound lines. Extravagant claims, freak sets, and useless components have disappeared. The public is no longer deluded into buying shoddy sets and components, and good material is now obtainable at quite reasonable prices. Certainly this year's show augurs well for the future of the great new industry.



A general view of the Exhibition. The Radio Press stand may be seen to the left of the centre, at the back.

Snaggsby This Time

IT was Snaggsby, I think, who was the first to suggest that the Little Puddleton wireless club really ought to obtain a transmitting licence, so that its activities might be broadcast to an eagerly-waiting world, not only in cold print, but also through the more romantic medium, the ether. He came to see me about it a day or two before he raised the question in the club-house. As he sat and smoked, he suddenly said, "I have been thinking?" "That is not an original remark, Snaggsby!" I replied, "Poddleby reported recently that exactly the same phenomenon had occurred to him, and certainly the results were little short of disastrous. If I remember aright it resulted in his spoiling two suits of clothes, a carpet, and his wife's temper. I therefore urge you to bear this terrible example in mind and, if necessary, to stifle at birth the results of your mental activity." Snaggsby waved his hand, blew a cloud of smoke, got up, sat down again, made some more smoke, cleared his throat, opened his mouth and shut it again. "Come on," I said, "it is quite obvious that you are oscillating under the impact of brain waves. Is there not an old song which tells of a lady upon whom some terrible disaster had fallen? Did not her old nurse say, 'she must weep or she will die?' I do not want you to weep if you can help it, for this is a new hearth rug; and I would rather that you did not die here, since the maids have strong objections to removing corpses in the morning. Speech, however, is obviously necessary or something untoward will happen. Out with it, my friend, and let me know the worst."

The Great Idea

Thus encouraged, Snaggsby became more communicative. "We must have a transmitting licence," he said. "We," I roared, "*we*? You speak for yourself, my friend. *You* ought to have one, I know, for the howls that you produce frequently make my hair stand on end and are heard as far away as Bilgewater Magna. But I have a perfectly clean sheet. I can stand up before the world and say with my hand upon my heart that I oscillate not, neither do I howl." "I am not talking about you or me, you ass," said Snaggsby, with some heat, "I mean the club. Here we are, quite the most up-to-date and go-ahead club in the country, and all we do is to receive other people's transmissions instead of sending out things ourselves. Now I don't believe there is a member of the club who knows the first thing about transmitting.

A Terrible State

"You must admit that this is a terrible state of affairs amongst really keen wireless people like ourselves." He went on to say that of course none of us wished to brag, but there was no doubt about it that the Little Puddleton Club was by now the best known in the world, and that on every hand people were asking, "Why don't those fellows do something to show us what they are made of?" Only the other day he had overheard a conversation between two residents in Bilgewater Magna, one of whom was telling the other (who cordially agreed) that he did not believe that those Little Puddleton fellows really knew anything about wireless. They just sat at home listening to broadcast programmes on ready-made sets, or went to the club and aired their ignorance for each other's benefit. This kind of thing, Snaggsby insisted, was not to be borne, and I was rather inclined to agree with him, for there is no more patriotic a Little Puddletonian than myself.

The Club Hears the Worst

At the next meeting Snaggsby stammered out his proposal to an electrified meeting, whilst I, who was seconder, made an eloquent little speech which put the whole case in a nutshell. Members were inclined to be a little doubtful at first, and there was a good deal of discussion, but in the end the resolution was carried that a transmitting licence should be applied for instanter. The authorities, I am sorry to say, showed a lamentable lack of appreciation of the services to the great science of wireless rendered in the past by the club.

Red Tape

Instead of sending us by return of post, as we had expected, full permission to transmit as freely as we liked and their official blessing, they merely wrote a cold, formal letter, enclosing a horrible document in which all kinds of questions had to be answered. This was duly completed and despatched. Then we sat down waiting with as much patience as we could summon for our permit. The first one that came was far from satisfactory, for it merely gave us leave to use an artificial aerial. This, as General Blood Thunderby remarked, was nothing more or less than an insult. He volunteered to go at once to London as the club representative and get matters put right without delay. We despatched the General upon his mission with hearts full of hope. By three o'clock that afternoon we received an official telegram: "We

surrender unconditionally ——; for heaven's sake remove your warrior ——." The General was recalled by wire and congratulated heartily, and the licence turned up by the following morning's post. I won't tell you the full story of his onslaught, as recounted by himself, but when I say that he appeared to have opened his mouth and let himself go, you will understand that the officials must have had a pretty hectic time.

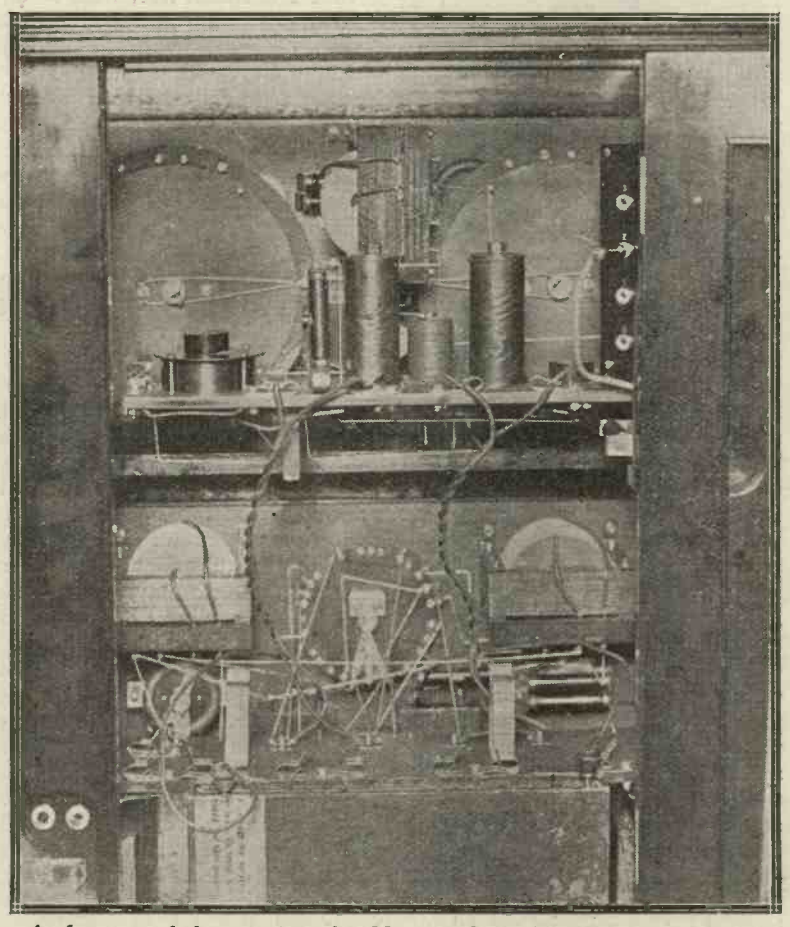
We Begin

Everything being now in order it remained only to erect our transmitter. It was decided to begin in quite a small way, for as Bumpleby Brown said, "It never does to rush things, and we don't want to be accused of swanking." Everybody contributed his mite to the club transmitting set. As I possess no gear of any kind suitable for the important parts of the apparatus, I could do no better than some terminals and a couple of rheostats, all of which were claimed in the most barefaced way by various members of the club as their own property. I did, however, offer, and the offer was accepted with alacrity, to proceed to Bush House to consult Mr. G. P. Bendall, of the Inquiry Department. I presented myself in his sanctum armed with an ample supply of half-crowns. These I placed upon the table in front of me, and he, with one eye upon a stop watch, removed one of them from my side of the table to his with a kind of croupier's rake at frequent intervals. He is really a very charming fellow, but as I had lots of questions to ask, the interview was an expensive one for the club, particularly as he suddenly went off into a discussion on tuning coils, plying his rake with great skill at the end of each ten minutes. At the end of our interesting conversation I was full of information about methods of winding, but remembered when I was outside the door that I had hardly been able to ask a single question on transmission, and that there was not a half-crown left. On my return to the club I was received rather coldly, even though I offered to give the finest lecture that they had ever heard on coil winding. It was seriously proposed by Poddleby that the half-crowns expended should be debited to my account. I am afraid that Mr. Bendall is in for rather a rough time, for next week we are sending up General Blood Thunderby to consult him provided with only two half-crowns. If he does not tell Mr. Bendall a few things about tuning coils I shall be surprised.

Renewed Efforts

Feeling that my reputation had somewhat suffered amongst the members of the club by my visit to Town, I then proposed a scheme, which was agreed to at once. "Mr. Hercy Parris," I said, airily, "is a friend of mine." This is quite true; in fact, I frequently call him Hercy when I think that he is far enough away not to be able to hear. "I will write to my friend, Mr. Hercy Parris, who has just started a transmitting station of his own at Wimbledon. I will propose myself for a week-end with him, and I am quite sure that he will be delighted to have me. During my stay with him I shall pick up lots and lots of tips, and if I am lucky I shall be able to borrow some very useful gadgets." I wrote, therefore, debiting the club the three-halfpence for the stamp, and anxiously awaited the reply. When it came I must say I was rather disappointed, for he said simply, on a postcard, mark you, "Afraid that during next ten week-ends shall be engaged in designing circuits for the following months. May be able to put you up next summer if I can find a vacant week-end. Am insuring all my wireless stock against loss." This was a rebuff, as you will admit, but I am not yet defeated. There are *other* members of the Staff who know something of transmission and have suitable gadgets. Perhaps I shall have better luck with them. Meantime, the club is still getting ready to transmit, and you may expect something rather out of the ordinary when its preparations are completed.

WIRELESS WAYFARER.



A close up of the interior of a Marconiphone four valve receiver embodying the new Marconi transformer.

Those Touching Plates

EVERYONE, I suppose, has had some experience of the troubles caused when the moving plates of a variable condenser touch the fixed at some point when they are rotated. This can be the most annoying of all faults when, as has just happened to me, it occurs in a condenser mounted in a very complicated set which cannot be removed for repairs without unsoldering a good many wires.

Self Oscillation

Touching plates may give rise to a good deal of bother without the cause being suspected. I had an example of this the other day with a set containing two tuned-anode-coupled H.F. stages. It was not working well, and there was a tendency to fall into self-oscillation. Both the anode tuning condensers *appeared* to be up to the mark, for no clicks or other noises were heard when either was rotated. After a long and fruitless search for the trouble I happened to remove the second anode coil and to rotate its condenser whilst it was not there. Terrific noises indicated that at one point the plates were touching.

How a condenser of good quality, which works perfectly before being mounted in the set, can suddenly develop this fault I do not know, but even the best of them are liable to do so at times. The job of setting matters right may be a perfectly easy one, or it may prove to be a long and exasperating business. The way *not* to set about it is to find the point at which touching is taking place and then to give one or more of the moving plates a bend upwards or downwards with the intention of correcting it. To do so merely means that if you cure them of touching at one point you will make them do so at another.

The Moving Plates

See first of all whether the moving plates are firmly locked together on the spindle. One of the commonest causes of misbehaviour on their part is that the nuts securing them have worked loose, allowing them to wobble a little. These nuts can usually be tightened with a spanner without it being necessary to remove the spindle from the body of the condenser. If the moving plates are not loose, turn your attention to the fixed ones. These are usually secured by three long bolts, which also form the frame of the condenser by supporting the top and bottom pieces.

Should it happen that these bolts have been tightened up unevenly, it will be found that the frame has been pulled askew. Owing to the strain the bushes at top and bottom are no longer properly aligned, and the spindle will not be quite at right angles to the fixed plates. Hence the moving plates which it carries will be cocked up a little at one end and will droop slightly at the other. The remedy in this case is to work the nuts upon the supporting bolts one against the other until the moving plates mesh truly with the fixed.

The Fixed Plates

Should the moving plates be quite level, but either too high or too low, the fixed plates should be raised or dropped a little by means of the nuts on the long bolts. This hint applies to most standard condensers; some, however, have an adjustment for regulating the height of the moving plates, which makes matters much easier.

When it is found that "touching" is caused by some of the plates having become bent, it is not, as a rule, worth while to attempt to straighten them. Plates can be bought so cheaply that by far the best way is to purchase a new set.

N. O. P.

Anode Resistances

I HAVE just had a rather curious occurrence in a set fitted with a resistance-coupled note magnifier. This system of coupling is becoming more and more popular for note-magnifiers, owing to its freedom from the usual distortion due to interaction between circuits. As a good many readers probably use sets fitted with it, this type of coupling the occurrence in this particular set may be interesting to them. When first made up it functioned very well indeed, giving good signal strength with an entire absence of distortion.

Reduction in Signal Strength

At the end of about a month the strength had fallen off considerably, the low frequency valves showed occasional signs of oscillation and the original purity of reception was spoilt. At first sight the case was rather a baffling one, for everything appeared to be in order, both with the wiring and with the components. Tests with a milliammeter showed that of the two resistances, each of which was marked 60,000 ohms, one had a value of rather under 10,000, whilst the other was about 15,000. They were not of particularly good quality, and what had happened was that they were not able to stand up for long to the load of the plate circuits.

Warning

Both of them had given way, with the result that the whole equilibrium of the circuits was upset. When you buy anode resistances, either fixed or variable, it pays always to get those that are of well-known and reliable make. Poor ones may fall off considerably when they are in use, and in some cases their value may vary from day to day with changing atmospheric conditions. With these things the set can never be relied upon, for signal strength will not be constant.

M. A. Y.

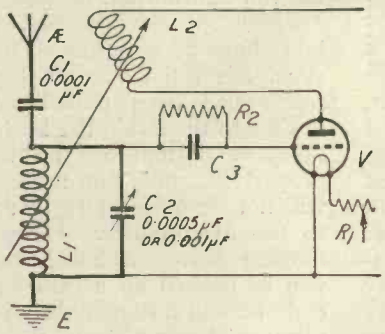


Fig. 1.—A simple aerial tuning circuit using constant aerial tuning.

Combined Series-Parallel Aerial Tuning

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

A FURTHER development can be made of Mr. J. Scott-Taggart's "Constant Aerial Tuning" device, in which (Fig. 1) by the use of a small fixed series aerial condenser a great deal of that uncertainty is eliminated which usually attends the introduction of a new receiver on to an aerial of undetermined character. The effect of this small series condenser is to minimise the active aerial-to-earth capacity, which would otherwise load up the grid-tuning-circuit to an undetermined extent, and may play havoc with the tuning range as determined by the designer or constructor of the particular set on his own aerial.

Series-Parallel Tuning

This development, which has a useful application in certain cases, consists in making variable BOTH the small series condenser in the aerial and also a small parallel tuning condenser arranged as usual across the tuning inductance. With only a small portion of a low-minimum variable series condenser in use, the effective capacity of the aerial is reduced to such a low figure that quite a small parallel tuning condenser will cover a considerable wavelength range, if the tuning inductance has small distributed capacity; at the same time the total tuning capacity can be kept low. In crystal reception, as is shown by actual measurement of resulting signal-strength, the use of a small series condenser with a proportionately larger inductance (an arrangement which is historically derived from a compromise necessitated by the excessive size of ships' aerials when short-wave reception is in question) produces a loss of signal-strength which corresponds closely in magnitude to that produced by a series resistance deliberately introduced into the aerial, of a value equal to the "reactance" (effective H.F. resistance) of that same small condenser to an oscillating current of the same frequency, when inserted in an untuned circuit. But in valve reception it is an entirely different story: the small condenser acts as an efficient capacity coupling, and at the same time minimises both the effects of excessive capacity and of resistance-damping in the aerial. A bigger voltage build-up in the local oscillating circuit (with its comparatively less important damped aerial-branch) is thus possible; and reaction can be applied in a much more refined manner. A marked increase in selectivity necessarily follows, though, of course, it does not become in this respect comparable with the semi-aperiodic types of coupling, or to proper loose-coupling in a two-circuit tuner.

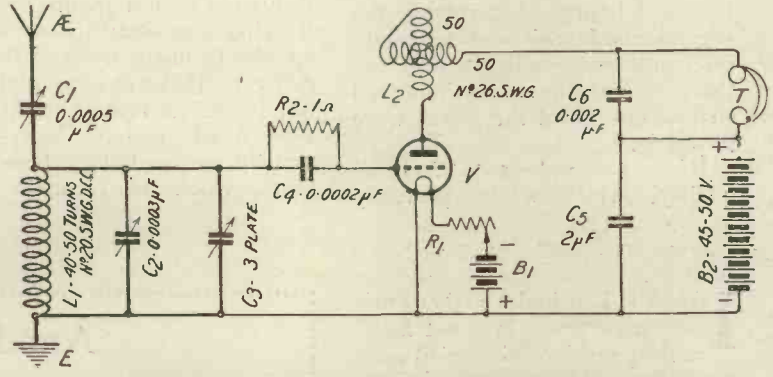


Fig. 2.—A circuit which will tune all short-wave B.B.C. stations on one inductance. The variometer may be loaded with a 0.0003 µF fixed condenser for higher ranges.

Tuning Inductance

If a low-resistance tuning inductance is used in the form of, *e.g.*, a basket-coil on a 1 in. former of No. 20 S.W.G. d.c.c. wire, say, 40 to 75 turns (according to the aerial and range of wavelengths in question), and tuning-condensers of really low minimum capacity, as indicated in Fig. 3, even a three-plate condenser will give enough range to bring in two adjacent B.B.C. stations at a signal-strength and with a delicacy of tuning which will be a revelation to those accustomed to the usual high-resistance tuning inductances with large parallel tuning condenser, and with the whole of the aerial-load in addition. The modest reaction-demands will also surprise many experimenters; a No. 50 coil will generally suffice over the usual broadcast range, and often the ordinary two-coil holder will not allow sufficiently loose coupling of the two coils to avoid oscillation with a valve of good filament emission and high amplification-factor. The loose coupling here also reduces that most annoying feature of the two-coil tuning device, the continual change of the aerial tuning with varying reaction-coupling.

Range Covered

In order to cover a very large range efficiently with a single home-made coil of low H.F. resistance, such as indicated here, one can adopt the highly-developed tuning arrangement

Those readers who are familiar with the advantages of constant aerial tuning will find in the following article much to interest and instruct them.

shown in Fig. 2. By using a rather larger (but low minimum) variable series condenser in the aerial, and a rather larger parallel tuning condenser across the inductance, with a three-plate (or so-called "vernier") condenser in parallel with this, we have the possibility of reducing the total effective tuning capacities to a low figure for the shortest waves (*e.g.*, for Brussels and Sheffield), whilst using a fairly large inductance and thereby obtaining good signal-strength; and for the higher stations, such as Aberdeen and one or two of the German stations, we can use a larger proportion of our aerial capacity (by putting the series condenser at its maximum), together with a reasonable parallel capacity, under conditions where these are less harmful to effective signal-strength. At the same time, with the small three-plate condenser, equipped with a long handle, we have fine tuning available at all times. Exceedingly smooth reaction is obtained over a wide range of wavelengths by means of the electrostatic reaction-coupling produced by a plate-variometer, *not* deliberately magnetically coupled with the A.T.I. in most cases, of about 50 turns each on stator and rotor, and preferably of the internally-wound spherical type.

Actual Results

Actual trial with a similar tuning device on a country aerial of an unassuming type showed that, after dark on a fairly favourable night, it was an easy matter to go the rounds of most, if not every, main B.B.C. stations on the single valve, followed up by Brussels, Petit Parisien, Ecole, Berlin, Breslau, Frankfort, Hamburg (with a ghost of Madrid at the edge of his wave), etc., with a few of the British relay stations thrown in for good measure.

The improvement of signal-strength with these tuning arrangements over that attainable with the customary types of low efficiency is considerably more than that given by existing methods of high-frequency amplification.

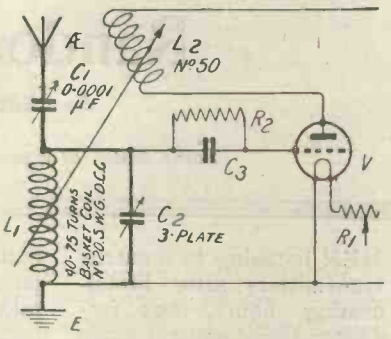


Fig. 3.—A combined series-parallel aerial tuning condenser circuit.

The P. O. and Amateur Transmitters

We reproduce below correspondence which has passed between Mr. Percy W. Harris and the Post Office. Our comments upon the attitude of the Post Office are given in our Editorial.

Experimental Transmitting Licence 2MQ.

SIR,—With reference to the above, I should esteem it a favour if you would kindly grant me a permit to communicate with experimental wireless stations outside this country and on wavelengths shorter than 150 metres, together with an increase of power when required to not more than 25 watts.

The reason for this application is that I am at present engaged on some highly important work for greatly improving the range of transmission with very low powers, and which will, incidentally, have a considerable bearing on the secrecy of communication.

As the experiments will probably form the subject of Letters Patent in the near future, I do not care to indicate in detail what these are, but trust that my standing as an experimenter will prove my *bona fides*.—I remain, your obedient servant,

PERCY W. HARRIS.

Wireless Telegraphy.

SIR,—With reference to your letter of September 12, I am directed by the Postmaster-General to say that the use of power over 10 watts and of wavelengths below 150 metres can only be allowed in cases where special justification is shown, and with the consent of the Government Departments other than the Post Office which are interested in wireless communication.

If, therefore, you will furnish full details of your proposed experiments, stating what wavelengths below 150 metres you require, and indicating clearly why you consider the use of such waves and higher power essential, the matter shall receive attention. Any information which you may furnish on the subject will be treated as confidential.

As regards your application for authority to communicate with foreign stations, I am to say that permits granted for the use of wireless sending apparatus are for experiments in wireless telegraphy between stations in Great Britain and/or Northern Ireland, although this was not expressly stated in the earlier permits issued. Communication with another country is not considered to be necessary under normal conditions, but the Postmaster-General is willing to consider any application for further facilities on receipt of detailed particulars of any experiments with stations abroad and evidence of an arrangement for co-operation by a foreign or colonial experimental station or stations.—I am, sir, your obedient servant,

J. W. WISSENDEN,
for the Secretary.

Random Technicalities.

By PERCY W. HARRIS, Assistant Editor.

Some Notes of interest to the Home Constructor and Experimenter.

WHEN listening to amateur transmitters after broadcasting hours, one frequently hears the statement made that the speaker is getting ½ or ¾ or whatever the fraction may be, of an ampere in the aerial, as if this was an indication of power. Furthermore, it is quite evident that many transmitters are under the impression that amperes in the aerial are all that matters, and that any increase in aerial current is bound to mean an increase in radiation. This fallacy is fostered to a certain extent by the often incorrect reference to a hot-wire ammeter in the aerial circuit, as a "radiation meter."

* * *

In a transmitting aerial our great object is to "get the juice away," not merely to obtain a high current in the aerial wire. It is quite possible to have two aerials, in both of which an ampere of high-frequency current is registered, one radiating excellently to long distances and the other barely getting a mile or two. We should therefore always aim at maximum radiation rather than maximum aerial amperes.

* * *

In a transmitting aerial we have two important factors to be considered—ohmic resistance and what is termed the radiation resistance. Radiation resistance is the convenient, if somewhat loose, term to indicate, in figures to which we are accustomed, the power we can get away. If we state the radiation resistance in so many ohms, this means that the same amount of power is radiated as will be absorbed by a plain resistance of that number of ohms.

* * *

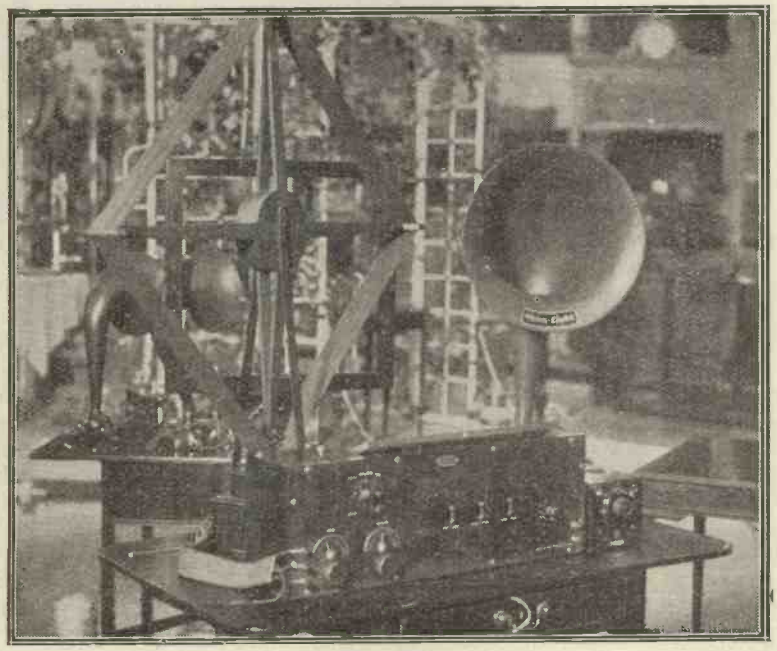
Now, we want ohmic resistance, which is of no value to us, to be as low as possible and our radiation resistance to be as high as possible. If the total high-frequency resistance is, say, 10 ohms, we want the largest possible percentage of this to be taken up by the radiation resistance. It is thus easy to see that two aerials both, say, having a high-frequency resistance of the same figure, one may radiate much better than the other.

* * *

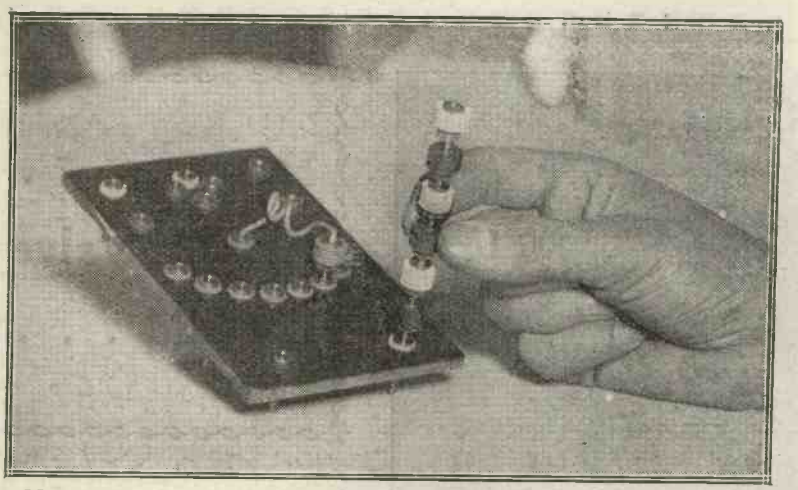
It will now be seen how misleading it is to give the aerial amperes only. Let us suppose that by some alteration of shape or general arrangement we are able to increase our radiation considerably. We will assume for the moment that our previous total high-frequency resistance was 20 ohms, and that the change we have made has increased the radiation resistance by 10 ohms. Our total resistance will now be 30 ohms and aerial current will actually drop; this will be seen from a few simple figures. If we have, say, 10 watts of power dissipating some way or other in the aerial system, and the total resistance is 20 ohms, then, according to the formulæ I^2R, the current will be approximately .7 ampere. Let us now add 10 ohms to the radiation resistance, making a total resistance of 30 ohms, the current necessary to dissipate 10 watts will be approximately .57 ampere.

* * *

And then there is a matter of counterpoising; I am not concerned at the moment with whether a counterpoise is a better arrangement than a direct earth. I merely take this opportunity to point out that erecting a counterpoise, say, 10 feet above the earth reduces the effective height of the aerial by that much, and from an increase in capacity can easily increase the aerial amperes without any improvement in radiation. Alternately, a man may be disappointed after erecting a counterpoise to find that his aerial amperes do not go up, whereas he actually may be radiating far more than previously.



A Western Electric Super Heterodyne Receiver employing seven Weco valves.



Many examples of what can be done with Clix plugs may be seen at the Exhibition.

Turning to receiving affairs, I recently came across a case which is well worth mentioning in these columns, as there may be others suffering in the same way. A friend of mine moved from one locality to another, and was greatly disappointed at the very poor signals he then obtained on his crystal set, compared with those he had previously received in the other district. Incidentally, the distance from the broadcasting station was not appreciably greater, and the new aerial was somewhat higher and generally looked better than the old one. I went down to the house to find out what was the matter, and could find nothing wrong with the aerial, the earth, or the receiving set. By the process of elimination I came down to the head-'phones, which, on being taken back to my own house to be repaired, proved to be very insensitive, although when purchased a year or more ago, they were practically as good as any on the market. Of course, substitution of new 'phones put everything right.

* * *

Now, when using a crystal set, telephones do not lose their sensitivity in the way which is possible with a valve set, for in the case of the latter, if the telephones are connected in the circuit the wrong way round, the steady anode current may tend to de-magnetise the 'phones and to reduce their sensitivity that way. In a crystal set, of course, there is no steady current flowing, and it does not matter which way round they are connected. What had actually happened in this case was that the telephones had been dropped on the floor a number of times, and each of the jars had knocked a little of the magnetism out of the magnet. A sharp bang or jar is very bad indeed for telephones, and it is always wise to have a hook handy on which the 'phones can be hung immediately after use. If they are left lying on the table it is as like as not that a member of the family will occasionally catch his or her foot in the cords, and drag them to the ground.

* * *

Congratulations to the Dubilier Company for at last bringing out a condenser with clips so that the grid leak can be placed across the condenser or in a position necessary for a tuned anode circuit. This little arrangement is long overdue, and I hope will be adopted by all other manufacturers as soon as possible.

□ □ □

Some Simple Questions Answered

Can a growing tree be used as Aerial ?

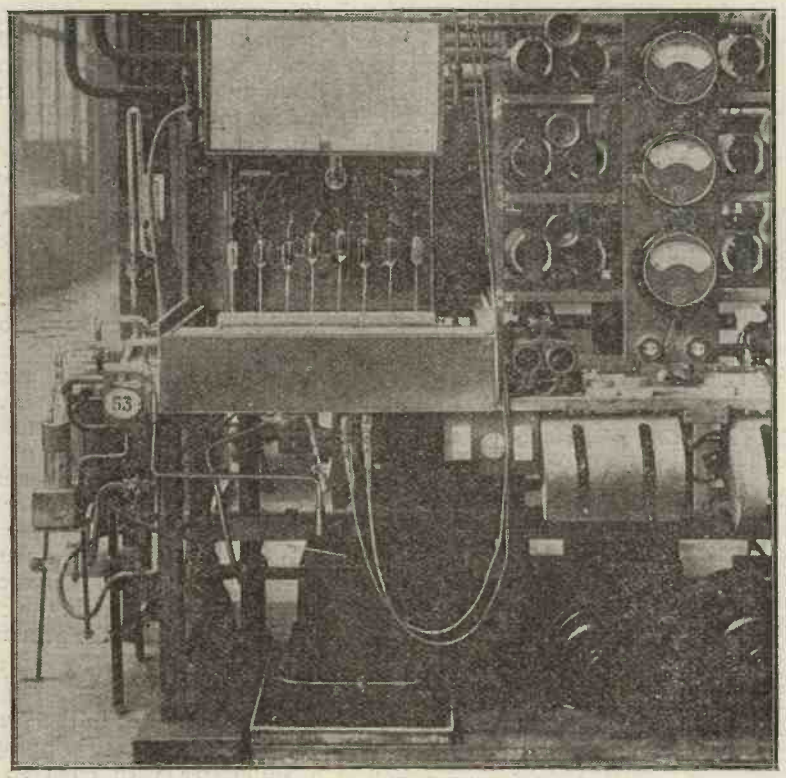
Some experiments have been carried out in which a tree was used as an aerial. The method consisted in driving a nail into the tree some 8 or 10 feet above the ground and connecting the nail to the aerial terminal of the receiving set in the usual way. An earth connection was obtained either by driving a steel peg into the moist soil or by the use of earth mats. Valve receiving sets were used, and the results obtained varied considerably, it being suggested that the connecting wire between the aerial terminal and the nail in the tree probably acted as a fairly effective aerial. There is no doubt scope for some interesting summer-time experiments in this connection.

What methods of winding are adopted to reduce the internal capacity of multi-layer Coils ?

When winding a multi-layer coil the points to be borne in mind are these :—Firstly, the turns must be separated from one another electrically by only a small difference of potential. The first object is achieved by adopting that method of winding which produces a cellular formation such as the honeycomb coil, or by spacing the layers from one another by either artificial separators, or a special spacing turn of wire. An example of this latter type of coil is the lattice. Electrical differences of potential between adjacent turns will be reduced by so winding the coil that turns which lie fairly close to each other are only separated in the electrical sense by a small number of convolutions. Thus, turn 1 may lie close to turn 3, but turn 1 and turn 20 must be well separated.

Can accumulators be used to supply the H.T. current for valves ?

Yes, batteries containing a large number of small accumulator cells are used to a limited extent. They are somewhat expensive, however, and require a good deal of attention to keep them in good order.



Pump tables with eddy current heating equipment for fine filament valves.

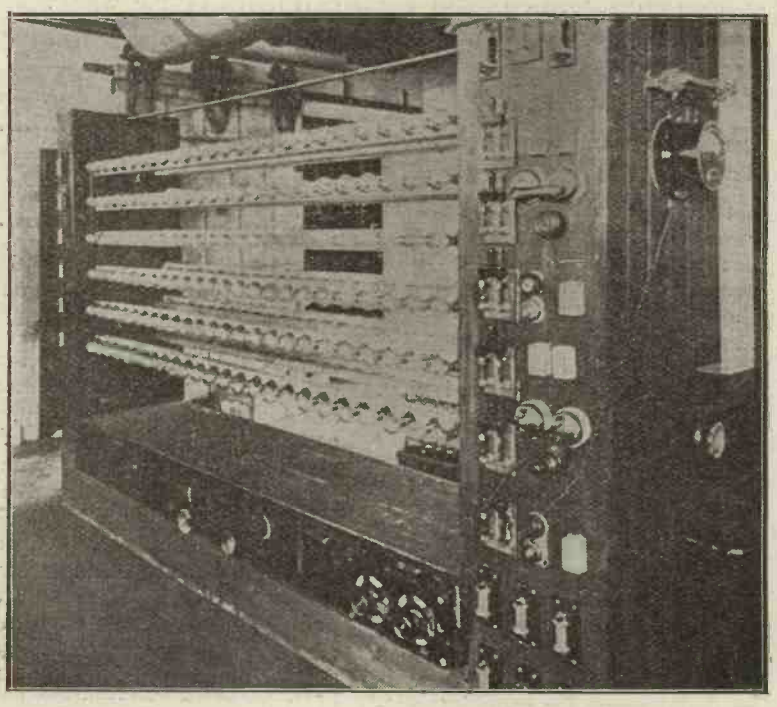
How a . . . Modern Valve is made . . .

IT is an unusual thing in this specialised century to find a factory turning out so highly-developed a product as the modern valve, which yet begins its series of processes with the extraction of one of its raw materials from the crude ore. That, however, is what is done at the M.O. Valve Company's works at Brook Green, Hammersmith, and the first thing which the visitor is shown is the plant for the preparation of pure tungsten. The ore employed is an Australian one, which consists in the main of a compound of tungsten and calcium, and a simple process of extraction with hydrochloric acid and ammonia, and finally re-precipitation with acid yields pure tungstic oxide. The requisite percentage of thoria is then added, after drying and grinding to a fine powder, and the mixed oxides are reduced to the metallic state by heating in an atmosphere of hydrogen.

Powder Filaments

The result is a grey powder which presents something of a problem, since it must be reduced to a coherent metallic mass before wire-drawing can begin, and the obvious process of fusion is undesirable.

The procedure adopted at the Brook Green works is therefore of necessity somewhat elaborate, although to the spectator it seems wonderful how soon the apparently uncontrollable grey powder becomes a stiff rod capable of undergoing quite severe mechanical treatment. The first step is compression in a hydraulic press, which produces a square bar something like a foot in length and a quarter of an inch square, possessing a fair degree of cohesion. This bar is next gripped by its ends, and a very heavy current is passed through



Ageing rack for receiving valves.

A brief sketch based upon a visit to the M.O. Valve Co.'s Works.

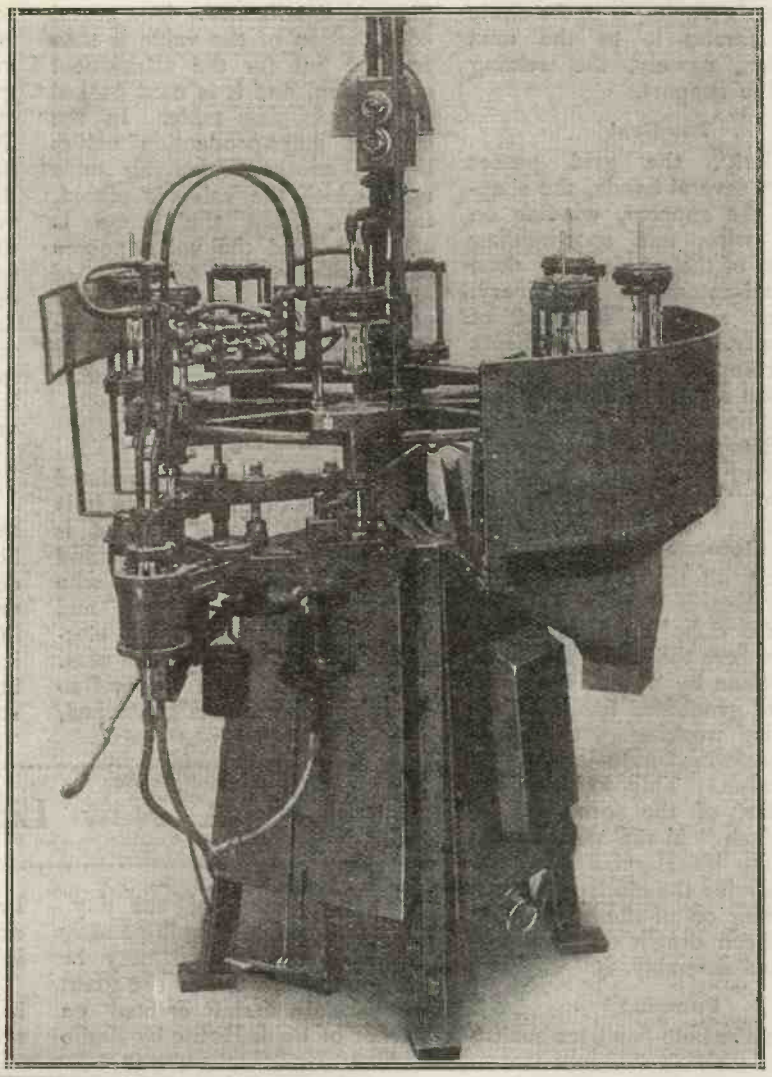
it, thereby welding its particles together.

Drawing the Filament

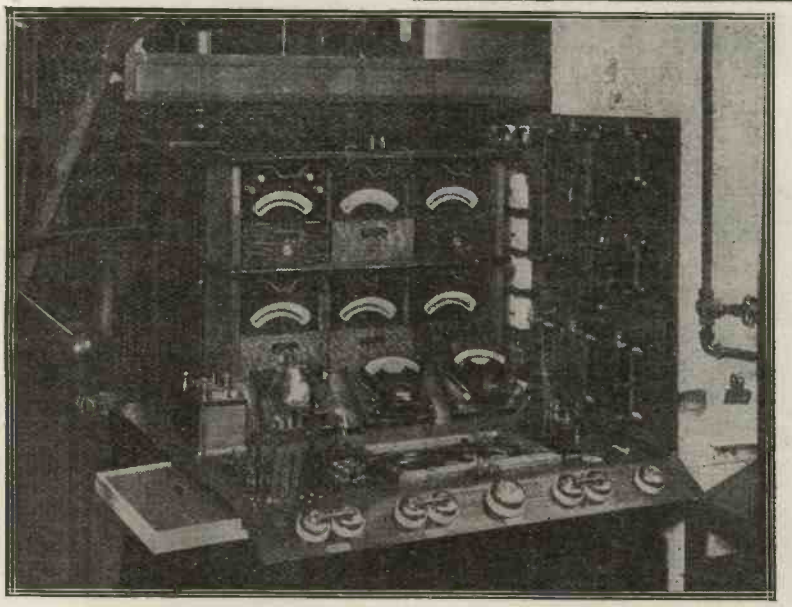
The solidified bar is then transferred to a series of small furnaces in which it is strongly heated, and at the same time subjected to the action of high-speed automatic hammers. Its successive passages through these furnaces produce a gradual elongation, until finally the rod is sufficiently reduced to be passed to the ordinary wire-drawing machinery, where repeated journeys through diamond dies bring it down at last to the thinness of a hair.

The Ore

Of the more important materials used in a valve the tungsten wire for the filament alone is prepared from the ore



A "sealing-in" machine for small valves.



Test table at the Marconi Osram works.

at the M.O. works, and in the factories carrying on the mass production of the various broadcasting valves the complete life-history of a valve can be followed from the punching out of the electrodes from sheet metal to the exit of the finished valve to the packing department.

Speciality Workers

Every stage is carried out by a worker who specialises in that one operation, and the result is, naturally, very high speed and great uniformity in the final product. Thus, one operator may work the machine which stamps out the anode from sheet metal. The anode is then passed down a little shute to the next

worker, who shapes it and electrically welds its edges together, afterwards placing it in the shute which carries it to the next operation, namely, the welding on of the support.

The Grid

Similarly, the grid passes through several hands, the shaping of the support, winding on of the wire, and spot-welding together of the whole being done by semi-automatic machinery, ensuring a high standard of uniformity. The three elements being complete, they are assembled upon a form of template and the next operation is the insertion of the filament (again welded into place) and sealing of the whole into the "pinch" of the glass stem.

Revolving Tables

Almost all the operations involving the treatment of the glass parts are done upon revolving tables, where the necessary heating is done by a series of gas flames of graduated temperature, the actual working of the glass being performed automatically in most cases. This is true, in particular, of the formation of the "pinch" in the stem of the valve (the inner glass structure which carries the electrodes) and the sealing on of the bulb when it has been drawn on over the completed assembly.

Pumping

When the bulb has been sealed on it is pierced at the top and the glass tube by which it is to be pumped is attached. The actual construction of the valve is then finished but for the attachment of the cap, and it is next passed to the pumping table. In the case of mass-production valves this is another revolving table upon which the valve is placed, the lead from the pump is attached, and the valve passes round slowly, the operation of pumping being accompanied by heating by means of gas flames to ensure the removal of "occluded" gases in the metal parts of the valve itself.

Sealing Off

When the valve has completed a revolution of the machine it is automatically sealed off and is then removed from the table and passed to the next workers, who cement the cap in place and solder the wires from the electrodes on to the appropriate pins.

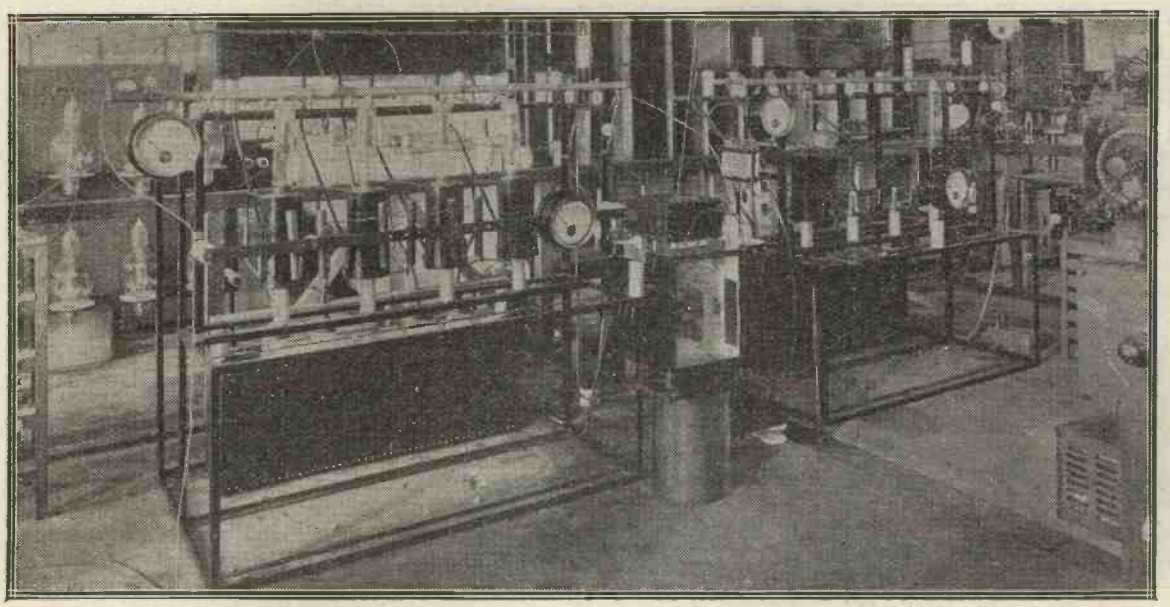
The valve is then finished so far as construction is concerned, and it is placed upon the ageing table, which is again of the revolving type. Here the filament is lighted and a high-plate voltage is applied, and the valve gradually heats up. When a certain temperature is reached a little piece of magnesium which had been attached to the anode during an earlier process is volatilised and the bulb suddenly fills with a brilliant blue glow, which persists for perhaps twenty or thirty seconds. Almost as suddenly as it appeared it vanishes again, leaving the familiar mirror on the glass, and having finally "cleaned up" the vacuum.

Testing

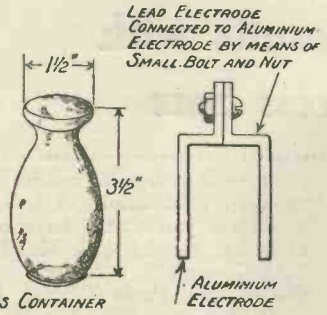
Upon leaving the ageing table the valve passes to the test bench, where it must conform to definite standards of hardness, emission, etc., and then, assuming that it has passed the tests, it goes off to be labelled and boxed and finally is placed into stock.

A New Landmark

EVERY hour of the day hundreds of people passing along the Strand may be seen gazing upward at the great new wireless aerial erected on the roof of Bush House by Radio Press, Ltd., for their head office experimental work. The aerial is of the cage type, high above every other building in London, completely free from screening effects.



Water-cooled valves in use at the high-power broadcasting station at Chelmsford (5XX).



Figs. 1 and 2.—Illustrating the jar and method of connecting the electrodes.

High-Tension Supply from A.C. Mains for Small-Power Transmitters and Radio Receiving Sets

By E. A. POLLARD (5HQ).

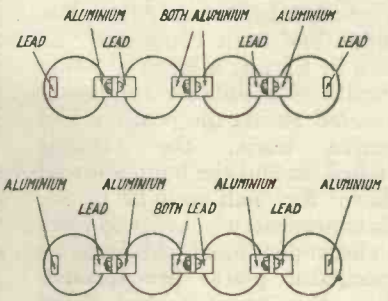


Fig. 3.—The complete rectifier with electrodes in position.

HAVING been troubled with the constant unreliability of the ordinary dry cell H.T. battery, the writer decided to try and obtain suitable current from the 220-volt 50-cycle A.C. mains.

Many methods of chemical rectification were tried with various salts in solution as the electrolyte, but it was not until after considerable experimenting that success was obtainable by using chemical rectifiers. The rectifier about to be described has been in use some considerable time as a means of supplying the anode current to a small power transmitter, but it was not until several weeks ago that experiments were commenced with a view to supplying the receiving set from the same source. First attempts were unsuccessful, as the hum arising from the A.C. 50 period supply spoilt all chances of good reception. Several modifications were then introduced, and now reception is as good, if not better, than using the ordinary dry cell H.T. battery. The experiments were carried out on a three-valve receiver, comprising one high frequency, one detector, and one low-frequency valve.

Constructional Details

The construction of the rectifier is as follows, and it can be made by any amateur without workshop facilities. The total cost of the apparatus need not exceed fifteen to twenty shillings.

The parts required are :—

One 4μF condenser, two 2μF condensers, and four 500-ohm chokes.

These parts may be obtained at a trifling cost from the many firms who specialise in ex-Government wireless apparatus. The remaining parts may be got from any reliable chemist, and will be dealt with in detail as required.

If the amateur has access to 220-volt mains, eight rectifier cells will be necessary, and in the case of 100 to 150 volts A.C. four cells will be required. The containers for the cells may be small boiling tubes, obtainable from any chemist, or the small glass jars in which a well-known food commodity is sold. These jars are some 3½ in. high by 1½ in. diameter, and serve the purpose admirably. The type of jar is shown in Fig. 1. Next procure some No. 16-gauge aluminium wire or sheet, care being taken to have only the best quality (pure), and either some 16-gauge lead wire or lead sheet, as the case may be.

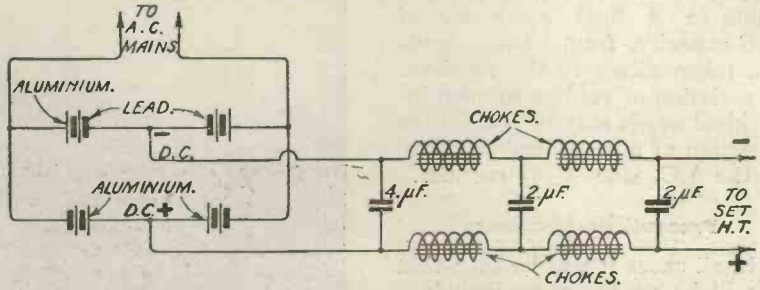


Fig. 4.—The complete arrangement of rectifier and smoothing circuit is shown here.

Chemical Purity

Care should be exercised in the purchase of the articles to see that both the lead and aluminium are of the chemically pure variety.

In the case of wire not being obtainable, the aluminium sheet and lead sheet is cut into strips ¼ in. wide by 4 in. long. These are bent to the shape shown in Fig. 2, and one strip of lead is joined to one strip of aluminium, as shown. The strips are next placed in the glass containers in the order shown in Fig. 3. These strips should not reach to the bottom of the jar, but should terminate some ½ in. from the bottom. This is to allow any sediment which may form to drop clear of the electrodes, so as not to interfere with the rectification.

The glass jars are then filled to within ⅜ of the top with the electrolyte. This electrolyte is composed of a saturated solution of ammonium molybdate (pure) chemical formula $(NH_4)_2MO_4$. The writer, as mentioned before, has tried various salts in solution, such as borax, ammonium phosphate, both pure and commercial, but in no case were the results as good as when ammonium molybdate was used. The saturated solution is got by dissolving 3 oz. of ammonium molybdate in 1¾ pints of water. Care should be exercised in using only distilled water in the preparation of this, as ordinary tap water contains impurities which may possibly affect the efficiency of the rectifier. The saturated solution is then poured into the glass containers to within ½ in. of the top. A good plan is to fill the remainder of the glass con-

tainer with some high-grade insulating oil, or ordinary paraffin is a good substitute. After the rectifier has been completed, as shown in Fig. 3, a lamp of some 50 watts of a suitable voltage is connected across the positive and negative leads, the current switched on and the lamp allowed to burn for half-an-hour or so. This is necessary in order to form the electrodes, much the same as accumulator plates are formed. When the rectifier has been formed the lamp is taken out of circuit and the rectifier is ready for use. The direct current, which can now be drawn from the rectifier, is of a pulsating nature, and is as yet unsuitable for use with the receiver circuit.

The Filter Circuit

The pulsations, which are of the frequency of the A.C. supply, are now passed through a filter or smoothing circuit, whence leads are taken to the receiving set. This filter or smoothing circuit is shown in Fig. 4. The positive and negative leads from the rectifier are led to a condenser of 4μF, thence from the condenser through two chokes of 500 ohms each to another condenser of 2μF, then from this condenser through two more chokes of 500 ohms to a final condenser of 2μF capacity, from whence leads are taken direct to the receiver. A variation of voltage to meet individual needs may be got by the insertion of a resistance or choke in the A.C. side of the rectifier.

Precautions Necessary

In all cases it will be seen that it will be necessary to include a large condenser of 0.002 μF in the earth lead of the set, otherwise a direct short will take place.

In conclusion, the author places the ultimate success of this method of obtaining H.T. from A.C. mains on the using of nothing but pure raw materials, and too much stress cannot be given to this point. The diagrams are self-explanatory, and the amateur should have no difficulty whatever in constructing a high-efficiency rectifier.

Further, this rectifier will deal with a current of some 30 milliamps without excessive heating, thus making it quite suitable for low power transmission.

Readers' Results with Radio Press Sets

SIR,—I have much pleasure in informing you of the success I have obtained with the "Simplicity" set. Signal strength is most astounding, and am compelled to say it is all you (or rather more) claim it to be. When Cardiff is broadcasting, which is 20 miles distant, signals are heard at great strength through the whole of the house when half-a-dozen pairs of headphones are attached to the set. When Cardiff closes down all other stations are easily got at enormous strength on an outside double aerial 38 ft. high. Its construction is very easy, having had no difficulty whatever.—Yours faithfully,

EMLYN JAMES.

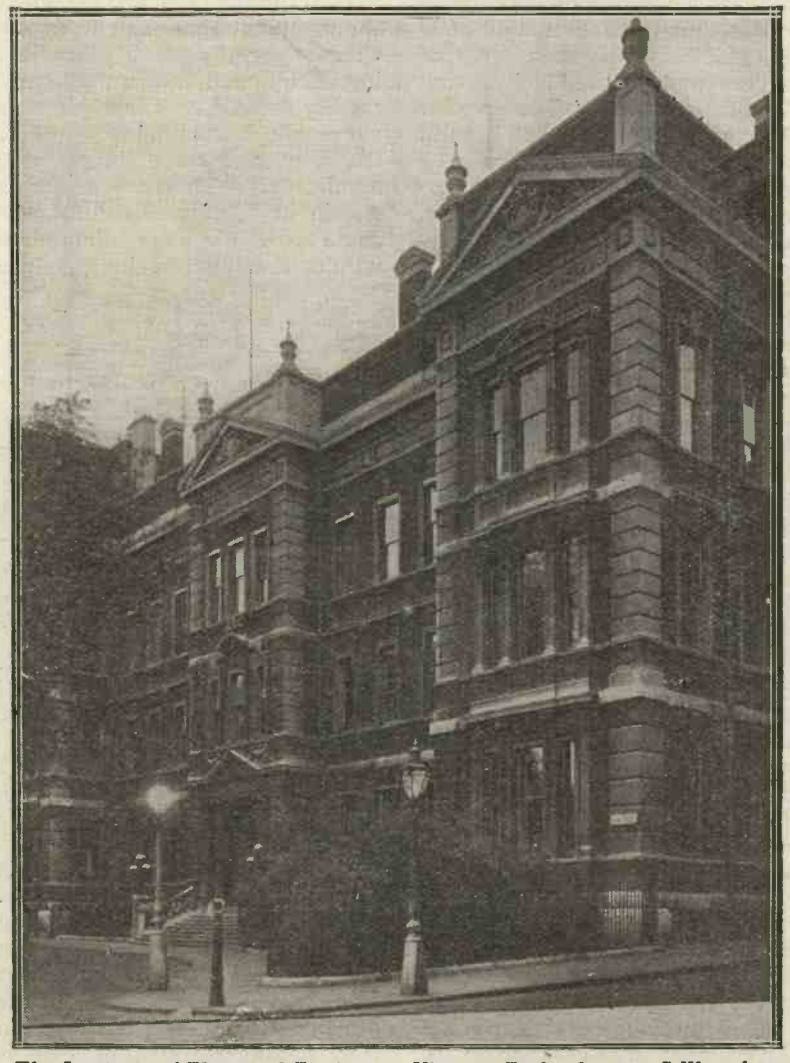
Glamorganshire.

SIR,—As a regular reader of your excellent publications, I feel obliged to inform you that I have obtained first-class results with Mr. Harris's "All-Concert" receiver. I hear Chelmsford, Paris (Clichy), Königswusterhausen, Zürich, etc., clear and without distortion on two or three headphones.

I followed entirely the instructions in Mr. Harris's book, "Twelve Tested Wireless Sets," and used Weco valves, all other parts are from the Vereinigte Telefon and Telegrafenfabriks A.G., Czeija-Visel & Co. My aerial is 30 metres long.—Yours faithfully,

FRITZ MENNY.

Vienna.



The Institute of Electrical Engineers, Victoria Embankment, S.W., where the meetings of the Radio Society of Great Britain are usually held.

Watch Your H.T. Battery

MUCH of the noisiness in their sets of which so many amateurs complain is caused by overloading the high-tension battery. The average high-tension battery is made up of very small cells similar to those used in pocket flash-lamp refills. It is doubtful whether any battery whose cells are this size is capable of an output for any length of time of more than three or four milliamperes without becoming partially polarised and therefore uneven in its output. Five milliamperes should certainly be the outside limit of the current taken from it. Those who do not possess milliammeters do not always realise what a great strain they may be putting upon their high-tension batteries. With ordinary bright emitter valves the plate current, if the filament voltage is not excessive, will average about 1.5 milliamperes per valve. This means that a three-valve set is the biggest that can be worked satisfactorily from a high-tension battery of ordinary size. A five-valve set using ordinary valves may make a steady drain of as much as 7.5 milliamperes, and if a power valve is substituted for an ordinary one, as a note magnifier, the current may rise to 12 or 15 milliamperes, which is quite sufficient to make a small battery noisy in a very short time.

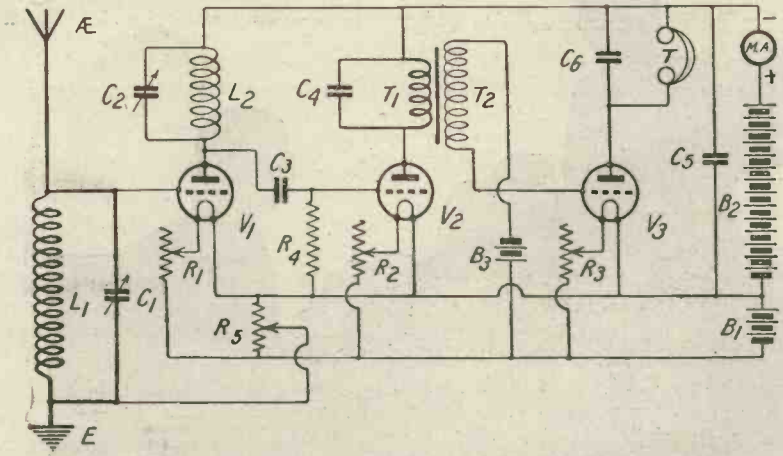


Fig. 1.—Indicating position of milliammeter when using a common H.T. voltage for all valves.

The power valve is becoming increasingly popular for note magnification, and with good reason. Its long, straight curve, low grid current, and small plate filament impedance enable it to give much purer amplification than the ordinary valve, and greater volume of sound in the loud-speaker. But these valves are specially designed to pass a large plate current, and if one is fitted to a set which is worked from a small H.T. battery, the gain in purity will be more than offset by the very great increase in parasitic noises.

Another cause of overloading the high-tension battery is to be found in using dull emitter valves with their filaments working too brightly. Some of these valves are a little on the soft side, and if the filament voltage is at all excessive their plate current may rise to quite an amazing magnitude. The writer was trying the other day an American UV 199, which was the first of the " .06 " valves to be designed. With the filament working at 3 volts the steady plate current with the grid at zero was one milliampere. Raising the filament voltage to 3.5 increased the plate current to nearly 2 milliamperes, and there was a much bigger jump when the filament was put up to 4 volts.

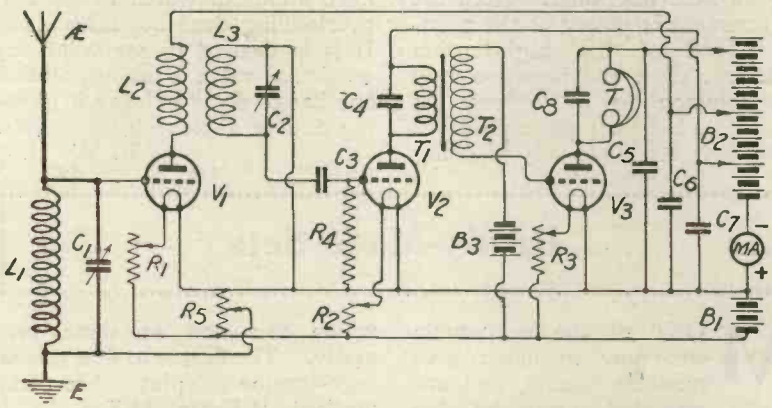


Fig. 2.—Showing position in which milliammeter should be used when employing three separate H.T. tappings.

During these tests the plate voltage used was 40. Any increase in this voltage resulted in an increase of plate current. With 4 volts on the filament and 80 on the plate the current in the anode circuit approached 7 milliamperes. With British-made dull emitters of the same type the anode current was not quite so heavy as this, but at the same time it increased to high values when either the plate or filament voltage were made excessive. The very greatest care should therefore be taken not to overload the filaments of dull emitters, for quite apart from its effect upon the life of the valve, to do so, may easily ruin the high-tension battery in a comparatively short time.

The milliammeter is by far the most useful instrument that any wireless man may possess. It is unfortunately rather expensive, for it is a delicate instrument and must be very accurately made. Still, they can be obtained sometimes second-hand or from shops which deal in Army surplus goods. Fig. 1 shows the best way of using the milliammeter when the same high-tension voltage is employed for all valves. It is wired permanently into the high-tension *plus* lead. It may be mounted in the cabinet of the

set or fixed to the table, the lead attached to the high-tension positive wander plug being connected to its plus terminal. In Fig. 2 is seen the position of the milliammeter in a set whose high-tension battery has three separate tappings in order to allow the correct anode potential to be given to valves working on the high-frequency side, as rectifier or as note magnifier. Here the instrument is placed at the negative end of the high-tension battery, since the negative lead is common to all valves, no matter what their plate potential may be. A simple way of doing this, whether the milliammeter is mounted in the cabinet or fixed to the table, is to connect the negative high-tension battery lead to its negative pole, and the wander-plug lead to its positive.

The milliammeter, mounted as shown in either diagram, records the total current that is being taken from the high-tension battery, and one is thus able to keep a careful watch to see that overloading does not take place. If it is desired to see what any particular valve is taking, all that one has to do is to leave it glowing and to switch off the others.

R. W. H.

Ready-Made Sets

MOST of the ready-made sets now available give excellent results, and are easily operated even by beginners. There is, however, one thing that I would like to see on them, and that is the provision of a means for supplying a higher voltage to the plates of note magnifying valves than to the rectifier. There are two ways in which this can be done very easily. The first is to fit a second high-tension plus terminal marked "Extra H.T.+." If the user likes he can then place the wander plug corresponding to the first H.T.+ terminal in the 40- or 50-volt socket of his battery and the other in the socket which gives the greatest possible voltage. If he does not want to use two H.T. leads, he can simply short-circuit the terminals—a swinging hook connection might be provided for the purpose. The other method which has the advantage of extreme simplicity is this. Between H.T.+ and the OP terminal of the transformer whose primary is connected to the plate of the rectifier is placed a resistance of suitable value. The plate of the note magnifier is connected *via* the telephones direct to the H.T. busbar with no intervening resistance. The effect of this is that, supposing that the single H.T. terminal is connected to the 80-volt socket of the high-tension battery, the note magnifying valve will receive 80 volts on its plate, whilst the rectifier will get only 50 or 60. If plate voltages are properly adjusted in either of the ways described, results are very much better, for no ordinary valve rectifies well with a high plate potential, and in the same way amplification is not good unless the plate voltage is high. If you give both rectifier and note magnifier the same H.T. voltage, best results will not be obtained. If the rectifier is functioning well the note magnifier will probably distort a little owing to the presence of grid current. Those who possess ready-made sets with only one H.T. terminal can alter them very simply on the lines indicated, and they will find that it is very well worth while to do so, for reception is very much improved, especially upon strong signals where the effects of distortion are very much more noticeable.

R. W. H.

Our photograph shows a huge "Brown" loud-speaker being placed in position at the Wireless Exhibition. On another page may be seen an "Amplion" loud-speaker, also of large dimensions.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

THOSE who have visited the N.A.R.M. Exhibition at the Albert Hall will have noted the remarkably good reproduction of the 2LO programmes, and consequently great interest will be taken in the general circuital arrangement for producing this result.

Those extremists who believe that the intervalve transformer is doomed will receive no small shock when they hear that three iron-core choke coils and [illegible] transformers are used in the apparatus.

This rather confirms my expression of opinion in these columns recently.

The Circuit

The general kind of circuit is illustrated in the accompanying figure, and, thanks to the courtesy of the B.B.C. engineering staff, I was able to examine the actual apparatus employed.

It will be noticed that in this figure I have drawn two vertical dotted lines, A.B. and C.D., and these are for the purpose of dividing the circuit into the three essential portions. The part to the left of the line A.B. includes the aerial and earth (no actual earth was employed), and a standard commercial receiver, which had been modified so as to give a stage of high-frequency amplification followed by a valve detector. I cannot actually guarantee that the circuit was identical with that shown to the left, but exactly the same effect was obtained.

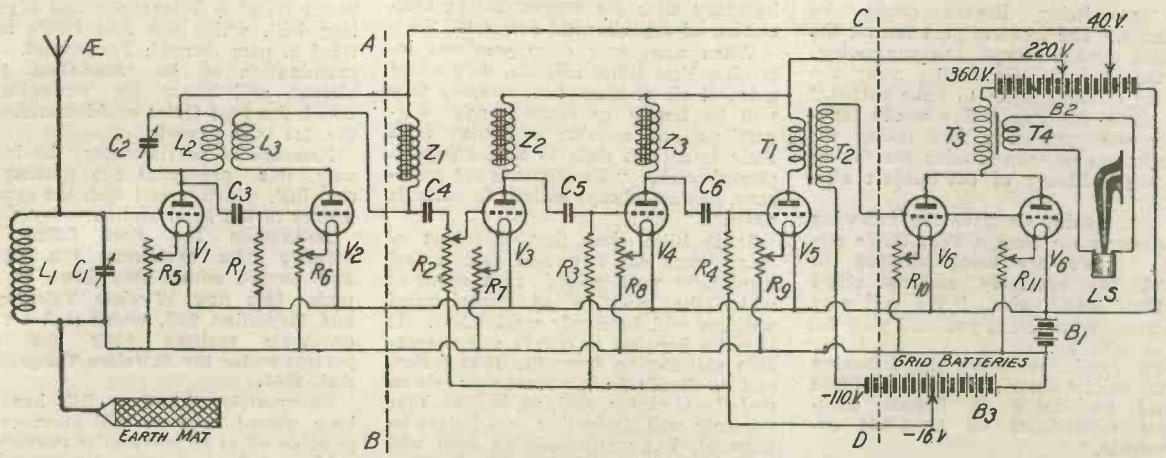


Fig. 1.—Showing the general principle of the circuit used by the B.B.C. for demonstration purposes at the exhibition.

The portion between the lines A.B. and C.D. is the low-frequency amplifier, while the portion to the right of the line C.D. includes the power amplifying valves V6, of which there were eight in parallel, and an output step-down transformer T3 T4, and a loud-speaker L.S.

The Low-frequency Amplifier

It will be seen that the low-frequency amplifier comprises several stages of choke couplings, the choke coils Z1, Z2, Z3 being used. These chokes were of substantial dimension of the order of a large intervalve transformer. The coupling condensers C4, C5 and C6 have a capacity of .5 μF, while the grid leaks R2, R3 and R4 have a value of 150,000 ohms.

It is to be noticed that the grid of the valve V3 is connected to a tapping on the grid leak R2, and by varying this tapping up or down R2 it is possible to vary the strength of the output in the loud-speaker, this being a very convenient method of obtaining a regulation of signal strength.

Grid Bias and Anode Voltages

The anode voltages of the first two valves, *i.e.*, the normal receiver, is 40 volts, while 220 volts are applied to the anodes of the valves V3, V4 and V5. A tapping is taken on the battery B3 so as to give the grids of V3, V4 and V5 a negative potential of 16 volts. The valves V3, V4 and V5 are of the L.S.5 type.

The Power Amplifier

The power amplifier consists of eight L.S.5A type, which has a

more open grid than the L.S.5, and has an amplification factor of from 2 to 3. These valves are all connected in parallel, and the output of the valve V5 is fed into the grid circuits of the power valves V6 by means of the transformer T1 T2, which is a step-up transformer of 1 to 6 ratio. The grids of the eight valves, two of which are shown as V6 in the accompanying figure, are given a negative potential by means of a grid battery of about 110 volts, while the anode voltage applied to these valves is 360 volts.

The very large output obtainable will be appreciated when it is mentioned that the normal anode current is 300 milliamps. through the primary T3 of the step-down iron-core transformer T3 T4. The low-resistance winding T4 is connected to the loud-speaker L.S., which is of a most modern type.

Lessons to be Learnt

This circuit diagram will be of great interest to those who desire to give experimental demonstrations of loud-speaker results, and the values given will indicate how the valves may be operated. There is certainly no shortage of iron in the circuit, and this alone is rather enlightening as indicating that the B.B.C. themselves are not committed to resistance-coupling amplification.

I believe that the L.S.5A valves are not actually on the market, but are only provided to special order for certain commercial interests. I believe there is no particular reason why L.S.5 valves or valves of this type could not be used in the last stages, but since there is apparently a commercial demand for L.S.5A type, it seems strange that the valve is not standardised. Perhaps the makers can explain this.

□ □ □

Post Office Hypocrisy

Continued from page 743.

a transmitting licence could be granted. The ironical part is that the official cannot accept the suggestion, because "it is like taking away the liberty of the subject to some extent." No doubt the Post Office would repudiate the suggestion that to-day the restrictions on transmission are taking away the liberty of the subject altogether.

Then, again, we have the following pronouncement from a Post Office official: **"We are most anxious to assist the amateurs and not stand in their way,"** also, "We will play the game with you if you will play the game with us."

Yet, again, we have the following in an official letter: **"The Post Office would be loathe to impose additional restrictions on bona-fide experiments."**

The position of the Post Office officials is truly a remarkable one. We have some officials as Vice-Presidents of the Radio Society of Great Britain. No doubt these appointments were made for the maintenance of friendly relations with the Post Office, although what these relations have brought we have yet to discover. The Post Office has flouted the Radio Society in no unmistakable manner. Whether officials of the Post Office admire Dr. Eccles or not, the President of the Radio Society, the other day, made it quite plain that the Post Office did not care two straws for the judgment either of Dr. Eccles or of any other member of the Council. We happen to know that applications for transmitting licences made through the Radio Society of Great Britain are given the most careful and thorough investigation, because the reputation of the Society is at stake in these matters. A specially compiled list of applicants forwarded by the Council were rejected *en bloc* by the Post Office, which continually expresses its considered policy of working in the closest harmony with the representative association of experimental interests.

When newspaper correspondents interview Post Office officials, they adopt a bland air of innocence, and say they will be happy to receive any suggestions, and nothing is further from their intentions than to hinder experimental work. "Restrictions are necessary, but are always waived in suitable cases."

It is high time that this sort of thing were cut out, and that a real legal fight were staged, as a result of which the position of experimental wireless will be firmly established. It is quite hopeless to obtain any reasonable satisfaction from the Post Office, and the Radio Society must now rely on their legal rights, and, we believe, that not only will no further restrictions be imposed, but many existing ones will be wiped out as the result of a test case. The Radio Society now have funds for such a case, and we hope that the matter will be brought to a very early issue.

We are able to disclose the fact that the recent restrictions inserted into new licences were made without the knowledge and against the wishes of Mr. F. J. Brown, the head of the department at the Post Office, who was away at the time. Mr. Brown, however, apparently disagrees with the insertion of these regulations merely because they are of a provocative character, but he maintains that the regulations are in force and that the Post Office have the power to make them. He has very graciously consented to change a prohibition into a permission with a restriction, a concession which leaves the position identically the same, and which is an insult to the intelligence of the Council of the Radio Society.

We publish in this week's issue an example of Post Office methods in the case of our Assistant Editor, Mr. Harris, one of the most competent experimentalists in the country, who has just applied for a small modification of his transmitting licence. If this is the method of dealing with an application of this character, we must sympathise with the ordinary applicant.

Anyone who doubts the attitude to experimental wireless in this country need only look at extracts from the proposed Wireless Telegraphy and Signalling Bill, which the Post Office have tried to pass through Parliament. An examination of its scandalous provisions will show the stranglehold which the Post Office could exercise, if the Act were passed.

Pressure of parliamentary business, only, has prevented the passing of this Bill, which would filch the experimenter of his legal rights.

Meanwhile the Post Office are actually now exercising the rights and powers which they hope to get under this new Wireless Telegraphy and Signalling Bill, which rights they obviously realised they did not possess under the Wireless Telegraphy Act, 1904.

Fortunately, this new Bill has not been passed, and we will exert every possible effort to prevent its passage.

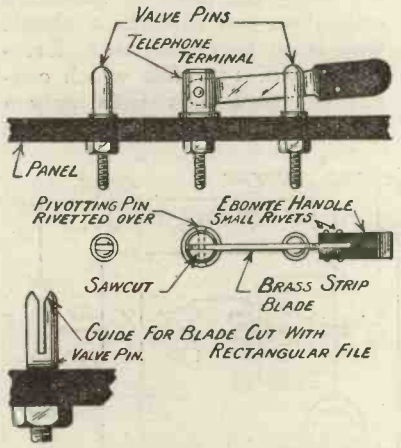
Meanwhile, it is interesting to reflect that the British Post Office officials, while quietly preparing this insidious proposed Bill, openly boasted of their desire to further experimental work and assist the amateur.

There is only one attitude to take up towards such a Government department, and the Radio Society will be failing in its duty if it does not take up that attitude at once.

A Simple Panel Switch

A SIMPLE panel switch may be constructed from spare parts, as shown in the diagram, all that is necessary being two valve pins, one telephone terminal, some strip brass, and a small piece of ebonite. The parts may be spaced upon the panel to such dimensions as best suit the requirements of the constructor, or the space available upon the receiver. The blade, which is made of brass strip, is pivoted to a telephone terminal, as shown. To do this, first cut a slot in the terminal, insert the blade, and drive a pin through the existing hole in the terminal. The pin, which should be a little more in length than the diameter of the terminal, is then riveted over by flattening the projecting ends down with a hammer. The gauge of brass used for the construction of the blade should be a tight fit in the existing slot in the valve pin. The length of the blade should, of course, clear the distance between the telephone terminal pivot and the valve pin. The blade is equipped with an ebonite handle, as shown. A guide for the blade should be filed on the valve pins, as shown in the enlarged diagram. To make a double-pole, double-throw switch all that is necessary is to use four valve pins, two telephone terminals, and two similar blades, the ebonite handle in this case passing from blade to blade.

H. B.



Constructional details of the switch.

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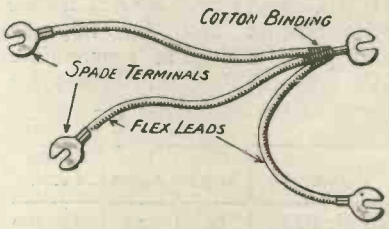
Flexible Connecting Links

MUCH trouble is often experienced in making multiple link connections, where it is necessary to place three or more spade terminals under one terminal. The diagram shows a simple method of overcoming this little difficulty. The links may be made up to form two-way, three-way, or four-way connections. It will be seen at a glance that instead of having to place three spade terminals under the desired panel terminal, the three leads shown in the diagram are bound together and attached to one spade terminal. If several of these are made and kept in stock they will be found to be quite a useful acquisition for linking-up units or loose components.

H. B.



Illustrating the multi connecting link.

□ □ □

One of the exhibits at the "All-British" Wireless Exhibition is a giant Amplion loud-speaker. Some conception of its size can be gathered from comparison with the neighbouring people.

Making the Most of Power Valves

NOT so very long ago it was almost out of the question for the amateur to use a power valve for note amplification purposes, partly owing to its enormous current consumption for filament heating—one ampere was nothing out of the way—and partly because to work properly it needed two or three hundred volts on the plate. The ordinary high-tension battery could not be used because its output was insufficient for these valves, which frequently passed up to 15 milliamperes in the anode circuit. To-day we have quite a variety of small power valves, such as B.T.H. B4, the Marconi Osram L.S.5, and the Mullard DFA0, DFA1 and DFA2, whose requirements both for filament and plate are quite reasonable. We may tabulate the figures for these valves as follows :—

Valve.	Fil. Volts	Fil. Amps	Anode Volts.
B.T.H. B4 ...	6	.25	80–100
L.S.5 ...	4.5	.65	100–150
DFAO ...	3.5	.35	50–100
DFA1 ...	5.5	.2	50–100
DFA2 ...	3.5	.25	50–100

With 100 volts on the anode and suitable grid bias the plate current consumption can be cut down to the following figures without any loss in signal strength :—

B.T.H. B4 ... 4 milliamperes.
L.S. 5 ..... 5 milliamperes.
DFAo ..... 3 milliamperes.
DFA1 ..... 4 milliamperes.
DFA2 ..... 3 milliamperes.

To get the very best out of a power valve, however, one should use a telephone transformer and low-resistance receivers. The reason is this. The last note magnifier has pretty large voltage variations to deal with. It is desirable, therefore, that the working point should be as near as possible to the middle of the straight portion of the grid volts-anode current curve, or at any rate that it should be such that neither the tops nor the bottoms of oscillations raise it to the saturation point or lower it to the bend at the bottom of the curve. Now the higher the voltage we apply to the anode the more we throw the whole of the characteristic curve over towards the left.

Grid Cells

There is no doubt that every set having even one stage of low-frequency amplification should be provided with a grid battery. Unfortunately many boxed-in sets are not so furnished, and there are hundreds of amateurs who have made up sets without this important fitting. Probably the best way to deal with the matter is to disconnect the lead which runs to the low-frequency intervalve transformer from L.T. negative, and to insert a pair of terminals in a convenient place upon the panel. Connect one of these to L.T.– and the other to the vacant transformer terminal. Mark the first plus and the other minus. Obtain a couple of flashlamp batteries and join them in series by soldering the short (positive) strip of one to the long (negative) strip of the other. Take tappings at each cell. This can be done quite easily by breaking away the pitch covering at the top and soldering flexible leads to the connecting wires. Take care, by the way, not to let the bared ends of your flexible leads touch, otherwise you will short-circuit some of the cells. Now connect the positive end of the battery to the plus terminal, and try the effect of using various grid voltages. As soon as the most satisfactory one has been found, the other tappings can be cut off. The battery can then be placed in a small box, and the leads taken to a couple of terminals placed on its lid. It will not, as a rule, be necessary to tap the first three cells, for there are few, if any, power valves needing less than 4.5 volts on the grid. If the task of breaking away the pitch of flashlamp cells does not attract, a simple way is to purchase two Ever-Ready No. 15 refills which consist of large cells with only a cardboard covering, which is easily removed. As the cells are connected by brass strips, it is a simple matter to solder leads on.

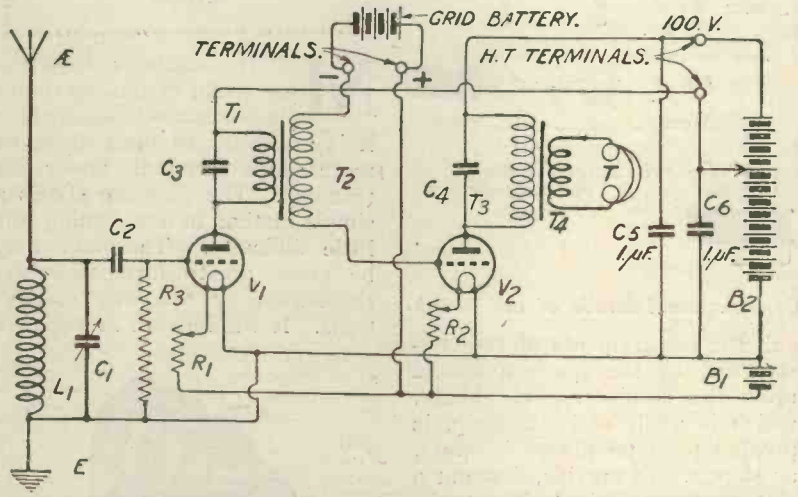


Fig. 1.—An ordinary detector and note-magnifier circuit adapted for applying negative grid bias and separate anode voltage to the last valve.

H.T. Voltage

The next problem to tackle is that of supplying a higher voltage to the anode of the power valve than to that of others in the set. It is first necessary to get a telephone transformer, which may be purchased cheaply from advertisers. There will generally be plenty of room for this beneath the panel. Keep it well away from the other transformers so that interaction will not take place. To wire this transformer disconnect the plate and H.T. plus leads from the telephone terminals, and connect the plate lead to one of the transformer primary terminals, connecting its secondary to the telephone terminals. Now mount an

additional H.T. plus terminal on the panel. Connect this to the unoccupied terminal of the telephone transformer's primary. The existing high-tension battery condenser should be left in place and a second should be fitted in shunt with the 100-volt high-tension lead. These small alterations can, as a rule, be carried out without much difficulty in any set, and it will be found that they will make an immense difference to its performances even if an ordinary valve and not a power valve is used as note-magnifier.

Power Amplifiers

The power amplifier excels for low - frequency amplification, largely on account of its design. Fig. 2 shows the parts of a typical small-power valve. As inter-electrode capacity will not be of much moment in a valve which has to deal only with low-frequencies, both the plate and grid spiral can be made of large diameter. In most types they are oval in form, the grid being very open. The filament is much longer than is the case in valves of the ordinary type, and the volume of electron emission is therefore very great. Further, as the internal resistance of the valve is generally not much higher than 10 or 12,000 ohms as compared with an average of 40,000 in ordinary valves, the power amplifier is capable of passing a greater amount of current in the anode circuit. The modern small-power valve is a dull-emitter, and it makes therefore a very small drain upon the accumulator. This low consumption is an enormous advantage, but the fact that they are dull-emitters brings one small drawback in its train. All valves fitted with filaments of this kind are inclined to be more microphonic than bright emitters, and small-power valves are no exception to the rule. However, if the set is placed upon a pad of baize or other material the microphonic qualities of the power valve will not be noticed unless it is actually tapped with the finger.

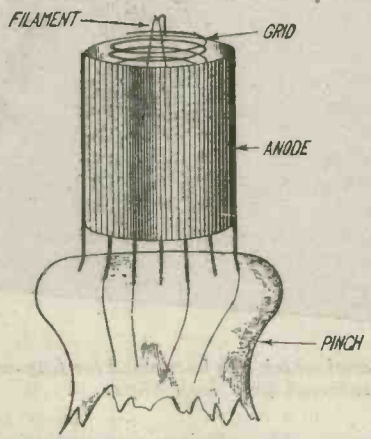


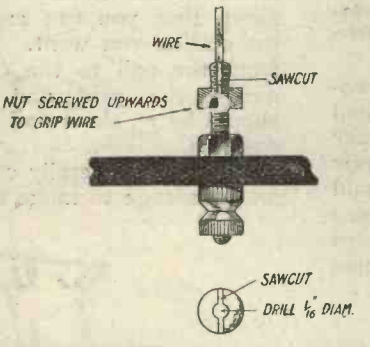
Fig. 2.—The electrodes of a power valve.

R. W. H.

□ □ □

A Neat Wiring Tip

A SIMPLE device for neat wiring which entirely eliminates the using of solder may be achieved as shown in the diagram. Although a little time and trouble will be expended in preparing the panel fitting screws, it has its compensations by reason of the fact that the connections may be altered from time to time with a minimum of trouble, without having to get out one's soldering outfit. All that is necessary is to first drill a 1/16 in. diameter hole down the centre of the screw, as shown, and then make a cut across it with a fine hacksaw. When 1/16 in. square tinned copper wire is forced into the 1/16 in. diameter hole drilled, the nut (which should be already on the screw) when screwed upwards will tightly grip the wire.



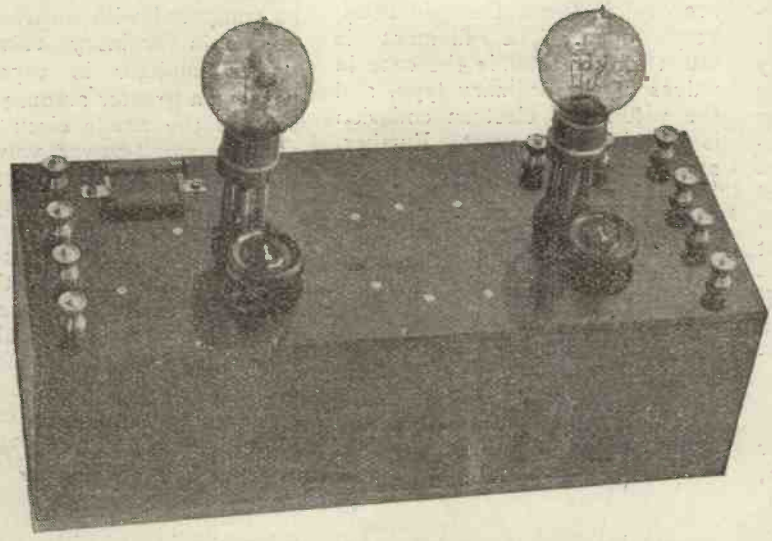
The wire fitted to the terminal.

H. B.

□ □ □

FRENCH EXPERIMENTERS

An enthusiastic group of members of the Société Francaise d'Etudes de T.S.F. photographed during an experimental trip down the Seine. Note the loud speaker on the top of the cabin.



A detector and note magnifier panel which has been used for fifty-metre reception. Note external grid leak clips.

One Hundr
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By PERCY W. HARR

Some Points on Sho

IT is only a year or two since all wavelengths below 600 metres were looked upon as "short," but nowadays the experimenter who cannot go below 200 metres on his tuner is looked upon as out of date. Our old friend KDKA, which last winter amused and intrigued us by working on the fascinating wavelength of 100 metres, has now abandoned this common playground and slid down to sixty metres or so, on which adjustment his strength of signal is about double what it was before. In the United States the amateurs are preparing to go as low as four or five metres, but there are some really big problems to solve before satisfactory reception is likely on such waves.

75-100 Metres.

Meanwhile, it will be interesting to consider a few points in tuner design for wavelengths in the neighbourhood of 75 to 100 metres — a most interesting band for the listeners who have become interested in something more than broadcast programmes.

Now, excluding super-heterodynes, specially designed neutrodyne receivers, and others of considerable complication, it is next to impossible to get satisfactory high-frequency amplification on such short waves as these. The efficiency of radiation is exceedingly high on the short waves, and it will be found that in practically all cases a detector and one note-magnifier will give all that is required. Incidentally this is the combination used by most of those British amateurs who are working two-way schedules with the United States, and now that the darker evenings and better atmospheric conditions are coming, it should be possible to receive 100-metre signals from the United States almost any night with this arrangement.

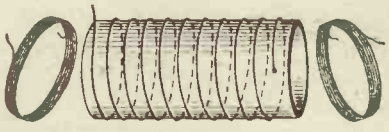
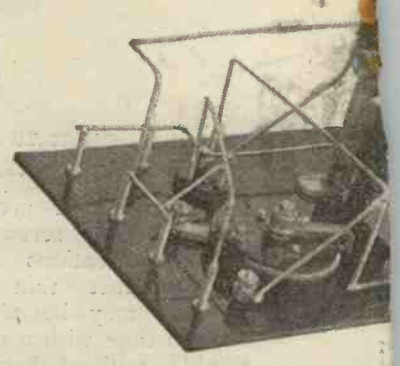


Fig. 1.—Diagrammatic representation of a simple short-wave tuner.

Short Wave Circuits

I have tried a number of different circuits on short-wave reception, and have come to the conclusion that there is nothing to beat a loose-coupled combination with reaction on to the secondary coil and an aperiodic aerial coil consisting of a few turns of wire wound in a hank as shown in Fig. 1. A good tuner for 100 metres can be made up with five or six turns of wire as the aperiodic aerial coil with a .0001 fixed condenser in series with it, and about 20 turns of No. 16 or 18 d.c.c wire on a three-inch tube not shellaced or treated in any way, as the secondary. If you shellac or wax the coil you add to the self-capacity and reduce the efficiency considerably, so I recommend you to wind it on a tube of either pure ebonite or of well-dried cardboard, the latter not waxed, but very lightly shellaced, after baking, to make it impervious to moisture. The reaction coil can be 15 to 20 turns of No. 18 or 20-gauge wire. The secondary should be tuned with a variable condenser not bigger than .0002 mfd., or the tuning will be so sharp that you can easily miss the station you want. All leads from the coil to the condenser and to the grid and filament should be as short and direct as possible.

It is now generally considered an advantage to make the coup-



A back of panel photograph sho

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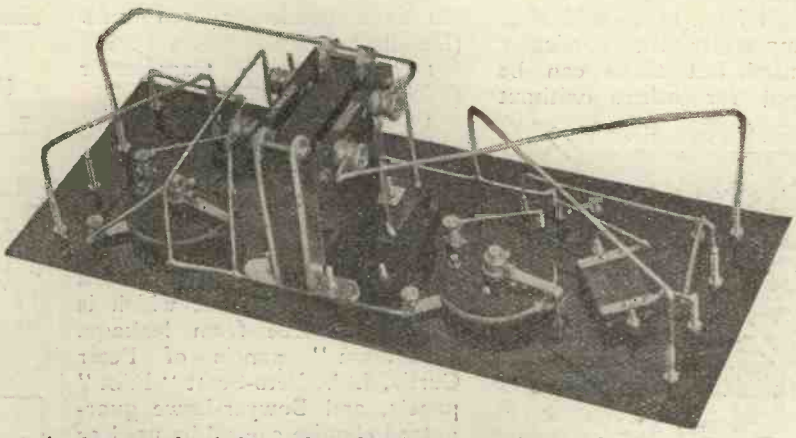
IS, Assistant Editor.

rt Wave Reception.

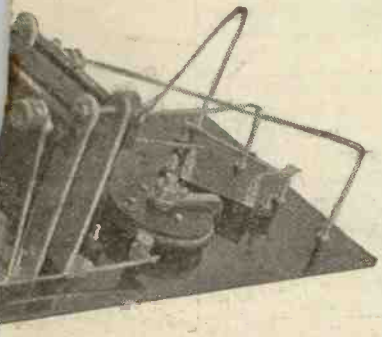


A photograph of the underside of the panel showing disposition of components.

ling between the aperiodic aerial coil and the secondary coil variable, while, of course, the reaction coil must have a coupling which is variable in relation to the secondary coil. A very good make-up is to tie the aerial and reaction coils on wooden rods provided at each end with bearings, so that they can be easily rotated. Whether or not you find a series condenser in the aerial necessary will depend upon your aerial, and you will be surprised to see how loose the coupling between your aperiodic aerial coil and your secondary can be on short waves.

Low Capacity Valves

You need not make any special endeavour to get very low capacity valves, unless you are working below 75 metres. Low-capacity valves of the tubular type have particular virtues when we use them in high-frequency circuits for short waves, where the capacity between electrodes is the unwanted source of feed-back.



wing the simplicity of the wiring.

As we have no radio-frequency tuned circuit connected in the plate there are no two tuned circuits to interact. The value of the grid leak should be watched carefully on these short waves.

In making up your tuner keep the tuning coils well away from

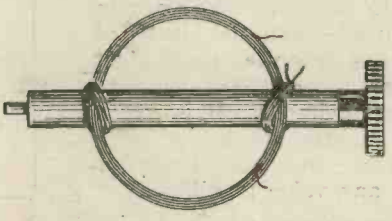


Fig. 2.—Method of securing the hank coil.

the panel and from the baseboard. A good plan is to keep them about at least two inches from both of these, by means of wood brackets or supports. The construction of the aerial coil is a very simple matter. It is only necessary to take some cylindrical object about three inches diameter (a jug or bottle will do), and to wind the turns round it, slip them off, and tie them in three or four places with stout thread; the coil can then be tied to a rod (see Fig. 2), and mounted so as to be able to rotate it as closely as possible to the secondary coil. An alternative variable arrangement is made by sliding the coil to and from the secondary coil or by hinging it so that it can open away from the end of the coil when necessary.

Whatever form of tuner you use you will need a detector and note-magnifier panel, and this can be made up in permanent form for use on any wavelength. I am illustrating in this article my own detector and note-magnifier panel, which I have used successfully with various kinds of tuner down to about 50 metres. There are no particular novelties in its make-up except that the clips for the grid leak are placed outside the panel so that various values can be tried at will. You may wonder why I have not fitted a variable grid leak instead of clips and fixed leaks, thus saving myself trouble. The answer is that I have yet to find a really reliable and permanent variable grid leak *which can be calibrated.* There are several variable grid leaks which are capable of adjustment through a wide range of values, but not one of them is sufficiently constant in its setting to be calibrated. I hear rumours that a well-known firm is shortly to place a really reliable and calibrated variable grid leak on the market, and I hope the rumour is true. Meanwhile, I keep on the bench a box of calibrated grid leaks from ½ to 5 megohms, and I substitute these as and when necessary with full confidence that I am getting the values indicated.

Notice particularly that the leads inside this amplifier are exceedingly short.

The component parts necessary to make this panel are as follows. I have mentioned after the components the particular makes used, but these can be exchanged for others without

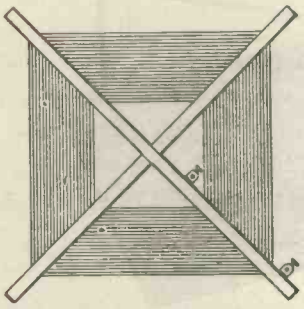


Fig. 3.—The Harris lowloss coil.

detriment, provided the substitutes are of good quality.

One panel, 14 x 5½ x 3/16 (Radion panel).

10 terminals.

2 filament resistances (Ediswan).

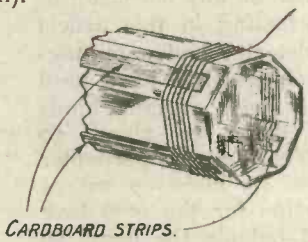


Fig. 4.—A simple way of making a low loss coil, due to M. B. Sleeper. The wire is wound over gummed strips which hold the coil when the bottle is withdrawn.

2 sets valve sockets.

1 pair of clips for grid leak.

1 fixed condenser .0003 mfd. (Dubilier).

10 terminals.

Set of grid leaks, or, if only one is decided upon, the usual value of 2 megohms.

1 fixed condenser .001 mfd. (Dubilier).

1 intervalve transformer (Woodhall).

1 box about 5 in. deep.

Square wire for wiring.

There are no particular difficulties in the constructional work. If you use a Radion panel you can make up your set on this right away, as it has a polished black surface which is guaranteed free from leakage. "Paragon" panels of Peter Curtis, Ltd., Peto-Scott "Pilot" panels, and Bowyer-Lowe guaranteed ebonite can all be used as received from these people, but all unguaranteed ebonite requires the surface to be removed. It is high time manufacturers stopped selling panels from which it is necessary to remove the surface before commencing work. The average experimenter has quite enough to do without the laborious process of rubbing down ebonite with emery. Now that—thanks to consistent advocacy in this journal—there is plenty of guaranteed ebonite obtainable, I strongly recommend readers to insist on having it. It is worth paying a little more for such ebonite, if you consider your time of any value at all.

Filament Resistances

So far as the filament resistances are concerned, these, of course, should be bought for either bright or dull emitters as required, or you can, if you wish, use the type of resistance such as Burndept's, which can be used for either bright or dull emitters, according to the position of the slider.

Short-Wave Plug-in Coils

Burndept's and Gambrell's,

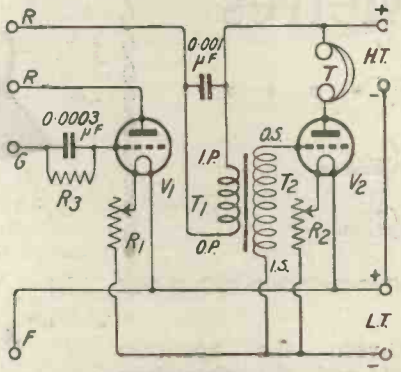


Fig. 5.—Circuit of the detector and note magnifier panel.

and just recently one or two other firms, are selling special short-wave coils, which are very good for 100 metres work. These

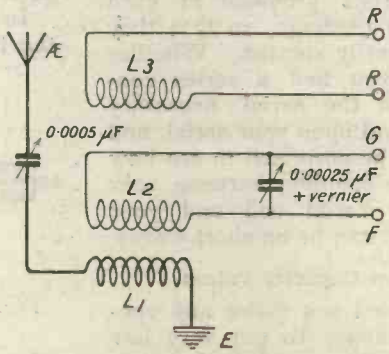


Fig. 6.—Three coil tuner for the Fig. 5 circuit.

can be used in a three-coil holder with a series condenser of .0005 mfd. in the aerial and one of

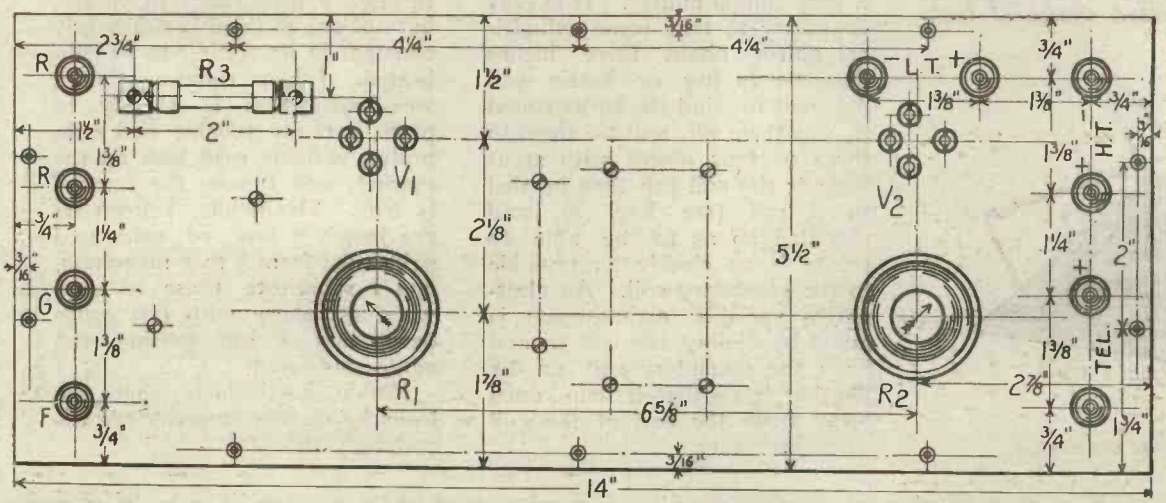


Fig. 7.—The layout of the panel and drilling dimensions.

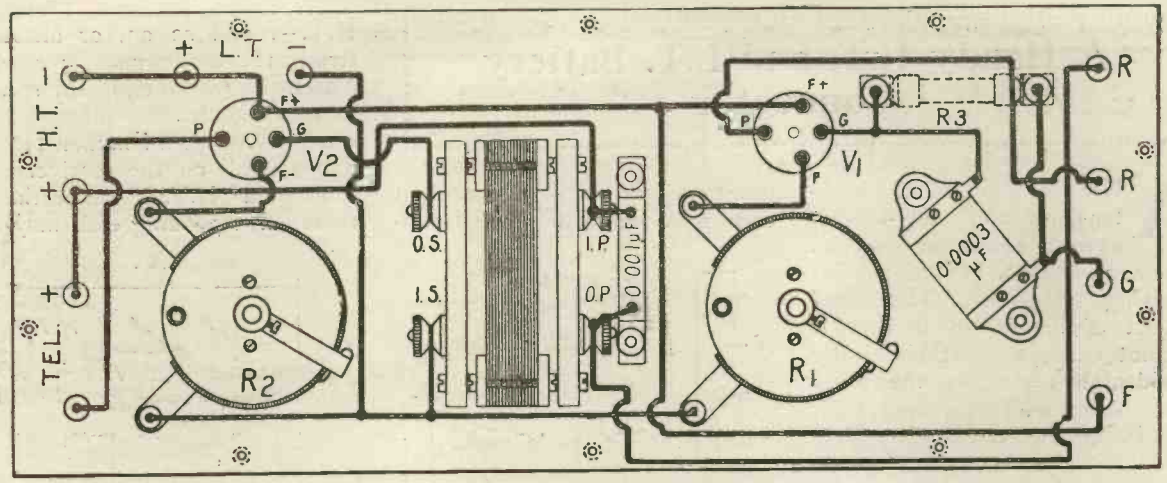


Fig. 8.—Practical back of panel wiring diagram.

.0002 or .00025 mfd. in the closed circuit. A vernier is preferable on the closed circuit condenser. For 100 metres reception it is practically useless to endeavour to receive with a direct-coupled circuit, so do not waste your time in this way if you want results. At first, though it might appear that handling a loose-coupled tuner on 100 metres would be a very critical matter, actually the tuning of the aerial is not at all critical; it is the secondary tuning which requires care.

Use a Heterodyne Wavemeter

To do any really successful work it is imperative to have a separate heterodyne properly calibrated as a wavemeter. I described one of these in *Wireless Weekly* last winter, and it has since proved very useful. It is also recommended in consideration of other listeners who will be annoyed by any autodyne reception on your part. Of course, when you react on to a secondary circuit which is loosely coupled with the aerial, you might imagine that practically nothing will be radiated, but, owing to the efficiency of radiation on these wavelengths, you may actually cause a good deal of interference in this way.

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The Proposed Wireless Telegraphy and Signalling Bill.

AN extract from a bill which the British G.P.O. have been trying to get passed by Parliament. This bill has been previously published, but it is very relevant at the present crisis as showing how the Post Office have vainly attempted by this proposed Act to gain powers which they are, in fact, now illegally exercising. The passage of this Act, unnoticed, would give the Post Office unlimited powers, and deprive every private citizen of the right to possess or work a wireless set. Our own comments on the consistent repressive attitude of the Post Office appear in the Editorial.

Copies of this proposed Act may be obtained from Members of Parliament.

BE it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

1.—The Wireless Telegraphy Act, 1904 (hereinafter referred to as the principal Act), shall become a permanent Act, and any provision in any Act in force at the time of the passing of this Act which limits the period for which the principal Act is to remain in force shall cease to have effect.

2.—(1) The Postmaster-General may, notwithstanding anything in the principal Act, make regulations—

(a) as to the terms, conditions, and restrictions on or subject to which licences of any class of licence under the principal Act are to be granted, renewed, suspended, or withdrawn; and

(*b*) requiring any operators or other persons engaged in the working of wireless telegraphy to be provided with certificates, and making provision as to the manner and conditions of the issue and renewal of any such certificate, including the examinations and tests to be undergone, and the form, custody, production, cancellation, suspension, endorsement and surrender of any such certificate, whether issued before or after the passing of this Act; and

(*c*) for preventing interference with the working of wireless telegraphy by the generation or use of etheric waves for any purpose other than the transmission or reception of wireless messages; and

(*d*) for giving effect to, and securing compliance with, the provisions of any international convention signed on behalf of His Majesty, and any regulations made thereunder, so far as the same relate to wireless telegraphy; and

(e) prescribing, subject to the consent of the Treasury, the fees to be paid in respect of the grant or renewal of any licence or certificate.

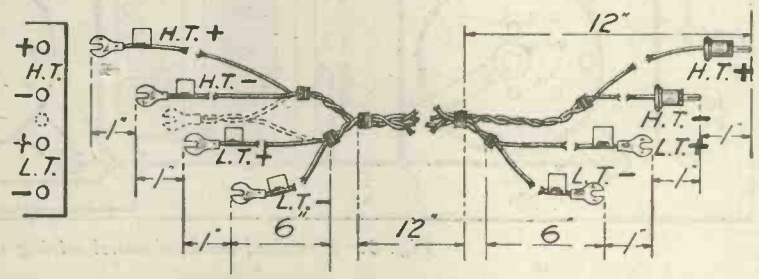
(2) Regulations under this section may provide that any person acting in contravention of or failing to comply with the regulations or any of them, or the terms, conditions and restrictions or any of them, on or subject to which any such licence or certificate as aforesaid has been granted, shall be liable, on summary conviction, to imprisonment for a term not exceeding three months, or to a fine not exceeding fifty pounds, and, in the case of a continuing offence, a further fine not exceeding five pounds for each day during which the offence continues.

(3) Subsection (6) of section one of the principal Act is hereby repealed.

3.—Subsection (1) of section two of the principal Act, which makes special provisions as to licences for experimental purposes, shall cease to have effect, and licences for those purposes shall be subject to the general provisions as to licences for wireless telegraphy contained in section one of the principal Act.

A Handy H.T. and L.T. Battery Connector

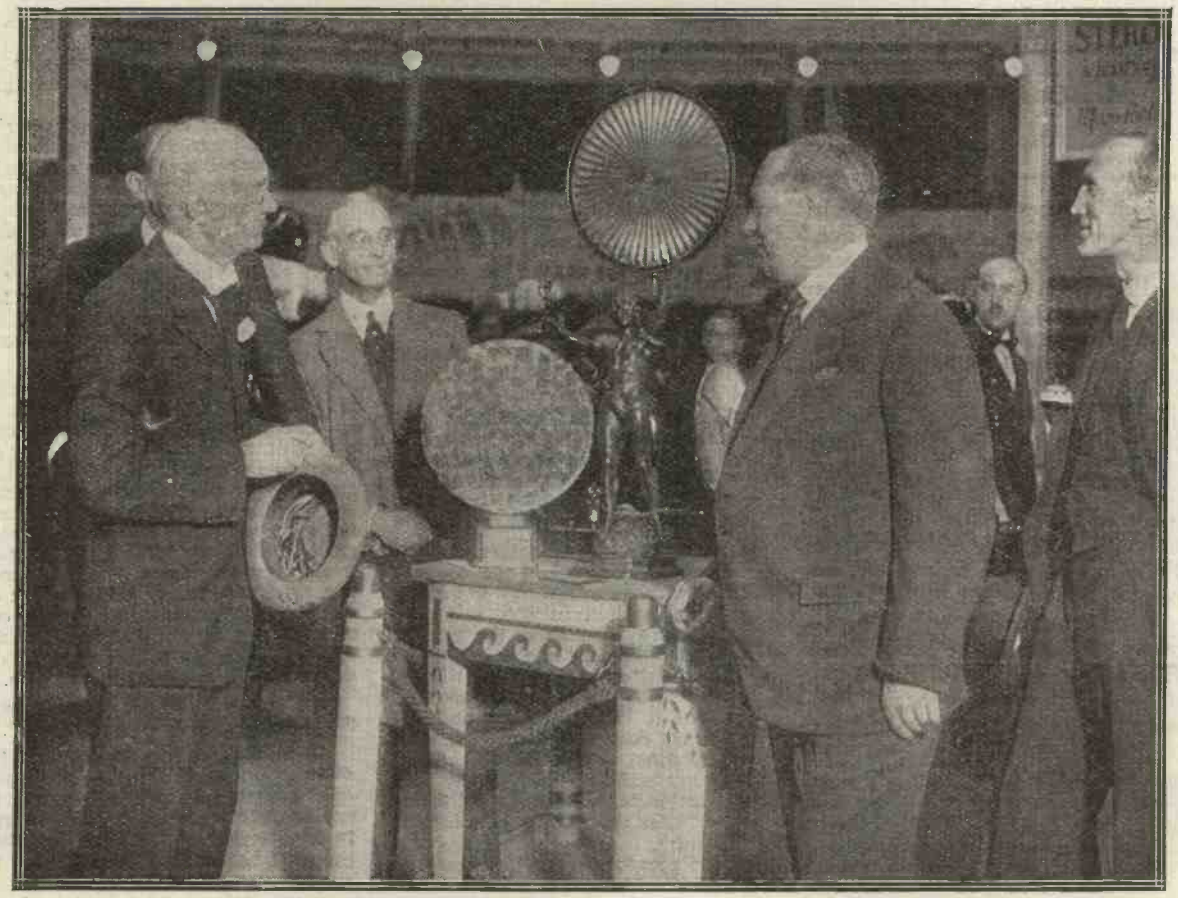
A HANDY combined high-tension and low-tension battery connector may be made as shown in the accompanying diagram. The chief object of its design is that it cannot cause a short circuit by accidentally bringing the leads into contact with each other, each tag being shorter than the preceding one. A piece of twin insulated flex 3 ft. long will be required for the high-tension battery connections, and a further piece of twin flex, 2 ft. 6 in. long, for the low-tension battery connections. The H.T. flex should be blue silk covered, and the L.T. flex red silk covered, or any two distinct colours may be used. The two lengths of flex are bound together, as shown in the diagram, and each of the eight ends provided with spade terminals or wander plugs, as desired. To ensure the elimination of any possible mistakes in linking-up the connector between the batteries and the receiver, paper tags may be secured to each of the eight ends and labelled H.T. +, H.T. −, and so on, or alternatively, the distinguishing marks may be engraved upon the spade terminals or wander plugs themselves. Where a common terminal is used on the receiver for L.T. and H.T. − connections, these corresponding ends may be bound together on the connector and secured by one spade terminal, as shown in dotted lines, resulting in this case in three ends only on one side and four on the other.



Constructional details and dimensions of the battery connector.

H. B.

THE EXHIBITION



Our photograph shows Lord Riddell on the left, inspecting a very handsome loud-speaker made by Sterling's. Mr. W. W. Burnham, chairman of the N.A.R.M., may be seen on the right.

A Dull Emitter Warning

I suppose that most of those who live in the country like myself make use of dull emitter valves of one kind or another chiefly because it is so difficult to get accumulators charged. There is always the bother of lugging them round to the charging station, and unless you keep a watchful eye on those who do the job you may easily find the battery is quickly ruined by their attentions or lack of attention. With the dull emitter the charging problem is greatly simplified, for a visit to the station every two or three months will usually suffice. There is one point which dull-emitter users do not appreciate. When you are using bright emitter valves consuming from ½ ampere to ¾ ampere apiece, the accumulator very soon lets you know when it needs to be charged by simply refusing to light up the filaments at their proper brilliance. But with dull-emitter valves this warning is not so obvious. Nor will a voltmeter always give a proper indication of the condition of the battery owing to the smallness of the load. It may thus happen that a battery is run down without the owner's realising it. Many an accumulator is ruined in this way, for to run it down too low means nearly always that sulphating will occur, and that spells disaster to the plates. The best tip I find is to keep on the wireless table a small piece of cardboard on which are made a number of strokes or "ones" equal to rather less than the hours of service that the battery should give. Suppose that your battery is rated at 50 ampere hours actual, and that you are using two dull-emitters whose filaments each consume .25 ampere. Your consumption per hour is ½ ampere and the battery *should* give a 100 hours of service when it is newly charged. Make ninety strokes on your card and cross off one for each hour that the set is used. The card then gives a good indication of the state of the battery, and there is no danger of running it down too low.

R. W. H.

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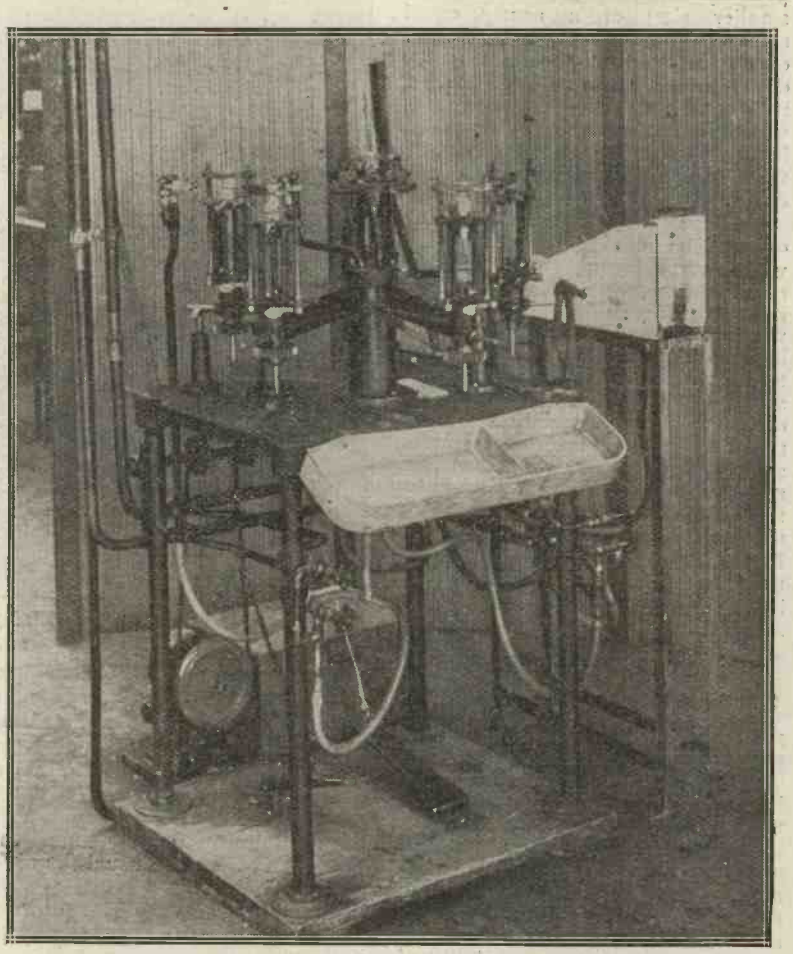
Note on Headphones

THE writer would like to bring a little suggestion before the notice of manufacturers, who may be interested in a small improvement to headphones, resulting in greater comfort to the wearer. In most of the patterns at present on the market the ear pieces are attached to the headbands by means of a spring clip which is pivoted on to the metal portion of the ear piece. This results in a certain amount of discomfort, as the headbands are stretched over, and do not fit on to the head, the earpieces themselves also having an angular position when worn. This could be simply remedied by pivotting the ear piece, not on the metal container, but on the ebonite cap. The point of pressure is then direct on to the ear, the headbands fit round the head and are not unduly stretched, and greater comfort is obtained. The writer has tried and found this device satisfactory.

H. B.



A "pinch" making machine at the Marconi Osram valve works.

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

Terminals

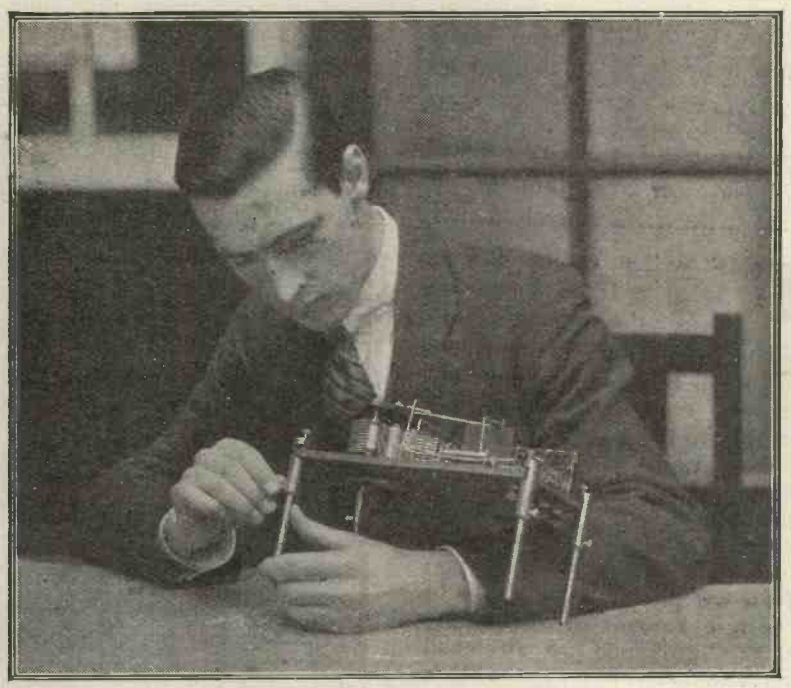
Messrs. Gent & Co. have submitted for our inspection samples of their "Tangent" terminals for electrical connections. In these, the tendency generally displayed by terminals to squeeze out the wire sideways when an attempt is made to tighten them up for secure connections (particularly when more than one wire is placed on one terminal) is effectively combatted by making the surface of the fixed portion of the terminals in the form of a curved groove, whilst the nut has its lower portion shaped to a rounded cone (roughly hemispherical in the smaller size) of a nearly equal radius. The result is that a wire, once inserted in the groove, is forced down to the bottom of the latter, rather than squeezed out sideways, when the nut is screwed down, giving a most secure hold and greatly facilitating rapid connections and disconnections.

On trial, it was found that secure connections could be made with wires of different sizes with the greatest ease, even when only one hand was available. Quite thick wires were readily secured, without bending the end into a loop. The terminals did not appear to be adapted for spade ends, which, however, become unnecessary with this type of binding-screw. The samples submitted were highly finished and nickel-plated; they were of substantial build, the bases in particular of the larger sizes being quite massive. For thick aerial and earth connections, and especially for telephone leads, these can be heartily recommended.

Plug-in Coils: "Pentawave"

A set of four plug-in coils of a particularly compact form has been submitted for test by Messrs. Thomas & Co. These are all 2⅜ inches outside diameter, by ⅝ inch thick; are enclosed in a smooth, black cover of neat appearance, and are provided with the usual plug-and-socket mounting. The small size, and unusually high D.C. resistance of these tuning coils appeared to suggest the probability of a fairly large H.F. resistance; this was confirmed in actual test, considerable difficulty being experienced in obtaining oscillation with the No. 1 in the aerial-tuning position, when using a liberal bright-emitter valve and ample H.T., and whether with series or parallel tuning-condenser. The tuning was also noticed to be markedly flat.

The makers give particulars of tuning range with these coils, which appear on close examination to have been based on a minimum tuning capacity for a P.M.G. aerial plus stray capacities of the set, etc., of about .0006 μF, with a maximum tuning capacity (.001 μF tuning condenser) of about .0016μF, which does not correspond with the best practice on the shorter waves. With a low-minimum .0005 μF tuning condenser and the more usual figure for a P.M.G. standard aerial of .0003 μF plus casual capacities of, say, .0001, the ranges recorded were actually, with the samples submitted, from about 350 to 1,420 metres wavelength, or to just under 1,800 metres with the No. 4 and .001 μF tuning condenser. An appreciable gap was left between the No. 1 and the No. 2; under these circumstances No. 3 had to be used for reaction with both Nos. 1 and 2. When effective reaction was once obtained a test in actual reception of local broadcasting came up to about the usual level of plug-in coils.



An interesting panel support.

Drilling Jig for Valve-Legs

Messrs. Baker & Finnemore, Ltd., have sent us a sample of their drilling-jig for valve-legs. This is a hardened rectangular steel plate 2½ inches by 1⅛ inches, with a centre hole for a No. 4 B.A. bolt, and the four holes for the valve-leg spacing. This is to be bolted down on the panel by a No. 4 B.A. bolt (one of which is provided with the fitting), a No. 26 drill making the necessary hole; and the other four holes are then drilled through the

jig guiding-holes. The rectangular plate facilitates the setting true to the edge of the panel.

On trial, this jig proved convenient in use, and gave the correct setting of the legs for the average valve. It is evidently carefully made, and is highly finished.

Wander-Plug

From Messrs. A. H. Hunt, Ltd., comes a sample of a new type of wander-plug. In this plug the wire comes out at the top of the insulating handle, a bared portion being nipped between an internal cone in the latter and the conical end of the brass plug, which screws into the former. The usual split tail is provided to obtain secure contact in the battery terminal holes. This makes an extremely neat and effective fitting; and on trial the wire was found to be nipped tightly, a good electrical connection being readily made.

Fixed Condensers

Messrs. Peter Curtis, Ltd., have sent us a sample of the new "Paragon-Curtis" one-piece condenser which is moulded in "Paralite" insulating material forming a closed case, so that the makers claim that it can actually be boiled for 24 hours without showing any change.

In the sample submitted small screws were provided for terminals, projecting from the side of a case of the usual size, viz., 2 inches by $\frac{3}{4}$ inch. As the nominal capacity was not marked on the condenser, the accuracy and permanence of capacity could not profitably be tested.

A Two-way Vernier Attachment Coil Holder

Messrs. Burnley Components, Ltd., have sent for test a sample of their two-coil holder, for panel or cabinet-mounting, with a fine-adjustment feature. In this instrument one coil-plug is mounted on a spindle controlled by the usual ebonite knob, turning stiffly in an ebonite base. The other is also pivoted, at a distance of about $1\frac{1}{4}$ inch centres from the first, but is moved through an angle of approximately 15 degrees by a micrometer screw operative in either direction, working in a swinging bridle. The first holder having a range of over 90 degrees of arc, considerable latitude of adjustment of coupling is thus provided, with a fine or "vernier" adjustment available at any point of adjustment.

The instrument is quite compact, being mounted on a base but $2\frac{1}{8}$ inches square. The two controlling spindles are necessarily at right angles to one another; the fine-adjustment spindle being of good length (about 4 inches) and insulated from the coil-connections the hand-capacity effects are reduced to a minimum. On trial, the mechanism operated smoothly, and gave the desired fine control over coupling of the coils. By tightening sufficiently a set-screw at the end of the main spindle the holder could be made stiff enough to carry the largest and heaviest sizes of plug-in coils.

Panel Supports

We have received from Messrs. Prince Bros., of Cleckheaton, a set of "Constructor's Panel Supports," for use by constructors when building up a new set.

The ebonite panel is secured in the milled slot at the top by the knurled set screws. The panel can be marked off and drilled, the components fitted and wires soldered, thus obviating the old method of packing with boxes.

This operation completed, the panel can be reversed, and the legs adjusted till components clear the work bench, when a test can be performed.

We can unhesitatingly recommend these supports, which are a great help to the home constructor. Our only criticism is that they might with advantage be longer.

Correspondence

TYPE W1 RECEIVER

SIR,—Herewith brief report on stations received on the above set. Birmingham, Manchester, Radio Belgique, Chelmsford, Eiffel Tower, Radiola, London, Bournemouth, Cardiff, Nottingham, Newcastle, Glasgow, Aberdeen, P.T.T. and Petit Parisien all audible on loud-speaker.

Madrid, Hilversum, Frankfort, Konigwusterhausen, etc., Voxhaus on 'phones, also four German and three other foreign stations whose call signs I cannot understand. All the above using constant aerial tuning, amateurs 43, including 2VG and 2KV and 2LF. The following Morse stations were logged on August 6: OAA, 8BV, 8BN, 2TF, IRA, 8NK, INA and 5JX.

The only variation from specification is the use of a Sterling square law condenser.—Yours faithfully,

TALBOT.

Coventry.

CONSTRUCTING COILS

SIR,—With reference to your article on p. 555 August 27, on "A Low Capacity Coil," we have for some time been experimenting with this type of coil, British Patent Number 196986, and think perhaps the following labour-saving device may be of interest to your readers. If headless nails are used and a piece of card is pressed over them before winding on the wire, the completed coil may be removed, by lifting the card, without the trouble of displacing, and afterwards replacing, any of the nails, as suggested in your article.—Yours faithfully,

FIDDIAN, BAWTREE & CO.
D. W. BAWTREE.

W.6.

SINGLE-VALVE REFLEX

SIR,—I have just constructed the single-valve Reflex receiver shown in *Wireless Weekly* of September 3 and 10 in the article entitled "How Every Crystal User May Become a Valve Expert," by E. Redpath. I feel I must write and thank Mr. Redpath for this excellent article; the results with the set are splendid. It is only a rough job, but the following stations prove it to be efficient, viz., London, Manchester, Newcastle, Glasgow, Belfast, Birmingham, Aberdeen and L'Ecole Superieure, Paris, and these on the

first " try-out " night after the construction was finished, with only Igranic coils Nos. 35, 50 and 75 in use. I have constructed one or two previous sets from the articles in your excellent papers, notably the Two-Valve Universal Receiver in *Wireless Weekly* of December 5, 1923. This was a fine set, but my single-valve Reflex gives much better results.

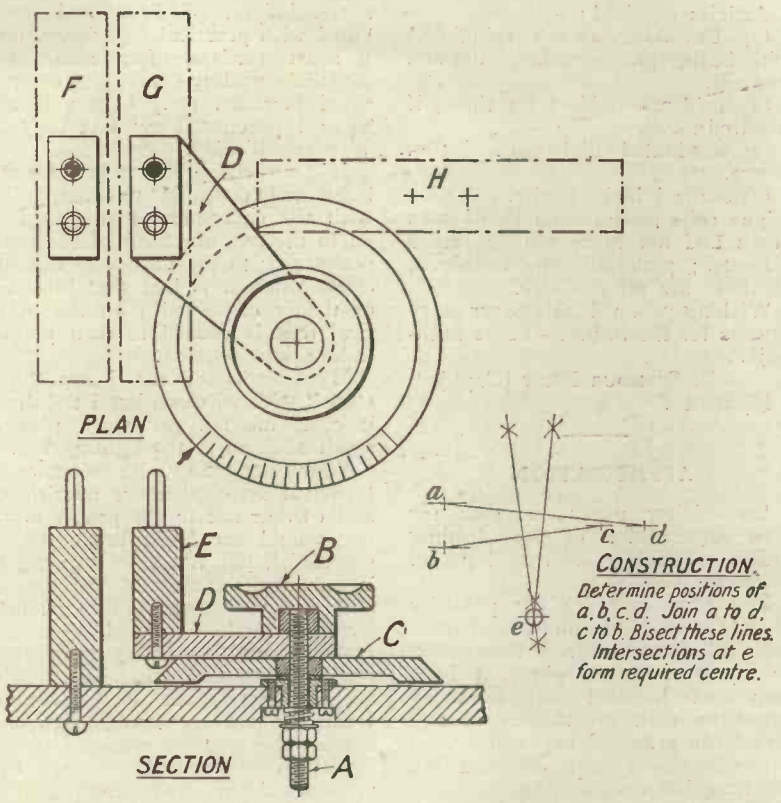
I am using 0.0003 μF variable condensers, as I happened to have these by me.

With the best of wishes for the future of your excellent papers, *Wireless Weekly* and *Modern Wireless*.—Yours faithfully,

Northwich. T. N. G.

AN EASILY MADE COIL HOLDER

SIR,—I enclose herewith a rough sketch of an easily-made variable two-coil holder. It was inspired by the article on " Cross-Coupling " in *Wireless Weekly* of June 11, 1924, p. 185. Everything can be bought from stock except the shaped piece of ebonite D. This is easily designed and made with the help of a pair of compasses and a drill. It is easy to see that by making a second movable holder with the shaped arm D reversed and the spindle placed at right angles to the first spindle, the position in Fig. 5 in the above-quoted article is obtained when fully open. An attachment can easily be added for fine coupling if desired.



Articles required :—

(*a*) Revolving switch spindle A with bush, spring washer, nuts and knob B.

(*b*) Two coil holders (or three, if required).

(*c*) Graduated dial with nut in centre.

(*d*) Some ¼ inch ebonite.

The coils used should be of even depth and not more than 4 inches diameter; preferably the Gambrell, as these are all one size.

Wishing your valuable paper every success for the future.—Yours faithfully,

B. SEYMOUR BAILY (Capt.).

Plymouth.

APPRECIATION

SIR,—Allow me to express my keen appreciation of your leading article in Vol. 4, No. 20 issue of *Wireless Weekly*.

You have indeed given publicity to the thoughts of hundreds of mere practical constructors. Personally, in my own small sphere, I have seen and handled sets built by amateurs with no theoretical and very little practical experience, and naturally the results obtained are anything but encouraging.

About two years ago I began to search for really modern technical matter, something that could be successfully applied to and combined with practical experience, and I must confess after about six months' wading through complicated formula, etc., I gave it up. Then I purchased my first copy of *Wireless Weekly*.

It is surprising how many sets are built and operated unsuccessfully, with the consequent blame thrown on to the manufacturer of the components or to the author of the circuits, when it is just that little bit of theory combined with the practical that is needed to turn partial failure into success.

My friends tell me I am "hot stuff" with wireless, but I tell them it costs me 6d. per week plus a small addition to the lighting bill.

Your suggestions with reference to technical instruction are admirable, and carried out in the proper manner would no doubt prove highly successful, but I venture to suggest it would need men of the proved ability of your own staff to conduct lectures, and I would even go farther than this and suggest that Radio Press, Ltd., be adopted as a national institution. At all events, I can but add my humble appreciation of the services rendered to me by Radio Press, Ltd., through the various publications emanating from Devereux Court, and I sincerely hope success will attend the new home and ventures of the company, as I feel sure it will.—Yours faithfully,

C. H. WHITE.

Luton.

THE RADIO CRITIC

SIR,—Your excellent journal is, for the experimenter and home constructor, a most valuable production. I feel, however, that it does not devote sufficient space to the listener who is a listener pure and simple, *i.e.*, to the person who is absorbingly interested in wireless as a means of entertainment, but has neither the inclination nor the time to dip into its technical intricacies. The prime concern of this huge body of enthusiasts is to obtain good programmes from the B.B.C., and plenty of them. Now, you publish many letters from constructors of sets, but few from listener-critics? Why is this? Do they not write to you, or do you think their utterances out of place in your journal? Until the day comes when an enterprising publisher brings out what we are all eagerly waiting for, a critical paper devoted to the interests of listeners, the wireless press would be well advised, I think, to give more space to criticism of programmes, and of the general activities of the B.B.C.

To set the ball rolling, I venture to draw attention to the following:—

(1) The listener is the keystone of the wireless arch. He pays the piper and has the right to call the tune.

(2) Every legitimate taste, if held by a sufficient number of people, should be catered for. It is the business of the B.B.C. to ascertain those tastes; ours to enlighten them.

(3) A necessary corollary of (2) is that we will not have what we don't want for any reason, least of all because some faddist or fanatic in the B.B.C. thinks it good for us. (The bearings of this observation lie in the application of it!)

(4) There is widespread dissatisfaction with recent B.B.C. programmes, times of transmission, etc. We want an outlet for ventilating this dissatisfaction. Will you give us space until The Radio Critic arrives to promote and protect our interests?

(5) The alternative programme is long overdue.

I hope you will consider the suggestion here made worthy of your consideration. I am sure you would receive many interesting letters from your readers which would tend to make your Journal more attractive than it already is.—Yours faithfully,

P. C. MAYWOOD.

Teddington.

SIMULTANEOUS BROADCASTING

SIR,—I should be glad if your independent columns could contain a protest against the present "S.B." policy of the B.B.C. In complaining to the company one is replied to in round terms (so round that it looks "circular") to the effect that S.B. is generally liked and is confined to artists of world-wide fame. Now the latter statement is capable of proof, and I think the artists in question, say, on a "play night," would be the first to deprecate any idea that their personal fame extends to the Antipodes.

Apart from the question of the nature of S.B. programmes (to which many strongly object), distortion and land line noise coming on top of the poisonous brand of Morse we have in this district, is enough to completely spoil enjoyment.—Yours faithfully,

IVOR P. JONES.

Taunton.

ENVELOPE No. 3

SIR,—I have recently constructed the "Simplicity three-valve receiver," and am more than delighted with it.

Using two valves only (Cossor H.F. and Mullard Detector) the following stations can be picked up nightly: — Sheffield, Nottingham, Hull, Leeds and Bradford, and all the main B.B.C. stations except Cardiff and London (although I can pick up London when Sheffield Relay is not working), Stuttgart, Frankfort, Hamburg, Breslau, School of Posts, Petit Parisien and Madrid, and a German station working on about 410 metres, which I have not yet managed to identify.

Recently I also picked up Rome on 425 metres, after 10 p.m.

Belfast comes in at fair strength, but is badly jammed by Morse.

In daylight, in addition to the above mentioned relay stations, Birmingham and Manchester come in at very good strength, whilst Newcastle is comfortably audible. On two occasions I have picked up Frankfort before 7.30 p.m.

All these stations have been heard on three coils (Igranic), viz.:—35 and 50, and 50 and 75, and I have no doubt that larger coils would bring in the higher wavelength Continental stations.

I have only found it necessary to use three studs of the tuning switch, viz.:—4, 8 and 9, and find that the A.T.C. in parallel gives the best results.

The total cost of the set, less valves, accumulator and H.T. was less than £5, which sum includes R.I. transformer and Igranic rheostats.

My aerial is a standard outdoor

one, barely 30 feet high at its highest point, and running very nearly due north and south.

Please allow me to offer you my congratulations. May I also congratulate you on the Envelope System as a whole.—Yours faithfully,

G. M. EADON.

Dore, near Sheffield.

MORSE TRANSMISSIONS

SIR,—Reference your article in the double number of *Modern Wireless*, by Mr. A. R. Burrows.

I am of the opinion that these transmissions would be of invaluable aid to many experimenters should they be of a slow and progressive nature—remembering always the Army rule: to march at a pace suitable for your slowest men.

The transmissions would be best after the broadcasting programme, say for 20 minutes, with the exception of the late nights devoted to the Savoy dance bands.

Experimenters surely have at least one valve, and I think this would bring in almost any B.B.C. station on Morse, so that the one broadcasting station need not have the whole of these transmissions. I am thinking of the engineers and the late hours that this would entail, and I think the work could be divided up, say, between several stations, without fear that the Morse practice would not be heard by any.

One thing is clear, that the transmission must be dogmatically slow to start with, and should be progressively slow enough so that none loose interest. Those that can read eighteen words a minute can find numerous stations at all hours of the day and night, so it is not for them that I presume your scheme will be intended.

Others join with me in asking your valuable publications to push this scheme, and express our indebtedness to Mr. Burrows on such an enterprise.—Yours faithfully,

R. L. THOMPSON.

Whittlesford.

ENVELOPE No. 4

SIR,—About three weeks ago I purchased the envelope containing particulars regarding the "All Concert Receiver," and wish to give you my results.

I am situated about 2½ miles from the Newcastle station and in a direct line south. My aerial is a single strand, and just on a level with the tops of some very high trees.

I was rather disappointed with the results at first, but am now getting excellent ones.

I am now using B.T.H. B4 valves in all the stages, and have had 50 per cent. better results than when using a Cossor for the H.F. and a Mullard or Marconi for the detector.

Without any wave-trap, I am able to tune in 2BD. at excellent loud-speaker strength and with very slight interference from 5NO. The only other set which I can do this on is the four-circuit Cockaday.

When using bright emitter valves I could not get 5NO up to strong L.S. strength, but now I have to de-tune, as it is much too loud even with the filament just glowing.

I have included a switch for reversing the reaction coil, and I find it very useful.

Radio-Paris .. Loud Speaker.

5XX ...	Good	These are all the B.B.C. stations which I have bothered with so far.
5NO ...	Excellent	
2BD ...	"	
5SC ...	Good	

Le Petit Parisien	Loud in phones.
Vox Haus? (woman announcer).	Fair L.S.
Hamburg ...	Good "
Breslau ...	Fair "

I have had many more foreign stations than these, but have not heard their call signs.

Trusting these particulars may be of interest to you, I remain,—Yours faithfully,

HENRY R. MYERS.

Durham.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

F.W.B. (LIVERPOOL) asks what is meant by hand capacity effects and how can they be avoided ?

If the hand of the operator is brought near to a condenser, inductance coil, or any other metallic part of the receiving set connected to a point of more or less high potential, the capacity to earth or merely the self capacity of the operator's body will alter the tuning of the apparatus. This effect is particularly noticeable in high-frequency amplifiers, and in the reception of short-wave signals, particularly those from continuous wave stations. The effect may be minimised, if not entirely prevented, by screening the variable condenser by means of a thin metal plate secured to the under side of the panel and connected by means of a wire to the earth terminal. The insulating extension handles now on the market also minimise this hand-capacity effect by making it possible to operate the condensers from a reasonable distance. It is mostly in the adjustment of condensers that the trouble is experienced, as they are usually used for the final fine tuning.

J.V.H. (CROUCH END) asks what is the difference between primary and secondary batteries ?

A primary battery is one in which the chemical change which produces the electric current is not easily " reversible," that is, the substances which result from the change cannot be re-converted into their original form by passing a charging current through the cell in reverse direction. Hence, when all the active substance has reached with the exciting agent, the cell is " run down "

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and must be discarded. A secondary battery, on the contrary, operates by virtue of a chemical change which can be reversed by passing a current through it in the opposite direction to that given out by the battery. The materials composing the cell are thereby restored to their original form, and will once more react and give out a current from the terminals of the battery. The battery can therefore be re-charged when it has run down, and the cycle of changes can be repeated almost indefinitely. Secondary batteries, of course, are commonly known as accumulators, though the name is something of a misnomer.

N.A.G. (LEEDS) desires to know the best type of outdoor aerial where space is strictly limited ?

A single-wire aerial of restricted length and height will have a short natural wavelength, and will not intercept and collect much energy from passing electro-magnetic waves. If the dimensions are particularly small, a large amount of inductance (in the tuning coil or coils of the receiving set) will have to be added in order to tune it to the desired wavelength, and the resistance of these turns will cause considerable damping. Under the circumstances, the best thing to do is to increase the number of wires in the aerial, thus increasing the capacity and consequently its natural wavelength. The disadvantages of a large-capacity aerial have already been mentioned in answer to an earlier question. A good effect can be obtained by the use of spreaders, say 7 ft. 6 ins. long, carrying four wires spaced 2 ft. 6 ins. apart. The down-lead should also be of four wires joined together at the point where they enter the receiving room.

W.E.M. (WOODFORD) wishes to know whether the natural wavelength of an aerial affects reception and transmission ?

Certainly. If the natural wavelength of an aerial is 400 metres, and it is desired to receive waves 300 metres in length, the natural wavelength has to be artificially reduced by the use of a small series condenser, which appreciably lessens the efficiency. On the other hand, if the natural wavelength of an aerial is about 200 metres, and it is desired to receive waves 3,000 metres in length, a very large amount of inductance has to be added in series with the aerial. The resistance of the turns of wire forming the inductance introduces what is known as damping and the efficiency is again low. It will be understood, of course, that in order to operate the receiving apparatus, there must be a certain number of turns of the tuning inductance in circuit. In practice the best possible results are obtained when the natural wavelength of the aerial is from two-thirds to three-quarters the wavelength which it is desired to transmit or receive.

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THE most absorbing Book on the Valve yet published. The author, John Scott-Taggart, F.Inst.P.,A.M I.E.E., Editor of *Modern Wireless*, has purposely set out to produce a book which will appeal to the very large circle of Radio enthusiasts who are very keen but who are not too technically minded. Taking the form of questions and answers, it provides an ideal source of information for every valve user.

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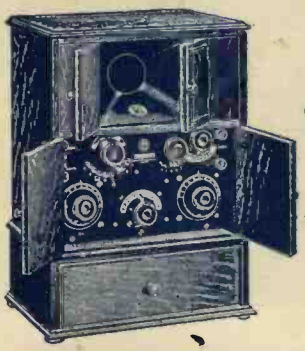

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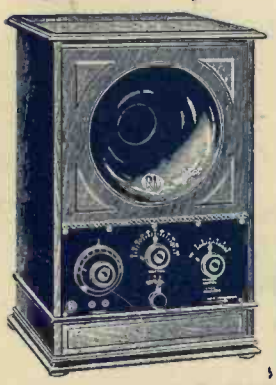

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Spare copy

Wireless Weekly

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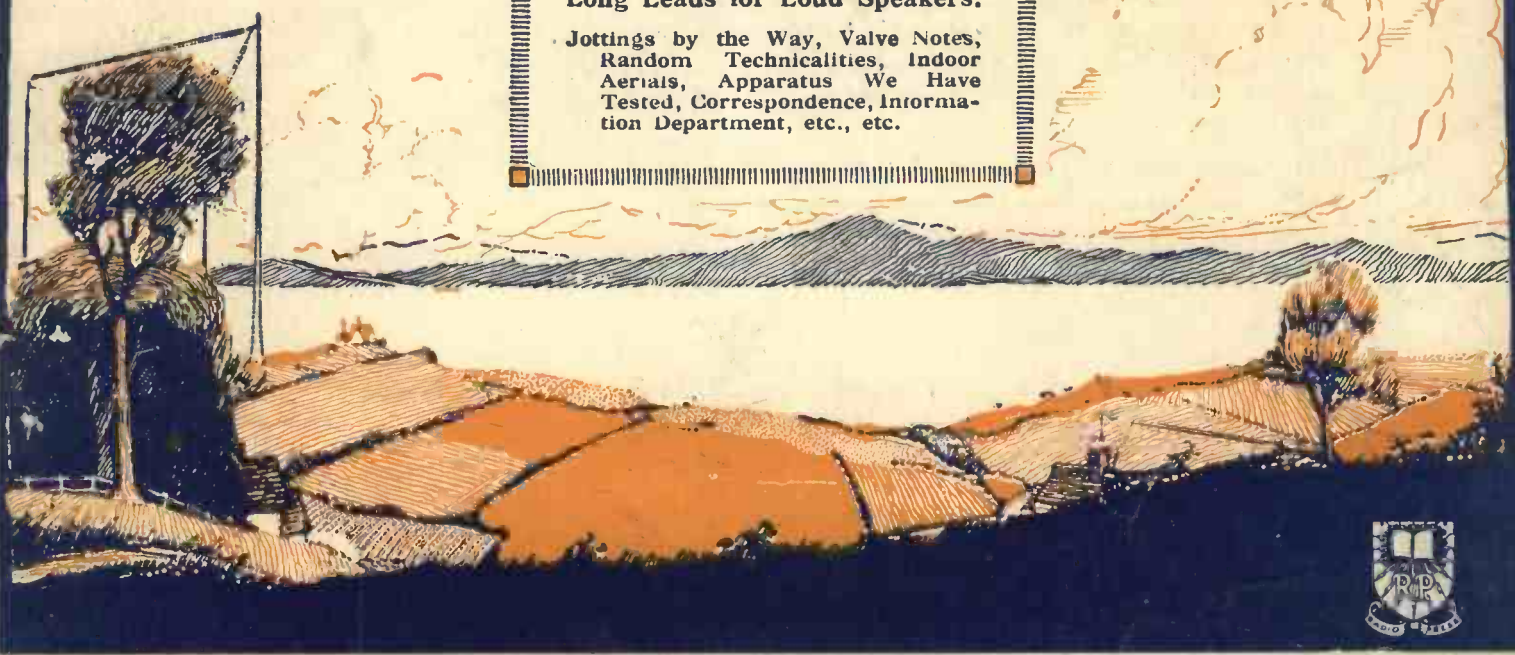

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More Post Office Disclosures

OUR criticisms of the Post Office officials in connection with their general attitude towards licences, and particularly experimental licences, has brought to light innumerable cases of, on the one hand, unnecessary hardship, and, on the other, Post Office bureaucracy and pettiness.

The remarks of Dr. Eccles, on the occasion of his Presidential address, were in no sense exaggerations.

One of the absurdities of the existing regulations is pointed out by Captain Ian Fraser in a letter to *The Times*, of October 9. Captain Fraser, of course, is the President of the Transmitter and Relay Section of the Radio Society of Great Britain. He writes as follows:—

"On the evening of Sunday, September 21, I was communicating with an amateur friend of mine with whom I was conducting some experiments. He was a good distance from my station, and I desired to know the effect upon his reception of my signals of certain adjustments which I had made. When I had concluded working with him and was listening for a few minutes to other amateur traffic, I heard a French station calling me. The French station was four or five times as distant as my English friend, and a report from him, situated as he was, would have been of very great value. If I had answered him I should have contravened the Post Office regulations, and have endangered my licence, so I had to lose valuable information, and, incidentally, as Dr. Eccles puts it, turn a deaf ear to another experimenter who wanted to be helpful."

The above example is only one of hundreds regularly occurring.

The Post Office require "detailed particulars of any experiments with stations abroad, and evidence of an arrangement for co-operation by a foreign or colonial experimental station" before they will give any permission.

This means that if a British transmitter is called up one night by an American amateur, his correct procedure is to reply by letter to such an amateur, fix up a working arrangement with him, send detailed particulars of the experiments it is proposed to carry out to the Post Office, and ask for the requisite permission. The next step, after several weeks, or, perhaps, months, is to reply to the call. By this time summer conditions may have intervened and communication is impossible. The crass absurdity of such regulations is appreciated by all but the Post Office officials. The whole usefulness of experimental work of this nature is in being able to carry on long-distant communication, and to reply at once to a call from some distant country. Short range experiments are of very little use, and a few hundred miles is the most that can be accomplished in this country. Incidentally, British experimenters, tied hand and foot as they are by Post Office regulations, are a laughing-stock to those of other countries.

To examine the questions asked by the Post Office before a transmitting licence will be granted, and the conditions on which such licence is granted, if ever, will be a revelation to any experimenter. The trembling applicant is expected to give the fullest details of exactly what he proposes to do; he is to give the circuits he is going to use, the size of the accumulators he proposes to employ, and many details which he either cannot give in advance, or which are quite unnecessary. We cannot understand why any regulations regarding circuits should be imposed. As it is, however, an experimenter who proposes to carry out experiments on all sorts of different transmitting circuits (many of which he may evolve as he goes along) is expected to give these circuits in advance. This, in many cases, will be equivalent to asking the experimenter to provide the Post Office with a solution of the problem when he asks for permission to attempt to solve it.

Supposing a would-be transmitting experimenter wishes to evolve a new method of modulation through being dissatisfied with the existing methods. How can he, in advance, give details of experiments which he can only make as he goes along?

The same absurdity occurred in the old receiving licences, and *occurred there unnecessarily*, as has since been proved by the hundreds of thousands of new licences issued.

The only answer which the Post Office has made is in the nature of a

(*Continued on p. 796.*)

CONTENTS

Fig. 1.—A tripod is desirable for outdoor use.

The Design and Construction of a Loud-Speaker Horn

By ALAN B. CALKIN.

A simple method of making a really effective horn in accordance with the latest developments is described in this contribution.

THE following article is intended to help those readers of this periodical who are desirous of making an efficient loud-speaker horn, which combines both purity of tone and excellent volume, and at the same time one whose construction is well within the scope of the average reader.

The horn, which is square in section (see photo) is made exclusively of wood; the curved faces of 3-ply mahogany 2 mm. thick, and the ribs of silver spruce. It is, perhaps, particularly suited for outdoor work, as the sound carries in quite a remarkable way,

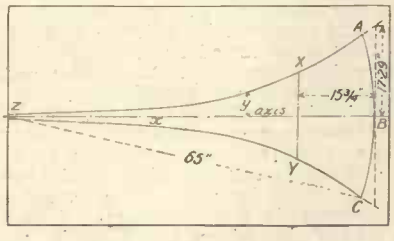


Fig. 2.—Dimensions of the horn.

largely owing to its unusual axial length (about 5 ft.). If a little trouble is taken, the horn can be made to look very elegant, whilst the overall cost does not exceed 15s.

The first step necessary is to draw out full-scale drawings on paper of the shape that each face will assume when laid flat in one plane. This is best done by drawing a line down the centre of the paper lengthways, to represent the horizontal axis, and marking off distances (x) along it from one end, and corresponding ordinates (y) at right angles above and below the axis, according to the following table :—

x in inches :—
0 12 24 36 42.5 49 56.4 65
y in inches :—
0.25 0.50 1.24 3.04 4.78 7.41 11.35 17.29

(The above figures were obtained by inserting suitable constants in the formula

$$A_x = A_0 e^{Bx}$$

where A_0 is the area of section of the small end, A_x is the area of section at any point distant x from the small end, B is a constant.)

Drawing the Outline

The curve itself is best obtained by inserting pins in the above points, and running a cotton along tied to the end pin and touching all the others. By running one's eye along the cotton, other pins, as many as considered necessary, can be inserted to give a better approximation to the desired curve. When both curves have been obtained in this way, lines joining consecutive pin holes can be drawn, and the curves cut out. The horn has a much more finished appearance if the wide end of each face is slightly curved. This can be done with a pencil and string, by striking an arc ABC of radius the axial length, viz., 65 in., and centre (Z) on the axis at the small end, see Fig. 2. Cut away the rest of the paper to the right of the arc and we are ready to cut the plywood to the pattern just obtained (Fig. 2).

Materials

If the wood can be purchased in sufficiently large sheets (6 ft. × 3 ft.) the construction of the horn is somewhat simplified, as each face will consist of one piece of wood only. In the writer's case, however, the plywood was supplied in sheets 5 ft. × 16 in., three of these sheets being necessary, and it was found economical to make each face in two pieces, joined along the line XY in a manner to be described later. The three-sided piece (XYZ) was cut with the grain parallel to the axis, whilst the remaining piece (XYAC) was cut with the grain running perpendicular to the axis. Fig. 2 shows the lay-out of the pieces XYAC, four of which will be required, and Fig. 3 shows the lay-out of the pieces ZXY, of which four will be required also.

Marking Out

The wood itself can be marked out by laying the paper pattern flat on it, and by tracing round the curves with a pencil. If the correct type of saw is not available, a strong hacksaw blade

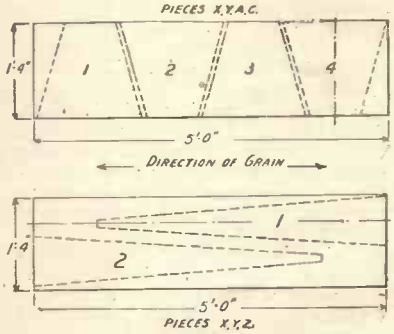


Fig. 3.—Cutting out the parts.

fitted into a file handle will be found just as serviceable. When the four pieces (XYAC) have been cut, they should be clamped together, and the curved edge ABC planed and papered. It will also be necessary to plane off at the same time ¼ in. from the side XY to make clearance for the tongue joint. The sides AXZ and CYZ can be left unplaned, for reasons which will shortly be obvious.

We should now have provided

ourselves with four pieces of plywood of the shape (XYZ) and four of the shape (XYAC), of which the sides ABC and XY of the latter four are planed and papered. We are now ready to make the ribs.

As previously mentioned, these are of silver spruce and should be cut from lengths, if possible, not less than 6 ft. 6 in., as difficulty may otherwise be experienced in bending. Fig. 6 (2) shows the method of cutting the ribs to the

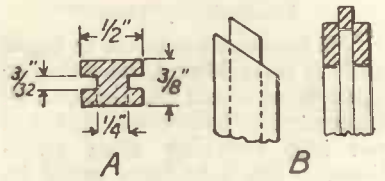


Fig. 4.—The tongue joints.

correct shape. A section is drawn after each cut has been made.

The object of cutting grooves $\frac{3}{32}$ in. wide instead of 2 mm. is to make the fitting easier. When the four ribs have been cut to the above dimensions they are ready for the bending process.

If a little care is exercised the bending can be carried out dry, that is to say, steaming is unnecessary. The method is as follows. Commence by holding the rib near the middle with the hands about 12 in. apart and the thumbs pointing inwards, and pressing on the side represented by PQ, Fig. 6, Section 5. Now apply a bending action with the hands in a manner which will bring the concave side of the rib nearest you, that is to say, the two grooves will be on the outside of the curve. Release the pressure on the hands, and repeat the process several times, each time straining the wood a little more. The process must be carried out steadily, and the wood should only be strained a little each time, otherwise folding of the fibres will occur on the inside, which may ultimately result in fracture. When the centre is sufficiently curved the hands should be shifted along, and the process repeated for the entire length. It is most important that each rib should be bent to the correct curvature before finally attempting to assemble the various parts. The curvature should constantly be tested during bending by inserting the faces in the grooves and seeing whether the curves coincide. If the ribs have been cut from 6 ft. 6 in. lengths as suggested there will be about 12 in. over, which will be found most useful at the wide end during the bending process, and should not be cut off until the horn is finished.

Before finally assembling the various pieces, we must provide ourselves with four pieces of wood to form the tongue joints of the two faces (XYZ) and (XYAC), Fig. 1. These should be of the same silver spruce 16 in. × $\frac{1}{2}$ in. × $\frac{3}{8}$ in., and should be rabbetted out as in Fig. 4 (A).

Fig. 4 B shows the method of cutting the ends of these pieces

Fig. 5.— A commercial instrument with an unconventional horn.

so that the small tongues formed fit into the grooves of the ribs. It is best to cut and fit each of these separately as it is wanted.

The assembling must be done in the following order.

Two ribs are first glued and clamped on to one of the (XYZ) faces. If the face has been cut correctly it will be found that the two ribs just touch one another at the small end. (A glue brush will probably be found clumsy, in which case the glue can be applied to the grooves with a thin piece of wood.) While the glue is drying, do exactly the same with the other two ribs and one of the other faces. When these are set hard, and not until, the pieces of wood to form the tongue joints can be cut and fitted to each section, both of which can now be completed by glueing the remaining (XYAC) faces into position. It is advisable at this stage to remove any glue which may have adhered to the sides. The two remaining (XYZ) faces can now be fixed, both of these being glued into the grooves of the same section. The next stage of fitting the two sections together should, if possible, be done by two people, although it is possible to do it single-handed. When the glue has been applied to both edges and to both grooves, the fitting should be begun from the smaller end, both edges being worked into position simultaneously. It will be found a great help to bind string round the outside of the horn until the glue is set hard. When this is the case, the two remaining tongue joints and (XYAC) faces can be fixed.

The horn is now ready for the finishing touches. The ends of the ribs should be sawn off, and the horn, if necessary, can be papered.

In the writer's case, better results were obtained by cutting off about 2 in. from the small end of the horn, and filing out the inside to about 1-in. diameter. This was done to accommodate the end of the sound box. The

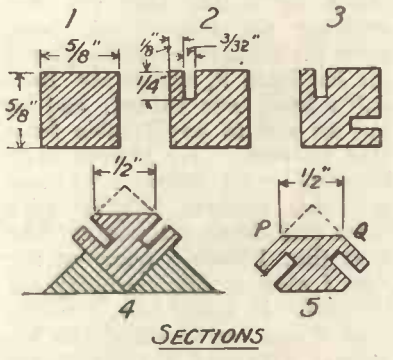


Fig 6.—Preparation of the corner ribs.

tripod shown in the photo is a stand for a telescope, which can be used to great advantage for outdoor work. If the loudspeaker is used inside the house, it is a good plan to suspend it in the corner of a room with the sound box quite high up and the horn hanging slightly downwards.

Sticking to It

AS I told you last week, we found certain difficulties when we started out to amass information about transmission. The General's visit to Mr. Bendall was, however, completely successful. When he discussed it with me after his return he told me that he had left nothing to chance. Before journeying to the Information Department he deposited his note-case with the hall porter at his club, taking nothing in his pockets but two half-crowns and twopence for his return 'bus fare. He certainly appears to have got his full five bobs' worth. Probably he was ingenious enough to ask about seven questions in one, or to make each of them a really good one, such as, "Now show me exactly how one transmits, remembering that I know nothing about it." He tells me that noticing the stop watch lying upon the table he carefully placed his hat upon it, whilst Mr. Bendall's back was turned, and so put an end to any trouble from that quarter. He arrived back bursting with information and with his pockets bulging with notes and circuit diagrams. The next time I have a query of my own I shall certainly employ the General. It would pay, I think, even if one had to stand him his railway fare and a good lunch.

Once bitten . . . .

It was decided by the club that I was far too useful to send on further missions of inquiry myself. Hence I was relieved of the necessity for approaching other members of the *Wireless Weekly* staff. But I must say that I am getting rather annoyed by the way in which they behaved when I arrived at the office. I have noticed for some time that if any of them have gadgets lying on the tables before them, they are always careful to remove them from my reach when I sit down. This, I think, is most uncalled for and does not show the proper wireless spirit.

A Staff Job

Anyhow, I was given what we may call a brass hat job at the club to superintend the making of the set. Now if there is one thing that I really can do well it is to watch other people working and tell them how to do it. When, for example, Poddleby is engaged in soldering an almost inaccessible joint I like to stand at his elbow showing him precisely how to carry out the job. He is apt to become rather ratty, and on occasions he has brandished his hot iron in my face, but, on the whole, I think it stimulates a proper show of activity. Thanks mainly to my untiring labours, the major part of the set was complete in almost record time and all that was required was the generator. Snaggsby was entrusted with the task of purchasing this, and returned from town one day with a small but exceedingly heavy packing case. This proved to contain a neat little thing looking like a cross between a magneto and a torpedo, to one end of which you attached a crank. Gubbsworthy was engaged in fixing leads to its terminals when I thought that I had better see if the crank fitted properly. It went on quite nicely and I gave it a preliminary whirl to see that all was well. Gubbsworthy, whose conductivity must be of the order of several megamhos, leapt into the air with a scream, and we all agreed that as far as the first test went the generator appeared to be eminently satisfactory.

Preliminary Tests

We confined ourselves to begin with to mere Morse, resolving to discover all about the elements of transmission before we launched out into anything more ambitious. No volunteers could be found to undertake the somewhat strenuous task of twiddling the crank of the generator, so the lad Edward Bugsnipp was hired at sixpence an evening to supply the necessary motive power. At the end of the first hour he went on strike, contending (*a*) that he wasn't no bloomin' donkey engine, and (*b*) that his union would not allow him to work in the evenings at less than a shilling a time.

Generator Troubles

Having compromised for ninepence, we were able to get on again, but Edward was never really a satisfactory source of power. His output was apt to be distinctly fluctuating. When he was fresh he would seize the handle and whirl it until things fairly hummed, but he rapidly became bored with his job and took a much greater interest in the doings of Poddleby, who was operating the tapping key. At such times he would lean over Poddleby's shoulders breathing heavily, whilst the r.p.m. became smaller by degrees and beautifully less. We decided, therefore, that before we made our *début* on a large scale in the transmitting world it would be better to install a generator which did not rely upon boy power. Our second instrument had once formed part of an aeroplane, and the Admiral was very keen that it should be driven by a little windmill erected on top of the club house. But as little Puddleton lies in a hollow, we felt that the wind might be an even more uncertain quantity than Edward Bugsnipp, even if it cost nothing,

and we decided to install a small gas engine to do the driving. Both Poddleby and Bumpleby-Brown blew themselves up with it once or twice, but otherwise it worked most satisfactorily. The only person who raised any objections was Winklesworth, who lives next door to the club. He appeared to dislike the fact that the exhaust pipe came out just by his study window, with the result that the room, when the set was working, was filled with an odour anything but sweet. However, we soon settled him by pointing out that he had no right to be in his studywhen transmissions were in progress, and that in any case he should be prepared to make certain sacrifices for the good of the club.

The new educational broadcasting is of great help in schools. A description of this school's work is given in our correspondence pages.

Our Splash

In spite of the fact that none of us is what you might call an expert at Morse, our key-pounding experiments were most encouraging. Poddleby, our star operator, soon achieved a speed of three words a minute, inclusive of corrections and repeats. We all agreed that things were going very well, and before long it was decided that the time had come for us to show that the Little Puddleton Wireless Club was no small beer in matter of transmission. We decided that our first night of telephony should be something really worth writing home about. We would not merely get into touch with some amateur station and ask, " Is my modulation O.K., old man? " or other time-honoured questions, such as you may hear on any evening. Rather we would broadcast a musical programme which would compare favourably with those sent out by 2LO and other mere professional broadcasting stations. Before we could do this it was, of course, necessary to obtain special permission. We had no difficulty about this, for we simply wrote to the Post Office saying that we required their sanction for something not covered by our transmitting licence and that we proposed to send up General Blood Thunderby to explain personally. This had the desired effect, for by return of post came a letter addressed personally to Poddleby, our secretary, and marked private and confidential. It said that they did not know what we wanted, but they had seen the General before, and if we would only keep him at home we could do what we liked.

The Programme

As our power was not very great we thought it unwise to advertise the transmission in the daily press; but it seemed good that the inhabitants of Bilgewater Magna should be fully informed of the treat that was in store for them. I was entrusted with the task of informing their secretary and motored over on the following day. Unfortunately my car had to be back in Little Puddleton rather early, since the other 'bus had broken down, and it was the only one on the route. I had therefore only five minutes with the secretary of the Bilgewater Magna Club, but in that short time I tried to make plain to him what an important occasion this first transmission would be when it took place on the following evening. Having begged him to impress upon the members of his club the necessity for not allowing their receivers to oscillate, with an airy remark that I understood there had been many complaints of interference in his district, I left him and motored back. There was a little difficulty about the fare, since I had spent my last remaining sixpence on a packet of cigarettes in Bilgewater Magna, but I appeased the conductor by presenting him with one of Snaggsby's gridleaks which I found in my waistcoat pocket.

The Great Evening

When the evening itself arrived all of us were a little nervous. We felt that nothing must happen to mar the club's great reputation. Poddleby was in charge of the transmitter as chief engineer, whilst I, owing to my eloquence and my charming voice, was given the job of announcer. The hands of the clock moved to 7.30. " All ready? " said the General. " Quite ! " replied Poddleby. He threw over the switch whilst I took up a graceful stance before the microphone. " Hullo the world ! " I said. " Hullo the Earth ! This is Little Puddleton calling ! General Blood Thunderby, our respected president, will now open our transmitting station." The General, mopping his brow, advanced rather hurriedly towards the microphone. His left foot caught in one of Poddleby's stray leads, and, to save himself, he flung out his hands, which came into contact with the terminals of Poddleby's generator, now working at record speed. When the General finally reached the floor he was embracing the microphone stand, and it appears that his remarks not merely buckled the instrument, but also burnt out seventy-five per cent. of the receiving sets within a ten-mile radius. Still, we are not downhearted. We shall transmit once more as soon as our president and the microphone have recovered.

WIRELESS WAYFARER.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

SOME commercial sets and a few home-constructed receivers operate with a single rheostat which controls the filament current to all valves. An interesting point worth mentioning is that an adjustment of reaction must be so made that when the filament current is increased a full build-up of signal strength may be obtained without the set breaking into self-oscillation.

Reaction Adjustment

For example, if the reaction has been made too tight and the listener turns on his rheostat gradually, it is quite likely with the particular adjustment of reaction the valve will oscillate before a sufficient signal strength from the loud-speaker, or telephones, has been obtained. This, of course, is because an increase of filament current within certain limits increases the amplification factor of the reaction valve and consequently increases the oscillation tendency. It is extremely likely that in many adjustments of the reaction, while the coupling is too tight, self-oscillation of the reaction valve will occur before the filament current for the low-frequency amplifying valves has reached its correct value.

Coupling Value

The reaction coupling should be of such a value that with the valves all well on the set will not oscillate. Under these conditions a variation of the rheostat will give a good control of signal output; but if, on the other hand, the reaction circuit has in the first place been made too tight, no control at all of signal strength will be obtained, because the reaction valve oscillates before the other valves give their full output.

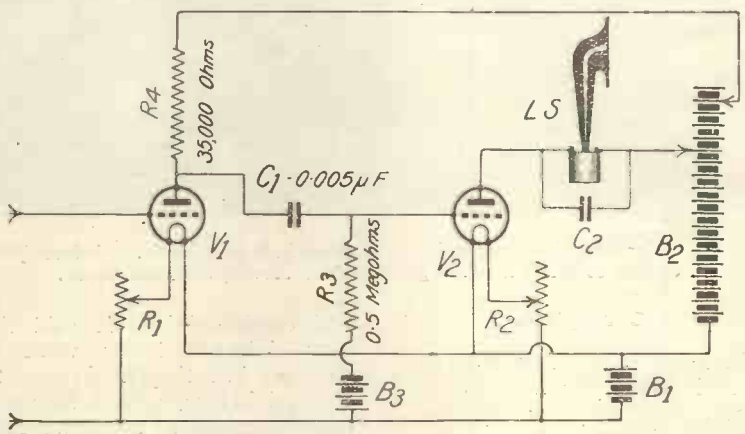
I have been using for many months a set, using dull emitter valves of the .06 type, using dry batteries as a source of filament current.

A slight drop in voltage of these batteries is inevitable after the set has been working some little time. I have not found, however, that using three large bell cells to feed three valves causes much trouble in this direction; but the little problem described above is intimately associated with dull-emitter valves and dry batteries.

The difficulty arises in this way. The reaction (made by the inexperienced operator) is adjusted to the critical value, and the rheostat so adjusted that just sufficient current is passing through the valve to give the desired signal output. After a little time the signal strength may fall off, due to the voltage across the filaments of the low-frequency amplifiers falling off.

Master Rheostat Adjustment

The natural tendency is to increase the normal current through the filaments to allow for a little drop of voltage in the battery without affecting signal strength; the increase now, of course, while not affecting the low-frequency valves, will cause the reaction valve to oscillate, so that the best way of adjusting a receiver of this kind is to adjust the master rheostat so that the current through all valves is greater than would be required when the set is first switched on. This will then allow for the battery voltage dropping a little. On the higher value of filament current the reaction is adjusted to the best point. If these conditions are observed, no trouble will be experienced by the novice in using a master rheostat.



Resistance coupling details.

Resistance Amplification

An interesting new component produced by the Radio Communication Company is a resistance unit which consists of a wire-wound non-inductive resistance, constituting the anode resistance, a fixed condenser and a gridleak, which latter goes across the grid and filament of a second valve.

The anode resistance is made of wire because the manufacturers are of opinion that there is no anode resistance on the market which is sufficiently con-

stant and capable of carrying an adequate anode current. The resistance, however, is only 35,000 ohms, which is less than that usually employed for this purpose. The coupling condenser has a capacity of .005 μF, also a lower value than that usually employed. It will be recalled that I pointed out in these columns that a value of from .002 μF upwards was suitable for this purpose. The gridleak has a value of ½ megohm.

Lag Effects

These values appear to be arrived at only after considerable work on the subject, and apparently a compromise has been made between signal strength and purity of reproduction. It is, of course, a common experience to find a resistance-coupled amplifier in which there is a decided lag effect. Users of the Puriflex, for example, will find that an alteration of an adjustment is only followed after a perceptible period by the result.

It needs only a little thought to realise that the coupling condenser between the anode of one valve and the grid of the next is isolated by two high resistances, one of which may have a value of from 20,000 to 100,000 ohms, and the other a value of 100,000 ohms to 5 megohms (the gridleak), according to the design of the circuit.

Suitable Characteristics

The charging and discharging of this condenser, taking place as it does through a high resistance, may take some perceptible time, and, consequently, from this point of view, the resistance values should preferably be kept as low as possible. This, however, would result in a decrease of signal strength, so that some compromise has to be obtained.

It is extremely important in resistance amplification to see that the valves used have a suitably straight characteristic curve, and that proper negative grid bias is given. If this is not done, a preceding valve will produce rectification, and the rectified currents will charge up the coupling condenser between the anode of the valve and the grid of the next. The resulting distortion is one of the troubles which the experimenter has to face, and a suitable choice of resistances and condensers will minimise any troubles that may arise through unintentional rectification.

Choking also frequently occurs, and this, of course, may be very prevalent if the experimenter is not skilled in the handling of reaction. The signal strength of a beat note with the incoming carrier wave may very readily choke up a resistance amplifier for some short space of time, and if gridleaks are of too high a value, the accumulation of electrons on the grids will take a very appreciable time to leak away.

The same effect is obtained if strong signals are being received. It is because a blasting effect occurs, *i.e.*, the grids of the valves become positive and electrons are consequently drawn from the filament to the grid and charge up the grid condenser. This charge will take time to leak away, and consequently it is desirable to have the gridleak of sufficiently low value to enable it to drain off the electrons rapidly. A normal negative grid bias will, of course, make a great deal of difference, but even when this is done a momentary strong note or signal may carry the grids positive.

If the gridleak is of too low a value, signal strength will be reduced, and similarly if the anode resistance is of too low a value, the same effect will be obtained.

It will thus be seen that resistance amplification involves compromises, and the best values depend largely, not only upon the type of valves used, but upon the signal strength desired, and also whether constant purity is required, or whether an occasional little blast won't do any harm.

Mr. G. L. Morrow, of the B.B.C. adjusting the apparatus used to broadcast animal cries from the Zoo.

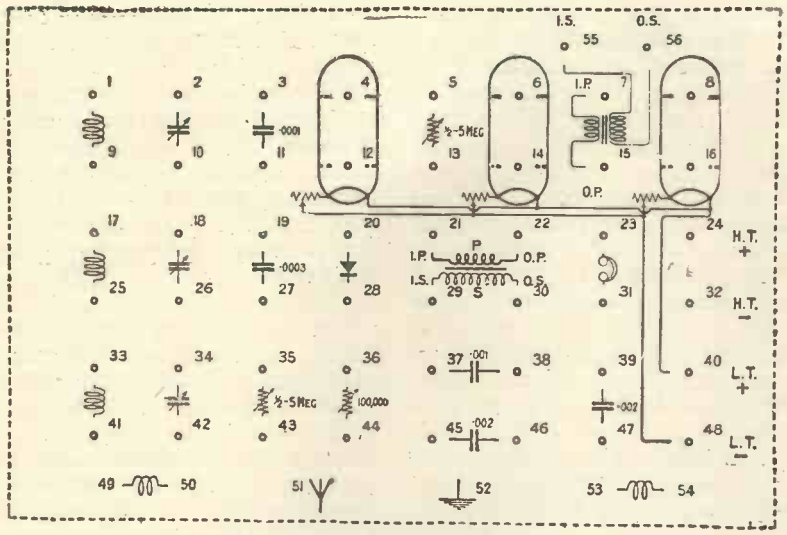


Fig. 1—The terminal board.

A Double . . . . . Reaction Circuit on the Omni Receiver

An interesting circuit which may be tried upon this popular experimental receiver.

THE interesting phenomenon known as "double reaction" was first described by Mr. John Scott-Taggart in *Modern Wireless*, Vol. 1, No. 1, and the circuit in Fig. 2 employing this principle, provides scope for considerable experiment.

The aerial is tuned by the coil L1, and variable condenser C1 of 0.0005 μF. The oscillations in the aerial circuit are applied to the grid of the first valve V1, which acts as a high-frequency amplifier. These currents appear in amplified form in the anode circuit of this valve, which is tuned by L2, and C2 of 0.0005 μF. The coupling between the first and second valves is effected by means of the fixed condenser C3 of 0.0003 μF and the grid-leak R4. The reaction coil L3 is included in the plate circuit of the second valve, which acts as a detector, and also the primary winding T1 of the L.F. inter-valve transformer T1 T2, across which is shunted C4 of 0.001 μF. The secondary winding T2 is connected across the grid and filament of the low-frequency amplifying valve V3, in the anode circuit of which are included the telephones T, shunted by C5 of 0.002 μF.

Coils

The coils L1, L2 and L3 are placed in a three-coil-holder in the order shown, *i.e.*, L1 and L3 on the outside and L2 in the centre. Double reaction is obtained by this means, the anode coil L2 introducing reaction into the aerial coil L1, whilst L3 introduces reaction into the anode circuit of the first valve. Of the two methods of obtaining reaction, the latter is the safer, since its use is far less likely to cause interference to other listeners than is the use of reaction directly on to the aerial. Consequently, when first operating a set employing this circuit, it is advisable to keep the coils L1 and L2 as far apart as the sockets of the coil-holder permit.

Connections

A few connections on the terminal board of the Omni receiver suffice to wire up the circuit, and are as follows:—

51—1	6—41
1—2	33—22
52—9	22—37
9—10	21—38
2—12	21—23
52—48	23—24
4—25	30—16
25—26	29—48
17—18	32—40
26—19	8—31
27—14	39—23
27—35	31—47
43—40	17—23

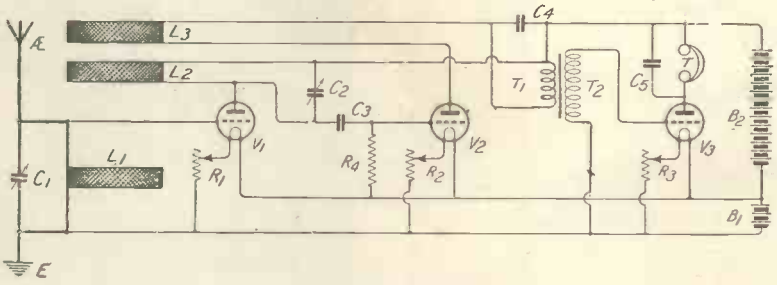


Fig. 2—A double reaction circuit for the "Omni."

Coils

For the aerial coil Nos. 25, 35 and 50 should be tried in the rear moving socket of the three-coil-holder, on the usual broadcast wavelengths. The anode coil, which should be plugged into the centre socket, will be a No. 50 or 75, as also will the reaction coil in the anode circuit of the detector valve, the latter coil being plugged into the front socket of the coil-holder.

For Chelmsford, in the order of aerial, anode and reaction, the following sizes of coils will be suitable: Nos. 150, 200 and 250.

Operating the Set

As indicated previously, the aerial coil in the rear socket should be kept well away from the centre coil when tuning is first commenced, and care should also be taken whilst adjusting the position of the reaction coil in the front. Tuning is carried out on the aerial and anode tuning condensers, and when signals are heard the reaction coil is moved slowly towards the anode coil, at the same time retuning on aerial and anode condensers, the latter

requiring the greater readjustment. If this does not result in an increase in signal strength, the leads to the reaction coil should be reversed. This is easily effected by disconnecting the leads 6—41 and 33—22, and joining 6—33 and 41—22; the above procedure is then carried out once more. The effect of bringing the aerial coil L1 towards L2 may now be tried, taking great care, however, to see that the set does not break into oscillation. Both variable condensers will need careful retuning as before. It is possible that a reversal of the leads to the aerial coil is necessary, in which case the alterations required are: Disconnect 51—1, 2—12, 52—9, and join 9—51, 10—12 and 1—52. Practice is required in the tuning of circuits of this type, as might be expected owing to the additional adjustments required.

Experimenting with the Circuit

Experiments worth trying, such as the reversal of the connections to the secondary winding of the transformer, will doubtless occur to the reader, and are always worth carrying out when a little extra efficiency is sought. The experiment mentioned necessitates the following alterations: Disconnect 29—48 and 30—16, join 29—16 and 30—48.

Constant aerial tuning will be appreciated where experimenting in different sizes of coils for the aerial socket is distasteful. This form of tuning requires the inclusion of a 0.0001 μF condenser; the necessary alterations are therefore: Disconnect 51—1 and join 51—11 and 3—1. A No. 50 coil will now be suitable for broadcast wavelengths below 420 metres, while for those above 420 metres a No. 75 should be used.

"Fiddling While Rome Burns"

A Note by the Editor.

AT the conclusion of the presidential address dealing with the position between the Post Office and the Radio Society of Great Britain, an anti-climax arose.

It is, apparently, the intention of the Radio Society to issue a badge which is to be worn by all members of the Society, and by members of affiliated societies with some small modification. The occurrence of this suggestion at a time like the present one strikes us as bathos. It is in the nature of a descent from the sublime to the ridiculous.

Surely the Council of the Radio Society must know that badge-wearing never has been, and never will be, a hobby of the average Britisher. In America there is a different temperamental attitude, and members of the Driton (Pa.) Prohibition League like to recognise fellow-members in whatever part of the world they may be; but we on this side regard as just a little vulgar the wearing of badges of this description.

If the badge is to be worn at meetings only, this would be bad enough, but in such an event a badge would be unnecessary. If, however, it is proposed, as the official organ of the Society states, that this badge should be worn "as a means of introduction amongst amateurs all over the country," and ultimately "in every part of the world," the general prestige of the Radio Society of Great Britain and its associated societies will be reduced to the level of a school picnic party.

We really seriously cannot picture the Council of the Radio Society walking down to the Embankment with badges in their lapels. If they themselves are not prepared to wear these badges in public (and we believe that they will not be), why should they cast reflections on the good taste of the rank-and-file members of the Society and members of affiliated societies?

A design which was unfortunately too late for entry.

We hope that these latter societies, if not the parent one, will turn the scheme down as unworthy of what should be an important Society, and what is an important movement.

What members of other technical societies display a badge? As far as we are aware, British technical societies do not go in for this sort of thing. They realise that it is simply "not done." If they were to put forward such a childish idea, we are perfectly sure that their members would have the good taste not to wear the badge.

Perhaps small schoolboys might take delight in wearing a badge, but we cannot believe that an adult British citizen would display a membership token of any kind whatsoever.

The idea of an august Council of the Radio Society discussing the pros and cons of badges at the present juncture is reminiscent of Nero fiddling while Rome burns.

Why not give up the idea, and make a graceful retirement by suggesting that the badge be used simply on the notepaper of the different societies?

A pursuance of the present intention will only result in calling down ridicule upon a Society which needs every ounce of prestige and dignity it can muster in these days.

A Series Parallel Switch

MOST students of wireless find occasions arise when the effect of changing the aerial condenser from series to parallel or *vice versa* is desired. With a view to avoiding the otherwise necessary disturbance of connections, the series parallel switch here described has been devised. By its use a small rotation of the knob will enable either type of connection to be immediately changed to the other.

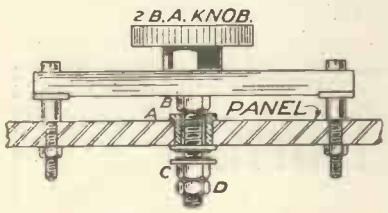


FIG. 1

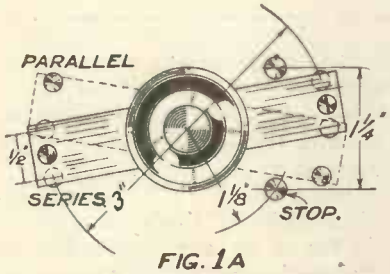


FIG. 1A

Figs. 1 and 1a.—Complete switch.

Components needed.

The necessary materials are :—

One ebonite strip ⅝ in. x ¼ in. x 3⅜ in. long.

One ebonite knob tapped 2 B.A.

Six contact studs.

Two switch stops.

Two pieces of brass strip ⅜ in. x 1-16 in. x ⅝ in.

Two 6 B.A. screws.

Three 2 B.A. nuts and washers.

One 2 B.A. screwed rod 2 in. long.

The ebonite strip is filed down 1-32 in. at each end for a width of ⅜ in., as indicated in Fig. 2, and the centres of the grooves are drilled to give clearance holes for a 6 B.A. screw. In the middle of the strip another hole 3-16 in. diameter is drilled. The two pads (Fig. 2), which are made either from 1-16 in. sheet brass or sheet copper, are drilled and tapped for a 6 B.A. screw, and each fixed by a single screw into the recess or groove at the end of the ebonite strip (see Fig. 1).

The 2 B.A. rod 2 in. long is then tightly screwed into the ebonite knob, passed through the 3-16 in. hole in the main strip, and locked to this by a nut underneath, marked B in Fig. 1.

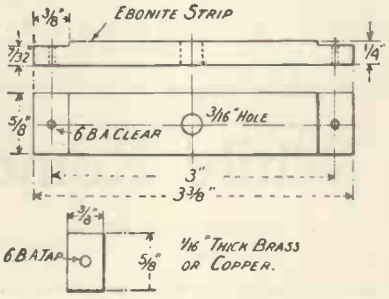


Fig. 2.—Strip details.

The panel of the set to which this switch is to be fitted is now marked out for the stem hole, and the six contact studs. The latter are spaced ½ in. apart on a 1½ in. radius, three on each side, as shown in Fig. 1A, and the holes for the stops are drilled on a 1⅛ in. radius and 1¼ in. apart on one side only, as shown in the same figure. The contact studs being fixed in position and filed level, the switch is assembled as indicated.

The stops are not essential to the working of the switch, but simply prevent the switch arm being turned too far so as to leave the contact studs.

The thickness of the washer between the upper surface of the panel and the knob marked A in Fig. 1, should be adjusted to make the combined depth of nut and washer rather less than the contact studs. The tightening of the under-nut C (Fig. 1) will then bend the ebonite strip downwards slightly, thus ensuring good contact between the studs and pads at each end, and making a spring washer unnecessary. The final nut D in Fig. 1 is for locking purposes.

Connecting up.

It will be readily seen from Fig. 1A that the brass pads are intended to cover two studs at each end, so as to make a connection between them. In Fig. 1A full lines show the switch operating a series circuit, and dotted lines a parallel circuit.

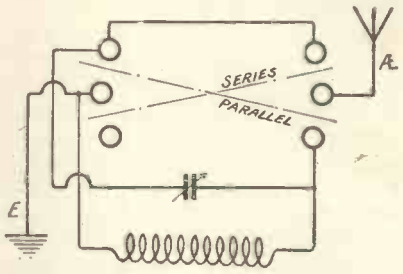


Fig. 3.—Connections.

It only remains to connect the components to the studs as shown in Fig. 3, and the switch is complete. The centre line of the switch strip is indicated in the series and parallel positions, which can be conveniently marked on the panel against the respective studs as shown.

AN EXHIBITION COMPLAINT

SIR,—I am not familiar with the precise objects of the Wireless Exhibiton recently held at the Albert Hall, but I imagine the main object was to make sales of wireless receivers and components. If so, then in my opinon the scope of the Exhibition was reduced by at least 50 per cent. by the fact that any demonstration of receivers or loud-speakers was prohibited. Surely the aim of the majority of prospective purchasers of receivers or components is to obtain a maximum of sound, both as regards quality and quantity, for the outlay of a reasonable sum of money, but in choosing a receiver or loud-speaker at an exhibiton of the kind recently concluded, one was rather in the position of a blind man endeavouring to make an intelligent purchase at a picture shop.

I quite realise that a simultaneous demonstration of the numerous receivers and loud-speakers now on the market would hardly have been melodious, but surely it is reasonable to imagine that some kind of programme could have been arranged for demonstrations of receivers and loud-speakers.

I may say that during my visit to the Exhibition I overheard many expressions of surprise that nothing had been done in this direction.—Yours faithfully,

TWO VALVER.

Leigh-on-Sea.

A Portable Broadcast Station

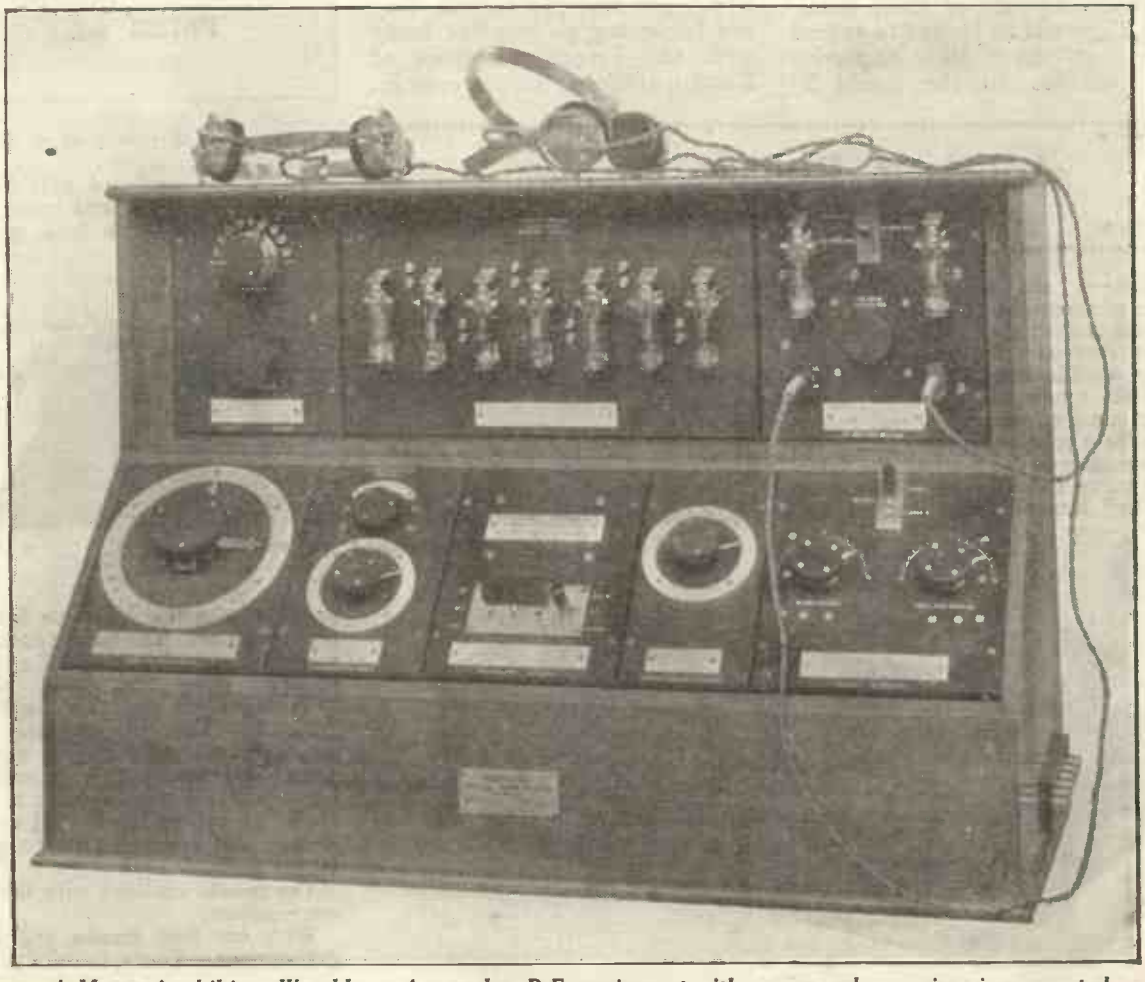
Owing to the large number of broadcasting stations in American cities interfering with each other, the Zenith Radio Corporation are conducting a series of tests with a portable station (WJAZ) to ascertain the best possible position for a new site.

A VERY unusual occurrence took place when an American broadcasting station was recently disposed of by one of the pioneer radio corporations in broadcasting, because the station dominated the air to such an extent as to prevent radio listeners within its immediate scope, from hearing any other stations.

This unexpected stroke of policy was announced by the Zenith Radio Corporation, when it sold the well-known station WJAZ, then situated on the Edgewater Beach Hotel. Because of the uncontrollable interference caused by this station throughout the entire North Shore of Chicago, the company decided to erect a new station far enough away from the city and its environs so as to be no longer an interference to the three millions of people who make up the second largest city in the United States.

Tests

On the heels of this announcement, the Zenith Radio Corporation was deluged with letters from the Chambers of Commerce of many of the small communities in the outlying districts of Chicago. Some letters came from places two hundred miles away. So urgent were many of the invitations from these smaller towns that it was decided to conduct a series of tests to ascertain the best locality for broadcasting and to determine at the same time the place offering the least opportunity for interference. The best working plan which suggested itself was to erect temporary broadcasting stations in all the towns selected for test. Then difficulties developed. For a time, it looked as though the



A Marconi exhibit at Wembley. A complete D.F. equipment with a seven valve receiver incorporated in the same cabinet.

plan of making tests would have to be abandoned, because the attendant obstacles seemed to be insurmountable.

The company now has in the process of construction a complete broadcasting unit mounted on a one-ton Federal lorry. There have been portable transmitting stations for telegraph work, but from all available information, this is the first portable broadcasting station in history. It will be equipped with a one-hundred-watt transmitter. It will be walled-in by glass, so that the public may witness the operation of the station wherever it is taken. It will be operated entirely from storage batteries. The aerial will be supported by means of telescoping masts, and will be made of gold-plated wire.

Arrangements are under way with the Chambers of Commerce of all towns favourably disposed to receive the new broadcasting station. Tests will be arranged in each case for a definite night and the officials of these municipalities will be invited to extend the greetings of their respective communities to the world by themselves speaking into the microphone of the portable broadcasting station.

For this series of experiments, which promises to be so intensely interesting, the call letters 9XN will be used.

WIRELESS NOTES AND NEWS

Amateurs in Russia Now Free

Late despatches from Moscow announce that the Russian Soviet Government has removed the stringent control over amateur radio sets, and that the latter are now at liberty to construct more or less as they please.

German and English Stations Interfere

The number of broadcasting stations in Germany is rapidly increasing, and as they are mostly working on wave-lengths between 400 and 450 metres, they are beginning to interfere badly with the French receptions of English stations, besides even interrupting the P.T.T. concerts in the north. The situation in Europe is apt to become really serious if something is not done to stop the rapid growth of broadcasting stations, as nothing seems to be done by the constructors in any of the Continental countries towards developing a receiving set of high enough selectivity to cut out the interfering stations. As one paper says, it is only necessary to have two transmissions on wave-lengths not more than ten metres apart and the entire concert programme is upset.

A Belgian Reader's Opinion

Radio Press Envelope No. 2.

SIR,—I am enclosing herewith two photographs of a recently completed receiving set which embodies your four-valve family circuit. The only modifications brought into this circuit consist in a loose coupling arrangement for aerial tuning and in a special key permitting the connection of the plate of the detector valve to a special high-tension battery terminal, and this for any combination of valves used during the reception.

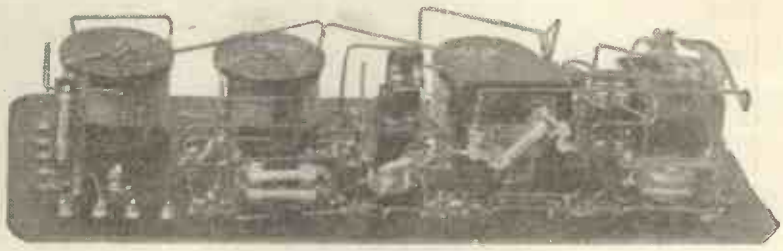
The set is equipped with transformers, condensers and resistances of good manufacture type, and is provided with the 300 ohms Igranic potentiometer. The tuning coils are wound in accordance with the information given in your book, "Tuning Coils and How to Wind Them." The components are mounted on a polished ¼-in. ebonite panel and enclosed in a polished mahogany cabinet, making a free room of 55½ by 20 by 10½ centimetres, and assembled with a glass at the rear.

The results obtained with this set are excellent.

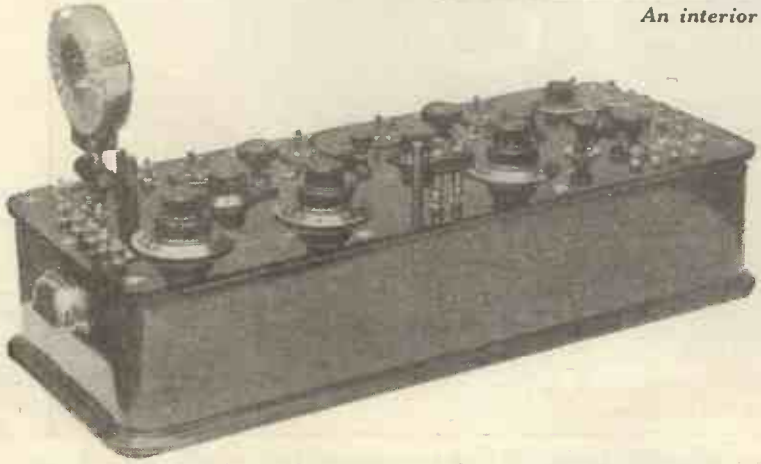
With my best thanks and congratulations.—Yours faithfully,

V. GUIDALEVITCH.

Antwerp.



An interior view of the receiver.



The Four-Valve Family Receiver as made up by Mr. Guidalevitch.

Random Technicalities.

By PERCY W. HARRIS, Assistant Editor.

Some Notes of interest to the Home Constructor and Experimenter.

A SPEAKER at a recent meeting of the Transmitters and Relay Section of the Radio Society of Great Britain dwelt on the importance of aerial insulation, and I quite agree that this aspect of affairs is very frequently neglected. It might be thought that the minute voltages set up in the receiving aerial could easily be prevented from dissipating themselves along unwanted paths by the thinnest film of insulating material. Insulation, however, is only one part of the story.

Air Insulation

Every experimenter should do a little clear thinking on the matter of insulation. For example, we all know that dry air makes excellent insulation, yet it is not generally realised that, when using a series condenser in a receiving circuit, two parts of the circuit are insulated from one another by the air intervening between the plates of the variable condenser. Oscillatory currents, of course, flow in the aerial circuit through the capacity so formed. If, then, at the extreme end of the aerial we have a metal mast with a very thin layer of insulation between the wire and this steel mast, why should our currents not flow this way, through the capacity of the intervening insulation, rather than through our receiving instrument, which, incidentally, has in series with it an inductance coil offering some impedance to their passage?

Capacity

Our aerial insulation, then, should have the smallest possible capacity. The popular shell type, whilst it will stand high voltages, has quite a considerable capacity, and, if I remember rightly, another lecturer before the Radio Society of Great Britain last year showed some experiments which proved how much energy could leak away through this capacity to earth. Personally, I am inclined to think that in our climate porcelain rods with holes at each end, through which the aerial wire and the guys or other wires can be threaded, are as good as any other form. If the shell or other similar types are used, two or three should be used in series.

A Combination

On my new aerial, which is used for both transmitting and receiving, I am using the arrangement shown in the figure. It consists of a Silvertown "Everdry" rubber insulator, in series with a Buller mushroom-type insulator (of glazed porcelain). The "Everdry" insulator is made of rubber treated with a special compound, and has over a portion of its length a kind of hood which keeps it dry in wet weather. This type of insulator has very low capacity, while the porcelain disc will stand a tremendous voltage before breaking down. The complete insulator, therefore, will stand far higher voltages than will ever be impressed upon it with the power the Post Office (so far) allows me to use, and in addition the capacity is exceedingly low, thus avoiding losses in this direction. No doubt the "Everdry" itself would stand the impressed voltages quite satisfactorily.

A combination insulator.

Hard Valves

Speaking of high voltages reminds me that the other evening I took from my rack a specimen of practically every well-known "general-purposes" valve, and applied over 500 volts to the plate of each. In not a single case did the valve "blue-up"—surely enough proof that the modern receiving valve is pumped exceedingly hard. A year or two ago any of the "R" type valves would have shown a blue glow at far lower voltages.

Plug-in Transformers

I am glad to see that the makers of plug-in transformers are at last adopting some kind of convention in the method of winding. The standard now is to connect one winding between the grid and plate legs and the other between the filament legs of the conventional valve base. Some makers, such as Gent and Igranic, mark the grid and plate legs "primary" and the filament legs "secondary," while other makers, such as McMichael, mark the grid and plate "secondary" and the filament "primary." As very frequently the number of turns in the primary and secondary is about the same, it does not much matter which winding is used as primary; for example, the Gent transformers, which are marked as indicated above, work in my "Transatlantic" receiver every bit as well as those of Bowyer-Lowe and McMichael. Ediswan plug-in transformers also work well in this set. They are marked with grid and plate as primary.

A Grumble

I do wish the manufacturers would standardise the *direction* of winding. It causes a good deal of trouble when, for example, in the "Puriflex" receiver (where the direction of winding is important) one cannot change one make of transformer for another without unsoldering a pair of connections and re-soldering them the opposite way round. In my special Neutrodyne receiver, described in the first issue of the *Wireless Constructor*, the direction of winding is vitally important, and it is still more

exasperating when one finds, as is the case with one particular maker, that some batches are wound in one direction and some in another!

A Condenser Point

Now that the variable condenser manufacturers have at last awakened to the importance of square-law condensers, and are producing them in good quantity and at a reasonable price, I would like to draw their attention to a very important omission. We all want accuracy of tuning, yet how can we get it without some kind of indicator? We are provided with a dial and knob, and, often, with a drilling template. We will assume that the panel is correctly drilled and condenser mounted. We then slip on the knob and dial, hold it in place with a grub screw, and then laboriously make a scratch on the panel as an indicator. With one exception, no manufacturer supplies an indicator. It would be a very simple matter to put into every box a small envelope containing a nice little pointer which could be fixed down to the panel with a single 6 B.A. screw through a clearance hole, and the cost would be negligible. Who will be the first to do it?

Wanted: Filament Ammeters

Unless you have tried to buy one, you will be surprised at the great difficulty that exists in obtaining a satisfactory and inexpensive low-reading ammeter. It is most interesting and helpful to find just how much current a single receiving valve is taking. Similarly in multi-valve sets it is useful to know just what is the load on the accumulator. Most ammeters available read up to 8 or 10 amps. if required, but are exceedingly difficult to read, with any accuracy, on anything below one ampere. What we need is an inexpensive ammeter up to 1½ amperes with a good open scale. I am not saying that such ammeters are not available for a price. My point is that it should not be necessary to pay two or three pounds for such a device.

An Aerial Gadget

I have recently introduced into my study a small arrangement which is proving of great help in testing a number of sets. It is merely a single aerial wire running across the room and completely insulated at each end. One end comes within eighteen inches of the lead-in insulator, and has attached to it a flexible lead finishing with a spade terminal. When necessary, this can be connected to the lead-in. If one is testing a receiver on a table in another part of the room, it is the work of a moment to clip on to the bare aerial wire a short lead connected to the set to be tested. This saves a lot of trailing wires and inefficiency due to them. Furthermore, the aerial wire itself is out of the way of anyone walking about the room. When disconnected from the lead-in, it serves as a short indoor aerial for testing sensitivity of a set.

NOTTINGHAM MAYOR BROADCASTS

The Mayor of Nottingham (Alderman Housten) and the Council standing before the microphone at the Nottingham Goose Fair.

A Simple "Edgewise" Coil

This coil is one of the few types which can be left without shellac or other impregnation.

MANY and varied types of inductance coils and the methods of winding and mounting them have been illustrated and described in the several wireless journals, and the writer offers as an excuse for introducing yet another type, that on test, and in his humble opinion, this particular coil is easier to make, has a lower self capacity, and when mounted presents uniformity of appearance, in that all coils wound by the method about to be described are of exactly the same external and internal dimensions.

Method of Winding

The coil under review may be described as a " four-pile " vertically wound coil; by this it is meant that turns running parallel with a previously wound turn are separated by three turns of wire which do not run parallel. Fig. 1 indicates one layer of wire and comprises four turns. Starting from the peg marked 1 the wire passes inside, missing three pegs to the peg marked 5, then again missing three pegs to the peg marked 9, again misses three pegs and is passed round peg that is marked 13. With a former containing 15 pegs this completes one revolution of the wire, for it passes from 13 to 2, commencing the second revolution, thence to 6, 10, 14 completing the second revolution, then to 3 for the start of the third revolution, to 7, 11, 15 ending the third revolution, and for the fourth revolution starting at 4 then to 8, 12, and completing the vertical layer by starting the second vertical layer on peg marked 1 again. By examining the sketch Fig. 1 it will be observed that all the 15 pegs have a wire turned about them. It matters not how many pegs there are in the former providing the number of them is an odd one; by this method of winding four revolutions of the wire constitute one vertical layer.

The self capacity of this coil is low, and the air spacing is large; when held near a light every wire is seen to be well separated from its neighbours.

The actual coil appears at first to be of frail construction, but this is far from being the case when mounted in the customary manner on the wedge-shaped coil-plug.

Winding Data

The first coil made by the writer upon a former made of wood with 1½ in. oval brads for the pegs, was a 75 turns coil, and when it was wound, without being shellaced, waxed or sewn, its width measured seven-eighths of an inch, the wire being No. 26 S.W.G. double cotton covered.

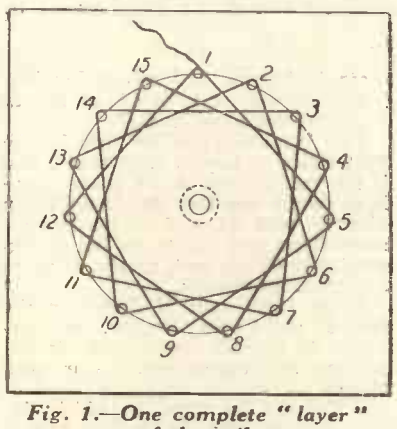


Fig. 1.—One complete " layer " of the coil.

Readers will see by these dimensions that by using a finer gauge wire for the larger coils, say, No. 28 or 30 S.W.G., this thickness dimension will not be exceeded. As is well known, the reputed makes are somewhere about one inch in thickness when mounted on the plugs. To make the former, obtain a piece of hard wood, preferably oak or mahogany, or a piece of brass or iron, four and a half inches square and at least half an inch in thickness. This wood or metal base must be perfectly flat as far as the surface upon which the wire is to be wound is concerned. Find the centre of it by crossed lines, and from this centre describe a circle of one and a half inches radius; mark this circle in well with dividers. Now with a protractor or by setting the dividers somewhere about eleven-sixteenths of an inch apart, set out on this circle 15 divisions; the dividers are the best for this job as a little adjustment narrower or wider after trial tends to greater accuracy in the peg - spacing holes. A little point to be observed in setting out the spaces with the dividers; don't count the spot where you start from as " 1 "; count the first mark bounding the first space as " 1," by this you will find when you get round the circle that your starting point will count as " 15." Assuming that the 15 spaces have been accurately marked out, take a centre punch and a hammer and at each mark make a " centre pop " for the purpose of locating and providing an accurate start for the drill. With a three-sixteenths drill make holes right through the base, be it either wood or metal, but see to it that all the holes are at right angles with the surface, as the steel or brass pegs must stand out vertical with the base.

Whilst drilling, drill a ¼ in. or 5/16 in. hole through the centre of the base and countersink or leave flat to suit your own convenience. This latter hole is for fixing the former to the table when winding.

The Pins

From a length of 3/16 in. diameter brass or steel cut fifteen 3-in. lengths; steel is preferable as it is much more likely to be straight and true to size; remove the burrs due to saw-cutting at the ends of each piece with a fine file, slightly rounding them off. Tap each piece into the wood or metal base, one of the ends of each 3 in. piece being flush with the underside of the base.

Take a piece of thin fibre, ebonite or 3-ply wood slightly smaller or slightly bigger than 4½ in. square, and drill 15 holes in it to the same pitch, on the same diameter, and of the same size; this is to be used as a lifter. Drill the central hole ¾ in., to clear the screw holding the former. With your pegs in place on the former, place the lifter piece over the pegs, screw the former down through the lifter piece to the workbench, mark the peg you start the winding from as "1," and wind for the number of turns required in the manner described, viz.: 1 to 5 to 9 to 13, to 2 to 6 to 10 to 14, to 3 to 7 to 11 to 15, to 4 to 8 to 12 to the starting peg at "1" again for the second vertical layer, and so on. When the required number of turns are wound, temporarily fasten the end of the wire round the peg last reached. Now raise the coil up, by inserting the fingers under the lifter piece almost to the top of the pegs, push the lifter piece down to the bottom, and now fasten the layers by cotton or silk, fastening the wires at the crossings that lie between each pair of pegs; it will be noticed that these crossings form a triangle between each pair of pegs; fasten lightly but firmly at each angle in each of these triangles. The coil may now be lifted off the former. It may be mounted as it is, or it may be waxed or shellaced and heat dried before mounting.

Mounting

To mount the coil cut a celluloid strip slightly wider than the finished coil, exactly the same length as the outer circumference of the coil; cut another strip the same width but only 2½ in. long. Place this short strip between the coil and the plug, bind it to the coil by empire or insulating tape. Place the coil with the strip attached on the plug and fasten one end of the long strip to the plug by means of one of the side screws; bring the free end round over the coil and pull it as tight as possible, marking the position of the other side screw by rubbing the celluloid on the screw head so as to scratch it. Make the second hole not at the point marked but half the width of the hole farther away from the free end, so gaining the required tension to ensure rigidity to the coil. A little difficulty will perhaps be met with in attaching the second end of the strip, but if the first screw is slackened, leaving it only just engaged with the plug, it will be found that the attachment of the second end is much easier.

Simultaneous Cutting of Strips

When once the length of strip and position of the attachment holes are determined one job can be made of cutting and holing as many strips as are required. The inner diameter of the coil may or may not be protected by a celluloid ring as desired. It is advisable before permanently attaching any coil to its plug that a piece of paper or thin card be marked with the number of turns and inserted under the retaining celluloid strip. When mounted this type of coil gives no indication of number of turns by its size.

L. C.

□

More Post Office Disclosures

(*Continued from p. 781.*)

reply to a Press representative, and is as follows:—

"If transmission was allowed to proceed without regulation there would be something like chaos; and **we want to give the widest possible facilities to all genuine investigators** without endangering the use of wireless telegraphy for public purposes, and without endangering the broadcasting services. Subject to that we have no axe to grind in refusing facilities, and we shall continue to give the closest possible attention to the matter, and when facilities can be given more freely than at present, we shall not hesitate to give them.

"With regard to the legal position, we think we are right, but if anyone wishes to contest it they must do so. If Dr. Eccles, for whom we have the greatest admiration, or anybody else, will make some practical suggestions for improving the regulations, well and good. I do not think we shall hesitate to relax any regulations that can be shown to be necessary. We have endeavoured to treat everybody equally in the matter of licences granted. We are sorry if we have failed to give facilities where they ought to have been given, and we are sorry if we have given them where they ought not to have been given. I can only reply that to err is human, but all applications are properly considered as far as possible on equal lines."

This is a much humbler tone for the Post Office to employ than usual, and if they are sincere in the matter there is no reason why they should not freely dispense with many of the burdensome restrictions, and also to cut out the expensive royalties, and, finally, to grant licences more readily.

There is no lack of desire on the part of the Radio Society, or ourselves, to provide suggestions for improving the regulations. Our own are:—

1. Cut out the royalties which increase with increasing power, and which we emphatically regard as illegal.
2. Simplify the facilities for obtaining licences while maintaining a reasonable standard of proficiency.
3. Cut out all regulations which prohibit communication with foreign countries.
4. Maintain the rule that a message must strictly relate to experiments.
5. Establish an effective inspection system.
6. Treat with respect recommendations from the Radio Society of Great Britain regarding applications for licences.

As we demonstrated last week, the whole history of the Post Office Wireless Department indicates that it has desired to impose regulations which were subsequently shown to be entirely unnecessary. Why should experimenters have to wait five years before the Post Office realises the unnecessary nature of some of the present regulations? Unfortunately, the present tendency is to increase the restrictions rather than to slacken them.

The following extract from a reply by the Post Office indicates that the restriction regarding foreign communication is something quite new:—

"As regards your application for authority to communicate with foreign stations, I am to say that permits granted for the use of wireless sending apparatus are for experiments in wireless telegraphy between stations in Great Britain and/or Northern Ireland, **although this was not expressly stated in the earlier permits issued.**"

Hitherto, the R.S.G.B. has, without prejudice, agreed to restrictions and regulations, the legality of which was very much in doubt. They do, no doubt, still desire friendly relations with the Post Office, and quite rightly, but they are determined it must not be at the expense of reasonable freedom.

If a case is fought, it is extremely likely that it will be shown that many of the restrictions already imposed by the Post Office and agreed to, without prejudice, by the R.S.G.B. will go by the board.

Unless the Post Office officials change their general attitude very considerably, a fight is inevitable. We are pleased to say that the Radio Society has officially accepted our offer of £500. towards the fighting fund, and that a Legal Committee has been appointed to take any steps that may be necessary.

LOOK AFTER YOUR . ACCUMULATORS .

SOME NOTES ON CHARGING AND MAINTENANCE.

Attention to these points may save expensive cells from rapid deterioration.

AS many listeners-in who are fortunate enough to have a direct-current electric supply are charging their own accumulators, a few notes on the subject may be helpful.

An accumulator, like many other pieces of apparatus, will only render good service if it is given periodical attention and not left until such time as it is not working efficiently. Then this attention becomes imperative, but it may come too late.

Polarity

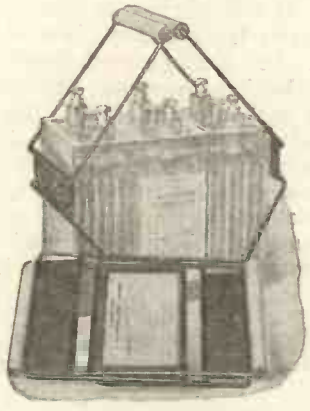
When erecting your charging board, you have to ascertain the polarity of the supply. This can be done in several ways. Pole-finding paper can easily be obtained for a few pence from your local electrician. This generally bears full instructions for its use. A simple and reliable alternative method is as follows: Pour some clean tap water into a glass and insert the two bare ends of the charging wires into the water about ¼ in. apart. After a few moments it will be noticed that a number of bubbles appear. The negative wire gives off twice as many bubbles as the positive. This negative wire should be connected to the negative terminal of the accumulator and the remaining wire to the positive terminal.

Wrong Connections

When charging accumulators great care must be exercised to ensure that the polarity is correct. An accumulator will be ruined if it is charged for any length of time with the connections reversed.

The charging rate is another important factor, and should be measured, if possible, by a suitable ammeter. A safe rule to remember is that the charging rate should not exceed 1-10th of the actual ampere-hour capacity. For example, a 40-ampere-hour (ignition) accumulator should not be charged at over 2 amperes. Charging at an excessive rate will buckle the plates and will cause over-heating and evaporation.

It will pay to inspect the acid occasionally. This can be done quite conveniently with a syringe hydrometer. If a hydrometer is not handy, take the battery to a charging station for testing. A hydrometer can be secured for a few shillings, and should be in the possession of everybody who uses accumulators. The hydrometer reading should show a specific gravity of 1.200/1.250. This, of course, varies with the state of charge of the battery, and will also vary with different makes of batteries.



A useful carrier

Inspect the Plates

The plates should be periodically inspected carefully from the outside. When the positive plates appear a dark chocolate colour and the negative a clean grey, and no signs of deposit on any of the plates, it will prove that the cells are in good condition and that they are fully charged. A fully-discharged accumulator will have little contrast in the colour of the plates, the positive becoming a light brown and the negative dull grey.

Sulphating

If the positive plates show any signs of a white or brown deposit this must not be neglected, as it is an indication of "sulphating." A battery in this condition will not be capable of receiving its full charge, and, therefore, unable to give its certified output on discharge. Sulphating is caused through too weak acid or may be due to the cell being left in a discharged state for a long period.

A Frequent Cure

When a battery is freshly "sulphated" the sulphate is comparatively soft, and can in most instances be slowly removed by a prolonged charge with acid of the correct strength. If this deposit is left for any length of time the available area of lead will gradually be reduced, and therefore the capacity of the battery will be reduced. Should your battery get into such a condition, and the deposit cannot be removed in any way, it would be wise to take it to an expert for his examination.

Buckled Plates

Do not short-circuit your accumulators. This seldom shows any ill-effects immediately, but the plates are sure to "buckle" in time. The remedy and repair for buckled plates are hardly within the scope of the amateur, but usually these can be straightened by special tools.

A. R. W.

Long Leads for Loud-Speakers

A simple method of using the loud-speaker when required at a distance from the set.

MANY enthusiasts wire their houses, using plugs and jacks or similar devices, so that the loudspeaker may be rigged up in any room in a matter of moments. This is a most convenient method, but not everyone has the time to carry it out or the skill to do the work so neatly that it does not spoil the appearance of walls and so on. Without going to the trouble and expense of installing permanent wiring, it is quite possible to make the loudspeaker easily installable in rooms other than that in which the receiving set itself is operated. The first step is to install upon the receiving set a plug and socket attachment for

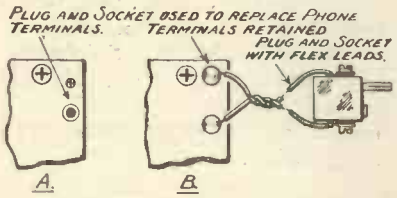


Fig. 1.—Adapting the set for plug-in leads.

the loudspeaker. This may be done in either of the two ways shown in Fig. 1. In the first drawing Fig. 1, A, the telephone terminals have been replaced by a flush-fitting plug and socket, to mount which is a matter of no difficulty, all that is necessary being to drill holes of the right size with their centres 9-16 in. apart. In the second method, shown at B, the terminals are retained, and an ordinary plug and socket mounting, such as may be purchased from advertisers for a shilling or so, is attached to them by means of a short length of flex. In either case the plug should be connected to H.T. plus.

Connecting the Loud-Speaker

A plug and socket mounting is now attached to a piece of flex about a yard in length, the ends of which are connected to the terminals of the loudspeaker. Here the connections must be reversed, the plus terminal of the loudspeaker being connected to the socket of the mounting. For use in the ordinary way close to the receiving set the loudspeaker is simply plugged in.

Distinguishing Leads

Fig. 2 shows how the extension is made when required. A piece of flex is obtained whose length is sufficient to enable it to reach from the set to any room where it is likely that it will be required to place the loudspeaker. Two further plugs and sockets will be needed. It is necessary to see that the lead which is attached to the socket of the first mounting runs to the plug of the second and *vice versa*, as shown in Fig. 3. It will always be found that the two leads in any piece of flex can be distinguished from one another in some way. Sometimes the rubber covering of one is light and that of the other dark; sometimes the inner silk coverings are of different colourings, whilst sometimes again there is a single strand of brightly-coloured silk amongst the wires of one lead.

Necessary Connection

Examination of the flex obtained will show which method of

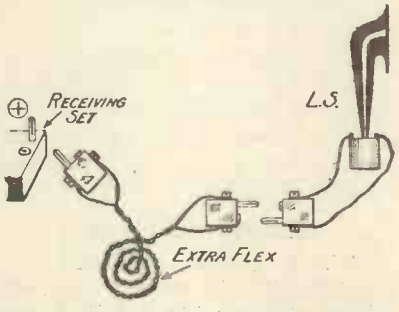


Fig. 2.—Method of making extensions.

distinguishing leads is employed. Attach the marked lead to the socket of the first mounting and to the plug of the second. Some readers may wonder why it is necessary to take all this trouble for making connections in certain definite ways instead of making them anyhow. The reason is that it is extremely important that the steady plate current should flow round the windings of the loudspeaker in the direction which increases the pull of its permanent magnets. By making connections in the way described we can ensure that this takes place. If they were made haphazard the direction of the current might or might not be correct, and if it was wrong the permanent magnets might in time lose their strength and the loudspeaker would have to be sent to the makers for remagnetisation.

Effect of Extension

It will be found in many cases that the fitting of extension leads effects an improvement in the tone of the loudspeaker. The reason is that there is a large capacity between the leads of a big length of flex which frequently has a very beneficial result. It may also be found that this extending of the loud-

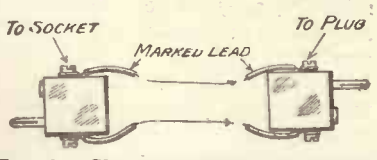


Fig. 3.—Showing correct connection of leads.

speaker by means of long leads will cause the set to howl most violently, and in these circumstances the inclusion of a telephone transformer of a suitable ratio for the loud-speaker used is necessary before this howling can be got rid of. In other circumstances long loudspeaker leads may cause the set to oscillate more freely than is the case when using the loudspeaker nearer to the set, in which case the incorporation of the transformer should be again used.

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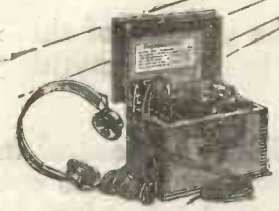

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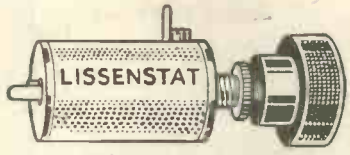

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PARTS THAT PULL TOGETHER—BUILD WITH THEM

The Telephone Transformer and its Purpose

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

A short chat on a subject frequently discussed at wireless meetings.

THE question of the relative merits of high- and low-resistance telephones is one which often perplexes the wireless man, even when he has long passed the novice stage. At first sight it seems that low-resistance telephones could not be used for wireless purposes, since receivers require to possess the highest possible sensitiveness to weak currents to be employed in a wireless set. To make 'phones sensitive they must be wound with a very large number of turns of wire, so that such currents as are available shall produce the greatest possible effect, and to fit these turns into the very small space available it is necessary to

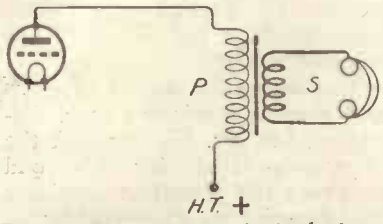


Fig. 1.—Connections of a telephone transformer.

use extremely fine wire. It therefore follows that the receivers will have a high resistance, and it should be understood that this is to be regarded rather as an unavoidable evil and in no sense as an advantage. Fortunately, in the majority of cases, there are already other components of high resistance in circuit, so that the telephones do not appreciably reduce the current which flows. This point is emphasised because the writer is often asked whether it would improve results to re-wind a pair of 'phones with resistance wire.

Efficiencies

It is possible, notwithstanding the apparent superiority of the high-resistance type, to enable low-resistance 'phones to give results practically as good by the use of a piece of apparatus known as a telephone transformer. This consists of two windings, one containing a large number of turns and the other relatively few, upon an iron core, the whole constituting what is called a step-down transformer. The primary winding of the transformer is that which has the greater number of turns, and through it are passed the weak currents from the receiving set. These currents, by the ordinary transformer action, induce currents in the secondary winding of a similar nature, but *reduced* in pressure (i.e., voltage) and *increased* in volume in proportion to the step-down ratio of the transformer. The low-resistance 'phones are connected to the secondary, and when actuated by the low-pressure, large-magnitude currents therefrom, give signals very nearly as loud as those from a high-resistance pair connected directly to the receiving set. Actually, of course, there is bound to be some loss of energy in transformation, since no transformer is hundred per cent. efficient, and therefore it may be assumed that low-resistance 'phones and telephone transformer will not give quite so loud a response to a given signal as the high-resistance type, but in actual practice the difference is usually almost imperceptible.

Purity

Another objection which is often raised regarding telephone transformers concerns the purity of reproduction of telephony when one is used. It is argued that any iron-cored winding must necessarily introduce a certain amount of distortion. This objection doubtless contains a certain amount of truth, but it need not be taken too seriously; as in the case of intervalve transformers, a well-designed instrument of good make does not produce a perceptible alteration in the quality of reproduction.

Some Advantages

So much for the drawbacks of the telephone transformer. Let us now see what advantages it has. The most obvious one, of course, is that low-resistance telephones are slightly cheaper and much more robust than the high-resistance pattern, and moreover, when a transformer is used, the steady anode current of the valve does not pass through the phones. This is an important point, since if high-resistance phones are used with a valve passing a fairly large anode current it is quite possible for them to be damaged. Moreover, if the plate current chances to pass in the wrong direction it may

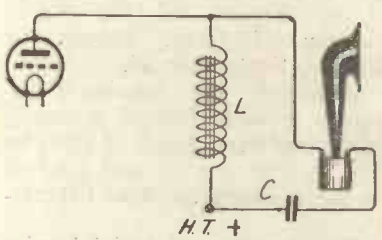


Fig. 2.—The use of a choke coil to by-pass the steady anode current.

result in time in a serious weakening of the permanent magnets. Yet another point: if a high voltage is applied to the anode of the valve it may break down the insulation of the very delicate coils in the ear-pieces, and in any case renders the operator liable to shocks.

Reflex Circuits

All these troubles may be eliminated by the use of a transformer, which is also sometimes advantageous in reducing body-capacity effects. In some reflex circuits, also, a transformer will greatly increase the stability of the receiver, enabling phones to be used instead of a loud-speaker.

The general conclusion to which one is led, then, is that where the utmost possible sensi-

tiveness is required, as in a crystal set, high-resistance phones are to be recommended, but that in valve sets it is possibly better to use the low-resistance variety with the protection of a transformer for the reasons given, even at the cost of a slight sacrifice of signal strength.

High and Low Resistance Loud-Speakers

In the case of loud-speakers the situation is somewhat different. Since there is little limit to the weight and size of the reproducing mechanism the windings can be made quite robust, and therefore there is not the same need of protection by means of a transformer. When power valves are used, however, it is probably wise to take some precautionary measure, such as the employment of a low-resistance loud-speaker and a telephone transformer, or a high-resistance instrument with a by-pass arrangement consisting of a choke and condenser to prevent the steady anode current from passing through the loud-speaker itself. This is shown diagrammatically in Fig. 2, wherein C is a 2 μF Mansbridge condenser and L is a choke which may consist of 4 ozs. of No. 42 s.c.c. wire wound upon a bundle of iron wires 4 in. long and $\frac{3}{4}$ in. thick.

Turn Ratios

The actual constructional details of a telephone transformer cannot be dealt with here, but it may be of interest to mention that there are usually something like ten times as many turns of wire on the primary as on the secondary winding, thus giving a step-down ratio of ten to one. The primary usually has a resistance of about 5,000 ohms, and the secondary of about 100 ohms.

□ □ □

The Radio Society of Great Britain

AERIAL INSULATION.

SOME useful and little known facts about aerial insulation were introduced by Mr. J. E. Nickless, in opening a discussion on the subject at an informal meeting of the Transmitter and Relay Section of the Radio Society of Great Britain on Friday, September 26.

Although the speaker's remarks were addressed primarily to transmitters, much of what he had to say was of real interest to the ordinary amateur listener-in.

The question of aerial insulation had been grossly neglected in the past (said Mr. Nickless), particularly from the amateur's point of view, and the market had been flooded with cheap insulators, which in reality were not insulators at all. For instance, the cheap reel type was practically useless in a transmitting aerial, and not much better for reception purposes. The shell type was a distinct improvement, but Mr. Nickless stated that he was disinclined to trust any insulator having a hole in the middle through which the wire was passed.

The ideal insulator should provide as smooth a surface as possible, and all sharp corners and curves should be avoided. In fact, every care should be taken to overcome capacity effects. The type of insulator favoured by the speaker was the "mushroom" variety, which was admirably adaptable to all kinds of weather. Even in a storm its shape ensured that, no matter in what direction the wind might be blowing, some portion of the insulator would remain dry. The mushroom insulator was also capable of surmounting great mechanical and electrical strains, and Mr. Nickless cited an instance in which an insulator of this type was submitted to a voltage of 52,000 without damage.

Dealing with the question of the lead-in, the speaker asserted that absurd mistakes were often made by those whose aerials were otherwise beyond reproach. The best form of lead-in, he submitted, should have a glass or air space between the wire and neighbouring objects.

In the course of the discussion, it was asserted that a potent enemy to good insulation was the ordinary spider, which seems to be strangely attracted to insulators! It had been found, however, that paraffin was an efficient remedy.

The respective merits of glass and ebonite insulators were discussed, but Mr. Nickless left the impression that for all-round purposes the porcelain insulator was superior to other types.

A view of the Radio Press stand at the recent Wireless Exhibition.

Testing Telephone Leads

How some uncommon faults have been traced.

WHEN a break occurs in a telephone lead, a thing which happens not infrequently as the result either of long use or unfair treatment, it is almost useless to attempt to make repairs unless the breakage is quite close to one of the ends. In this case the broken portion may be cut away and fresh connections made; but where a break is so far from the end that to cut

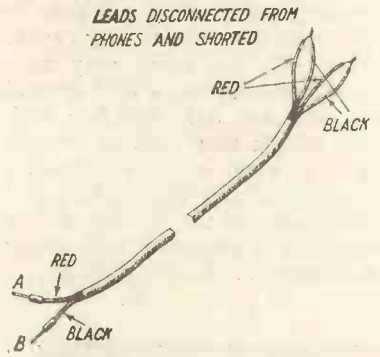


Fig. 1.—The leads arranged for a continuity test.

the leads would shorten them unduly it is better to fit new ones without bothering to attempt any kind of botching up. The symptoms of a broken lead are easily recognised. Reception suddenly becomes extraordinarily uneven. Loud crackling and grating noises are heard when the leads are shaken, whilst signals come in strongly at one moment and are weak or entirely absent at the next. If loud noises or big variations in signal strength take place when the leads are moved or shaken you may feel pretty sure that there is a break in them. If, however, you are unconvinced, a simple test is shown in Figs. 1 and 2. The first drawing shows how the leads are arranged for testing. Detach the wires from one earpiece and connect the ends together red to black. Then detach the other earpiece and connect its wires in the same way. If the leads are O.K. there should now be a direct path for current from the red end A to the black end B through the leads. Fig. 2 shows diagrammatically how the test is made with a flashlamp and a refill battery. Having attached the ends A and B, as shown in the drawing, move the leads about in all directions, coil and uncoil them, swing them about and shake them. If there is a break it will be shown up at once by variations in the light of the flashlamp or by the filament being extinguished altogether in certain positions. A voltmeter, galvanometer, or other measuring instrument may, of course, be used instead of the flashlamp. New leads should always be tested in this way before they are attached to the telephones.

Choice of leads

Telephone leads are now obtainable so cheaply that it is not worth while making them oneself. A good long pair made of stout, well-insulated flex can be purchased now for eighteenpence, and exceedingly good leads are obtainable from firms which specialise in disposals goods for about half this sum. Fitting them is quite an easy process. All that one has to do is to attach

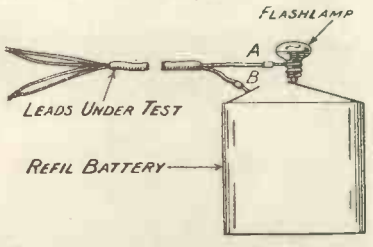


Fig. 2.—Variations of the lamp indicate the condition of the leads.

the red ends to the terminals marked plus of the receivers and the black ends to the others.

Correct polarity

Should the telephones not be marked it is generally quite easy to discover which terminal is which in the way shown in Fig 4. Unscrew the cap of one of the receivers and remove the diaphragm. Obtain a piece of steel watch-chain and see how many links one of the permanent magnet poles will lift from the table when no current is passing through the windings. Now connect up a flashlamp refill, as shown. It will be found by experiment that when the short (positive) strip of the battery is connected to one of the terminals of the receiver the magnet becomes more powerful than when no current is flowing at all, and much more powerful than when

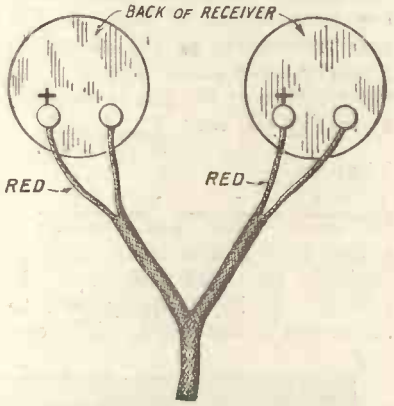


Fig. 3.—The cord lead marked red should be joined to the + terminal of the receivers.

it is flowing in the opposite direction. The connection which gives the strongest pull, *i.e.*, that which enables the magnet to lift the greatest number of links, is the correct one, and a plus sign should be scratched on the case of the receiver close to the terminal connected to the short strip of the battery.

Parallel connections

There is one case in which telephone leads may be fitted in a rather different way. Some amateurs have an idea that the higher the resistance of the telephones used with a crystal set the more powerful will signals be. With certain crystals telephones of very high resistance may be used with advantage, but with most of the synthetic galena types now on the market 2,000 ohms is probably the best value for really good results. By wiring the receivers of his headset in *parallel* instead of in series any reader can reduce the resistance of a headset to one-quarter

of its original value. The rules for resistances in series and in parallel are exactly the opposite of those for capacities. If two

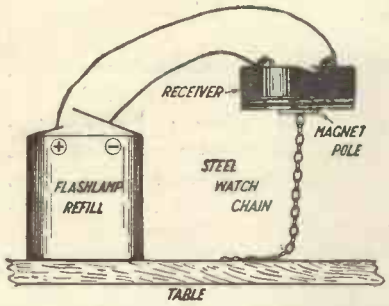


Fig. 4.—A polarity test for telephone connections.

resistances of 2,000 ohms each are in series as in Fig. 5A, the total resistance of the circuit is 2,000+2,000=4,000 ohms. If the resistances are put in parallel, as in Fig 5B, then $\frac{1}{R}=\frac{1}{R1}+\frac{1}{R2}$.

That is,

$\frac{1}{R}=\frac{1}{2,000}+\frac{1}{2,000}=\frac{2}{2,000}=\frac{1}{1,000}$;

hence R=1,000 ohms. If it is desired to wire receivers in parallel it is probably best to make one's own leads, which can be done very easily from a length of good quality flex. The arrangement is shown in Fig. 6. The leads are untwisted at the

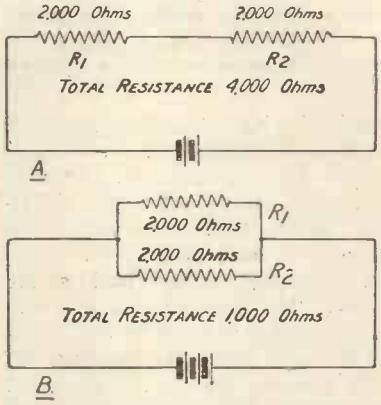


Fig. 5.—Illustrates the effect of resistances in series or parallel.

top for a length of about 18 in. The positive lead is then bared for about an inch at the point A. A piece of flex 18 in. in length is prepared, and the end is soldered to A. The distinguishing colour of this piece should be the same as that of the red lead. A second 18-in. length of flex of the same distinguishing colour as the negative lead is soldered to the point B. The joints are carefully covered with insulating tape and bound with silk. The four ends of flex are then twisted together,

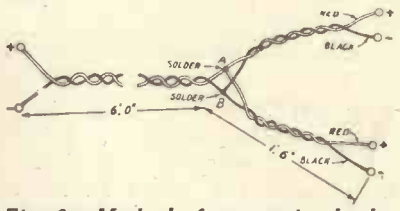
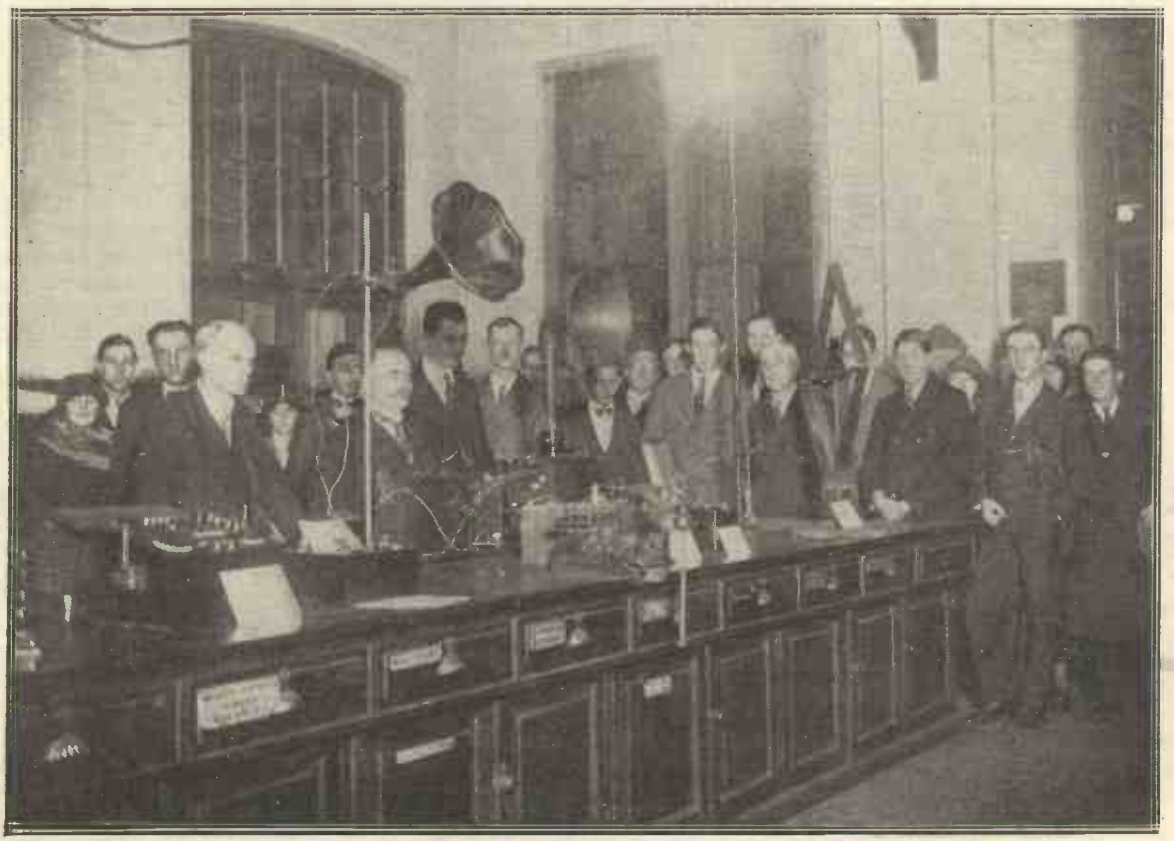


Fig. 6.—Method of connecting leads to put earpieces in parallel.

as shown in the drawing, and the fork of the Y is tightly wound with strong silk. If the leads are now connected correctly to the positive and negative terminals of the receivers these will be in parallel, and current will flow in the proper direction through each. Those who are using very high resistance telephones with crystal sets and are not satisfied with their results may with advantage try the experiment of making up leads of this kind which will enable them to see whether better reception is obtained with lower resistances in the telephones.

R. W. H.



Great interest was shown in the recent West London Radio Exhibition at the Paddington Technical Institute.

A FINE ..... ADJUSTING .. COIL HOLDER

FOR ACCURATE TUNING

THOUGH there are numerous types of coil holders on the market, many of excellent finish, smooth working, and careful workmanship, yet few possess the quality of very delicate adjustment so necessary for fine tuning. Most of these rely on hand movement, and it is difficult to get that fractional movement which often separates two stations of adjacent wavelengths. The holder described below has been in the writer's use for some months, and gives a surprising degree of accuracy.

The components may be found in any amateur's toolbox. They comprise a 1-ft. 2 B.A. rod, 2 B.A. nuts, threaded collar knob, coil plugs and wooden blocks.

No dimensions are given, as the holder can be devised to suit individual ideas.

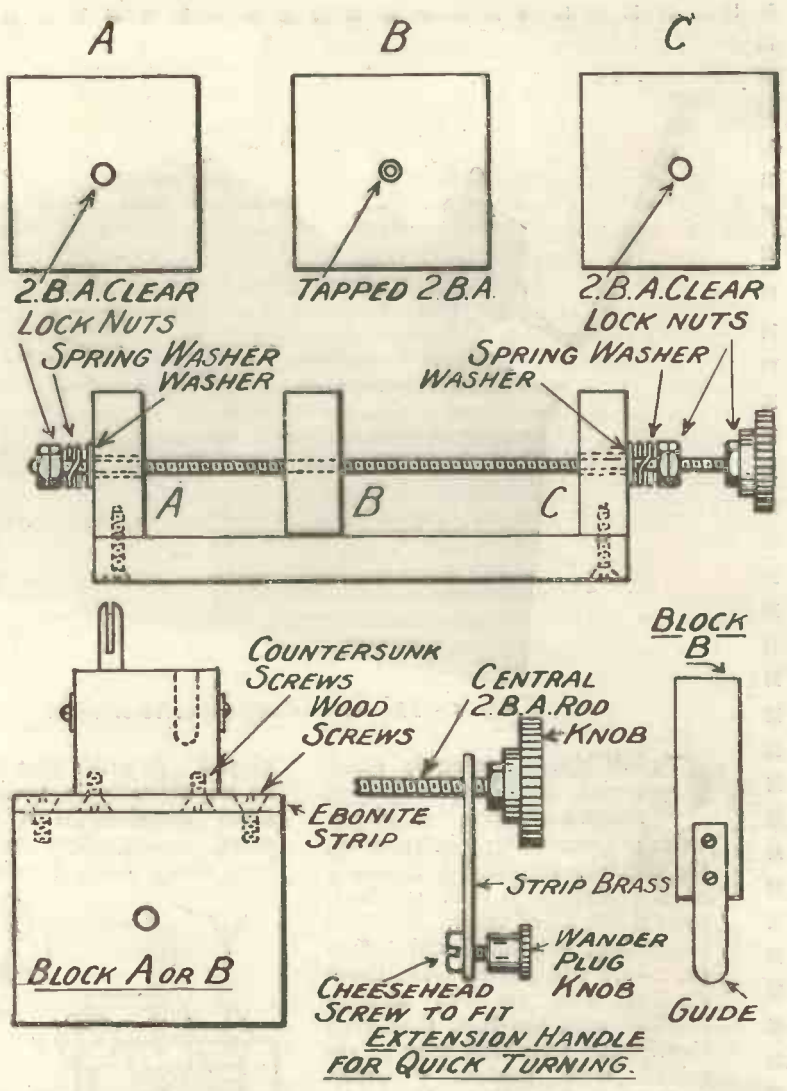
The upper figures show the three blocks. A is the end block, a fixed one. It has a smooth collar to take 2 B.A. rod easily, but not too loosely. A drilled-out terminal head would do. B is the middle block, which travels along the thread of the rod. It has a 2 B.A. collar inserted flush with the block face. A 2 B.A. nut would do if its hexagonal edges were filed to make a square. C is the other end nearest the knob, and is identical with A.

On A and B are mounted two coil plugs in the usual way, care being taken to provide that when assembled these plugs will stand absolutely level with one another.

The middle figures show the assembled holder. It will be noted that the collars have been inserted at exactly the same distance from the bases of the wood blocks, and, equally important, they are central from the sides, otherwise the rod would not turn freely.

Two strips of brass could be screwed on the sides of B to act as guides, and so prevent B from rocking when moved.

This holder has the defect of its most useful quality—it needs a large number of turns to move the block B a small distance. This can be remedied by adding a handle to the knob, made of a strip of brass, and fitted with a small auxiliary knob as indicated in the lowest figure.



Broadcasting Notes

A New French Station

Les Ateliers Lemousy of Paris, whom some experimenters have listened to last year, are just completing the construction of a new station, which it is hoped will start broadcasting at the end of this month on 320 metres.

The power used will only be 100 watts, but judging by the good reception obtained last year from this station, then only using 30 watts, it is hoped that many pleasant evenings will be afforded to British listeners by this station. The hours of transmission will appear in our Continental broadcasting table in due course.

Broadcasting Station on Board Liner

It is announced that the Transatlantic liner *Leviathan,* of the United States Line, will shortly be equipped with a broadcasting station. Dance music and other items that are being performed on board during the crossing will be transmitted, thus enabling other smaller vessels in the vicinity to partake of the festivities.

A Single Valv
Bright or Du

By STANLEY G. RATTEE,

Simplicity in Construction a over all telephony wavelength of this sim

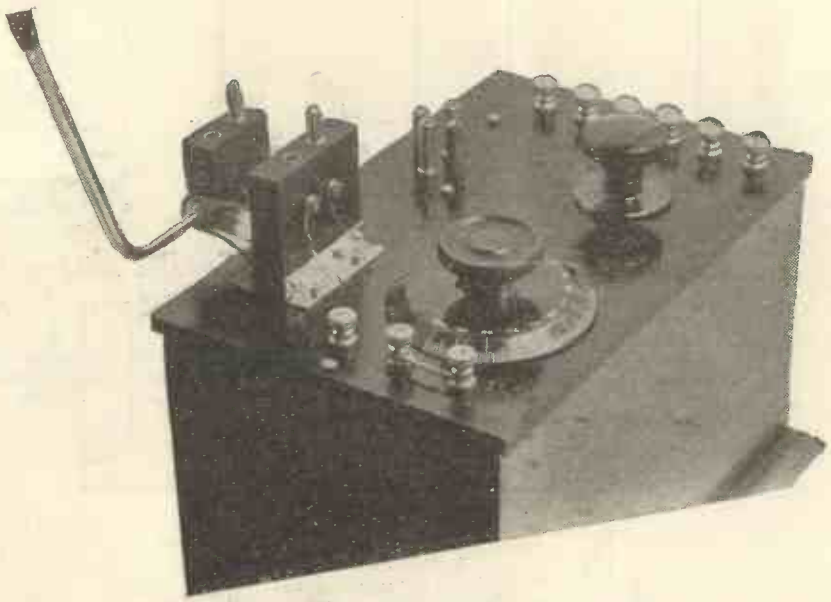


Fig. 1.—The receiver without valve or coils.

GIVEN an averagely good aerial, the possibilities of reception upon a single valve are exceedingly interesting, the receiver responding to many of the distant B.B.C. stations, even if not all of them. Patience in tuning, together with some practice, will reveal to those readers who are not already familiar with the fact, that even Continental telephony may be received with perfect clearness upon a single valve. With the receiver illustrated Radio-Paris can be received in south-east London with very little difficulty, whilst the Eiffel Tower also offers similar possibilities. So far as the B.B.C. stations are concerned, Bournemouth, Birmingham, Cardiff, in addition to the local station, can be tuned with very little skill. Aberdeen, Glasgow, and Manchester are somewhat more critical, but can, with patience and delicate tuning, be received at a volume consistent with a single valve circuit.

General Considerations

For reasons of simplifying the construction, and at the same time to permit all the telephony wavelengths to be covered by this receiver, the well-known method of using plug-in coils is employed. In order that there may be no difficulty in tuning to the short wavelengths a three-terminal arrangement which has been many times described with-

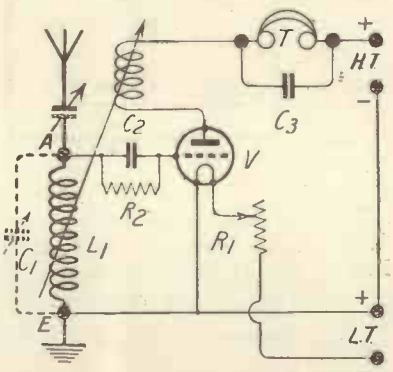


Fig. 3.—The theoretical circuit.

in the pages of this journal, permits the aerial tuning condenser to be connected either in series with the aerial tuning inductance or in parallel.

The appearance of the set may be observed from the photograph Fig. 7, which shows the receiver with valve and coils mounted in their respective positions. The three terminals on the right of the panel are for the aerial, earth, series or parallel aerial condenser connections, whilst those on the right, reading from the top downwards, are the telephone terminals, the H.T. positive and negative terminals, the L.T. positive and L.T. negative. The few components involved and the simple layout of the panel may also be gathered from the photograph.

The Circuit

A simple theoretical circuit of the receiver is given (Fig. 3), where the condenser C1, shown in black, is in the series position, whilst C1, shown in dotted lines, indicates the same condenser in parallel. An inspection of the actual circuit used in the receiver will show how these two arrangements are arrived at.

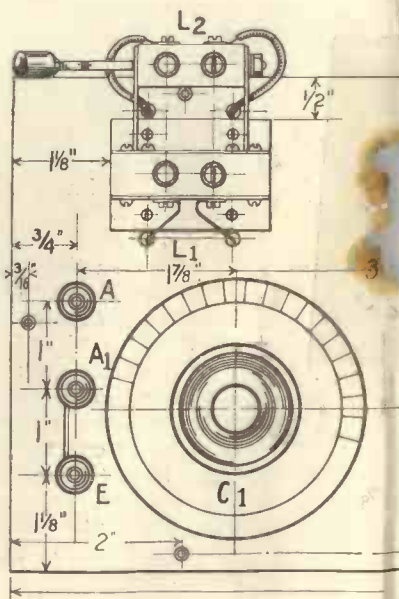


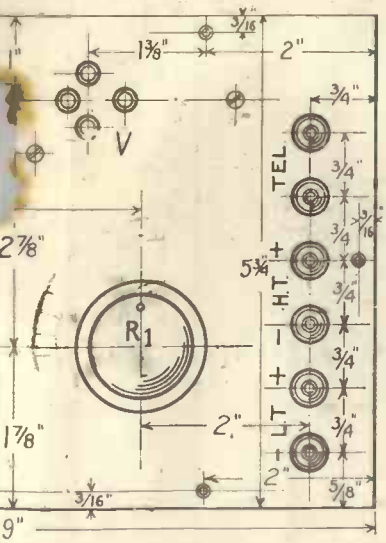
Fig. 5.—Top of panel mar

e Receiver for Emitter Valves

ember I.R.E., Staff Editor.

ether with ease in operation are the outstanding features le receiver.

With the aerial connected to the terminal marked A, the earth to E, and the terminal A1 joined to E, then the condenser C1 will be in parallel with the coil L1; on the other hand, if we connect the aerial to A1, the earth to E, disconnect the joining wire between A1 and E, leaving the terminal A quite free, then the condenser C1 is in series with the aerial inductance L1. When receiving the B.B.C. stations it may be taken that the condenser C1 will, in most cases, be used in parallel with suitable coils, but for the reception of stations using wavelengths below those used by the B.B.C. the series connection should be tried.



ings and drilling details.

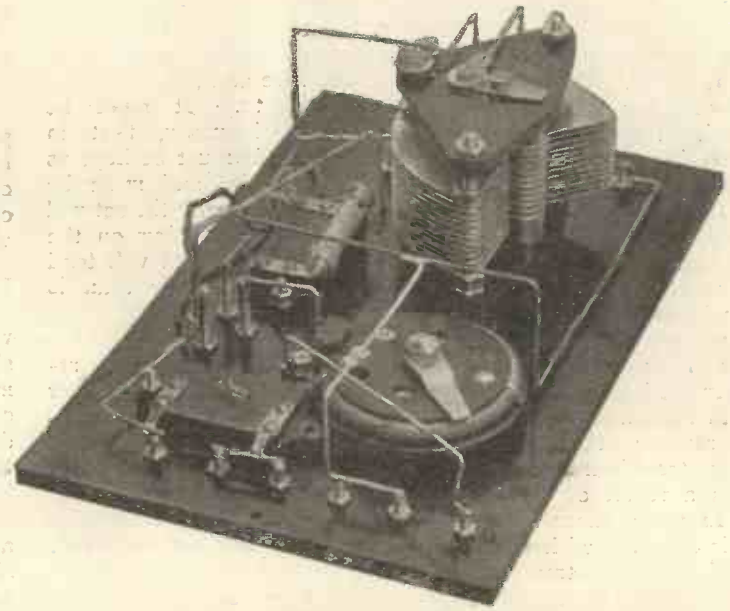


Fig. 2.—Back of panel wiring.

Components and Material Required

The materials and components embodied in the receiver are as follows, and for the guidance of

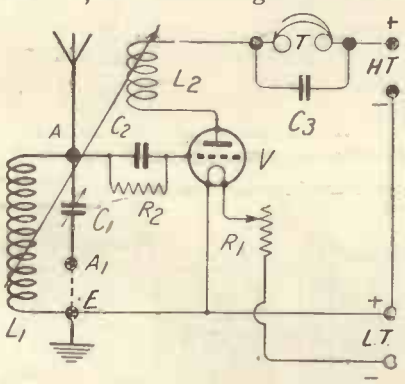


Fig. 4.—Terminal arrangements.

those readers who wish to build a set strictly in accordance with the one illustrated, the names of the manufacturers are also given. This information is given purely for the benefit of those readers who wish to take advantage of it, and does not in any way imply that these makes must be used before results similar to those obtainable with the receiver illustrated can be hoped for. In the matter of values, these must be strictly adhered to in every respect in that they are the result of considerable experiment, and any departure therefrom may quite easily be recognisable by the receiver either not working at all or, at any rate, not working satisfactorily.

One ebonite panel measuring 9 in. by 5¾ in. by ¼ in.

One 0.0005 μF variable condenser (Bowyer-Lowe).

One two-coil holder (Burne-Jones).

One fixed condenser of 0.0003 μF capacity (Dubilier).

One similar condenser of 0.002 μF capacity (Dubilier).

One grid leak of 2 megohms value (Dubilier).

One filament resistance for bright or dull emitter valves (Burndept).

One valve socket or alternatively four-valve socket pins.

Nine brass terminals.

Quantity of connecting wire.

One pair of 2,000 or 4,000 ohms telephones.

One accumulator (suitable for the particular valve chosen).

One H.T. battery of about 60 volts.

One valve (bright or dull emitter).

Set of plug-in coils for the wavelengths desired.

One set of Radio Press wireless panel transfers.

The Panel

This is made from the ebonite sheet given first in the list of components, and is drilled in accordance with the instructions given in the figure illustrating the layout of the panel. When purchasing ebonite for this or any other panel, the constructor should ascertain whether or not the material offered is guaranteed to be free from surface leakage. This warning, many times repeated, is necessary in that there are on the market certain makes of ebonite which are not guaranteed, and unless, after the drill holes have been made, such panels are treated with a severe rubbing with fine emery paper in order to remove the glossy finish, serious trouble may be experienced as a result of surface leakage. In those cases where the reader is supplied with guaranteed ebonite the treatment of the panel with emery paper is not only unnecessary but will undoubtedly spoil the fine finish of the material.

Wiring the Receiver

The photograph illustrating the underside of the panel will reveal to readers the simplicity of the wiring, and the need of nothing more than average skill with a soldering iron. The wiring, it will be seen, is carried out with stiff wire, but in those cases where readers anticipate difficulty in wiring by this means the somewhat easier operation of using soft wire and systoflex may be resorted to. It must be pointed out, however, that in either case leads must be kept as short as possible, and must be well spaced, otherwise the set will not give accurate tuning on the short wavelengths, and will tend to oscillate more easily than is intended.

Valves

As the title implies, this receiver may be used with either bright or dull-emitter valves, subject, of course, to the filament resistance specified (or other similar make) being fitted. When operating with this receiver it is essential that the correct H.T. voltage is applied to the valve chosen, otherwise the control of reaction will be somewhat erratic; information regarding the most suitable voltage will be found either upon the valve chosen or else upon its wrappings when purchased; in any case, a 60-volt tapped H.T. battery will cover all requirements for easy control of reaction and good reception with this receiver.

Operating the Receiver

After the wiring has been successfully completed and the constructor has assured himself that all soldered connections are firm, the set should be mounted in a suitable box and with the filament resistance turned to the "off" position, the accumulator, H.T. battery, and telephones should be connected to the terminals indicated in the panel layout, and the valve inserted in its socket.

Short Waves

For the reception of the short-wave B.B.C. stations the aerial should be connected to the terminal A, the earth to E, and A1 connected to E (parallel condenser). In the aerial coil socket, that is, in the fixed coil socket, insert a No. 25 or 35 coil for wavelengths below 400 metres, or a No. 35 or 50 for wavelengths above 400 metres. In the reaction coil socket (moving) insert for wavelengths up to 400 metres a No. 50 or 75 coil, and for wavelengths above 400 metres a No. 75 or 100 coil.

With the coils mounted move them to a right angle position and light the valve to a suitable brilliancy.

Tuning is effected by slowly turning the condenser C1 at the

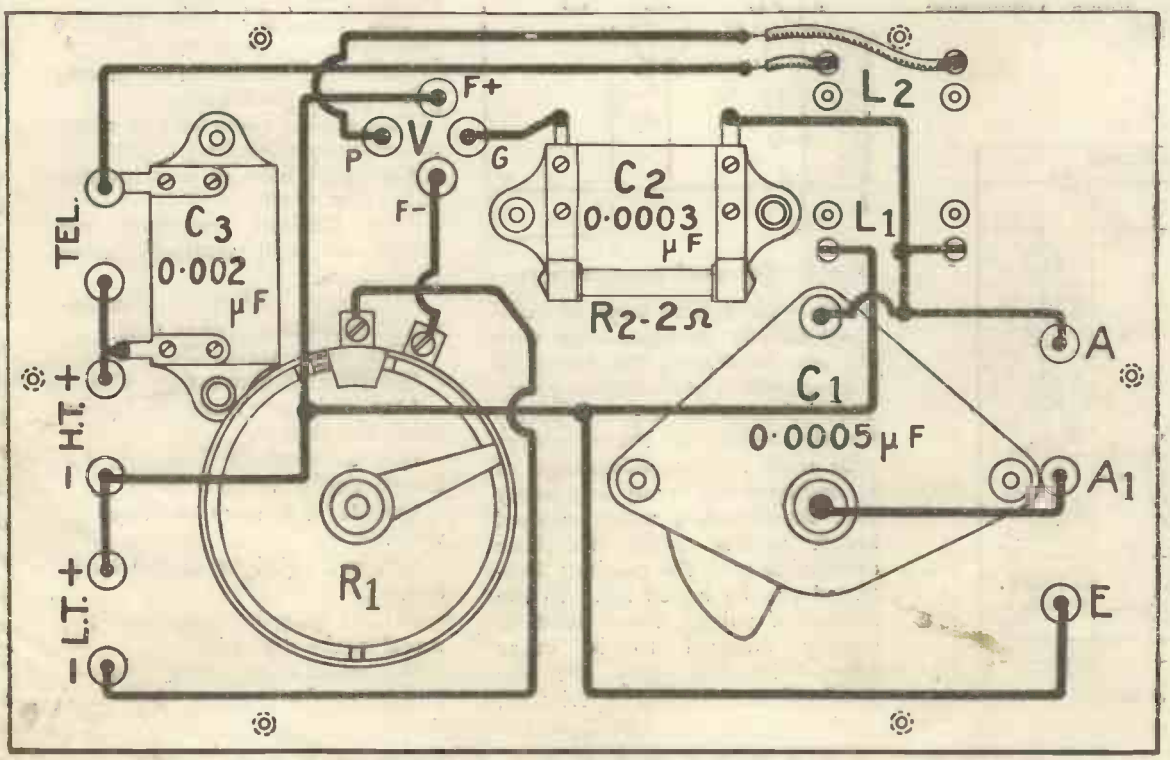


Fig. 6.—Practical wiring diagram of the instrument.

same time bringing the moving coil nearer to the fixed until the best results are obtained with the one particular station desired; the positions of both the reaction coil and the condenser will, of course, vary with each individual station. When tuning with this receiver every care must be taken to prevent the set from oscillating, a condition which is brought about by the too close proximity of the reaction coil in relation to the aerial coil, and is indicated by a pronounced "plonk" being heard in the telephone receivers. It may happen, however, that no "plonk" is produceable which is indicative of the set not oscillating at all, which condition is remedied by reversing the connections to the reaction coil socket. It must be remembered when operating this receiver that any change in the position of the aerial condenser, filament resistance, or H.T. voltage will affect the reaction adjustment.

Readers desirous of receiving wavelengths other than those used by the short-wave B.B.C. stations, should, in the cases of 5XX and Radio-Paris, use a No. 150 in the aerial socket with a No. 200 or 250 for reaction, whilst the Eiffel Tower may be received with a No. 250 for the aerial coil and a No. 300 or 400 for reaction. The operation of the receiver for these higher wavelengths is precisely the same as in the case of the shorter ones.

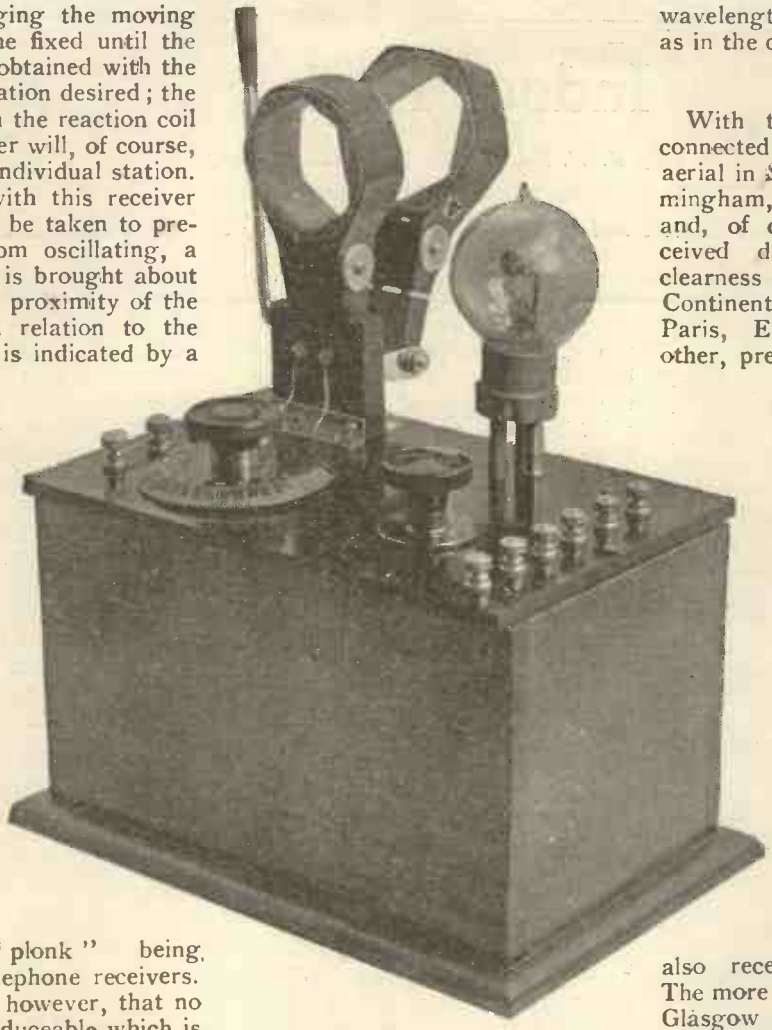


Fig. 7.—The complete receiver with coils in place ready for work.

Test Report

With the receiver described connected to an average P.M.G. aerial in South-east London, Birmingham, Bournemouth, Cardiff, and, of course, 2LO, were received during daylight with clearness and easy tuning. The Continental stations, Radio-Paris, Eiffel Tower, and one other, presumably German, were also received during daylight. The more distant B.B.C. stations, Glasgow and Manchester, after careful tuning, were received at faint strength during the evening hours.

Connected to an indoor aerial in the same district, Birmingham, Bournemouth, Radio-Paris, Eiffel Tower, 5XX, and Madrid, in addition to London, were received at fair telephone strength consistent with what one might expect from such a simple receiver as the one described.

Organ Recitals from P.T.T., Paris.

THE Paris station of the Ecole Superieure des Postes et Telegraphes will be transmitting organ recitals by Monsieur Georges Jacob, organist of the "Société des Concerts du Conservatoire." Each recital will be accompanied by a small talk about the history of organ music. These transmissions will take place every third Sunday of the month at 8.30 p.m. G.M.T.

French Experiments on Fading.

For some time the Paris Station P.T.T. has been conducting experiments on fading.

Up till the present the only reliable conclusions to which the experimenters have arrived at are as follows:—

(1) Fading only occurs during the periods of darkness.

(2) Maximum fading occurs for wavelengths between 180 and 400 metres.

Indoor Aerials

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

Hints for flat dwellers and others who cannot conveniently erect an outside wire

WITH the approach of winter and better conditions for broadcast reception, it is safe to say that thousands of new sets will be installed throughout the country within the next two or three months. For many people the erection of an aerial may present a rather difficult problem. Those who have the space to do so should certainly erect an outdoor aerial, making it as high as possible and using the full length of wire allowed by the Postmaster-General's regulations. There are, however, other enthusiasts not so fortunately situated, such as dwellers in flats, occupiers of

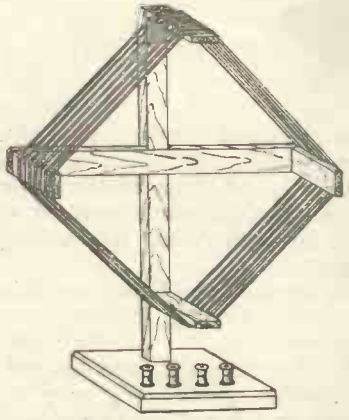


Fig. 1.—A simple frame aerial.

houses which have no gardens, and the like, who must perforce make use of some indoor device. There are quite a number of types of indoor aerial, and in this note I want to say a little about two or three of them. The handiest and most compact form of indoor aerial, though it is not by any means the most efficient so far as range and signal strength are concerned, is the frame, a simple type of which is shown in Fig. 1. This may be made quite easily by fixing an upright 2 ft. 6 in. in length to a suitable base and connecting an arm 2 ft. long to it at right-angles 1 ft. down from the top. To the ends of the arm, to the top of the upright and to the base of the upright 6 in. above the base pieces of hard wood 1 in. by ½ in. and 4 in. long are fastened by means of screws. Slots ⅛ in. apart are cut in the edges of these pieces and ten turns of good quality flex are wound round the frame resting in them. Four terminals mounted in panel bushes are fixed to the base. The first of these is connected to the starting end of the windings, the second and third to tappings taken respectively at the eighth and ninth turns, and the last to the out end of the winding. This aerial with a .0005 μF condenser in parallel will tune from about 275 to 550 metres and will enable the broadcast band, including the relay stations, to be covered with ease.

Frame Efficiencies

It is almost impossible to prophesy how the frame aerial will behave in any particular house. In some it does extremely well, whilst in others—such, for example, as my own—it is practically useless. As a general rule, however, it should enable main station transmissions to be brought in by a crystal set up to about two or three miles, on a single valve set up to 15, and if one stage of high-frequency amplification is used, the range should be increased to about 50 miles.

Not Always Directional

It will generally be found that a frame aerial is directional, that is, in order to obtain the best results it must be turned so that its edge is pointing towards the station which it is desired to receive. This condition of affairs is practically always obtained when a frame is used in open country, but indoors it may be found that the frame is not directional at all, or that, if it is, it must be turned towards the fireplace or some other large metallic object to give the best results. Speaking generally, the frame aerial will be found to be rather more than one high-frequency stage worse than a good outdoor system. If the frame is directional in any particular house, this property is all to the good, since it enables unwanted signals to be cut out with the greatest ease. A further advantage of the frame is that it eliminates to a very great extent both mush and the atmospheric noises that are brought in by an outdoor aerial.

Electric Light Wire Aerials

A second type of indoor aerial makes use of electric light wires as collectors of oscillations. This consists of a small device whose base is shaped like that of an electric lamp. Within is a condenser which acts as a com-

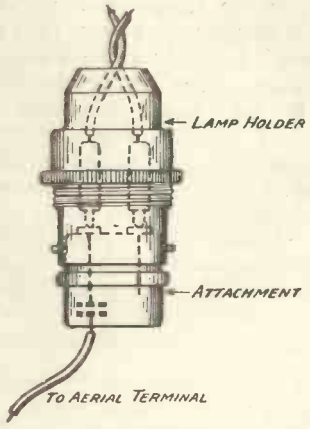
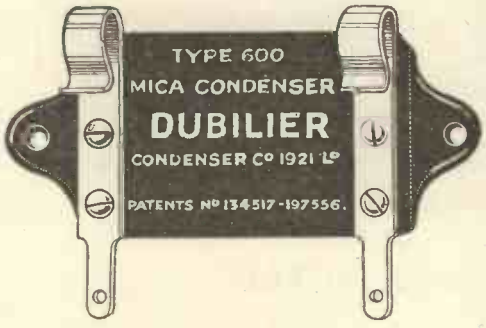


Fig. 2.—Principle of the plug-in attachment.

plete barrier to direct current, but allows high-frequency oscillations to pass with ease. This component, which is obtainable from advertisers in this journal, is called the "Ducon."

Wires Round the Room

Another kind of indoor aerial which usually gives results superior to those obtained with either of the foregoing devices is made by suspending an insulated



Type 600—For all purposes in connection with receiving apparatus. With or without clips for grid leak.
.0001-.0009 mfd. 2/6 each
.001-.006 mfd. - 3/- each

Type 600a—As Type 600 but for vertical panel mounting.
.0001-.0009 mfd. 2/6 each
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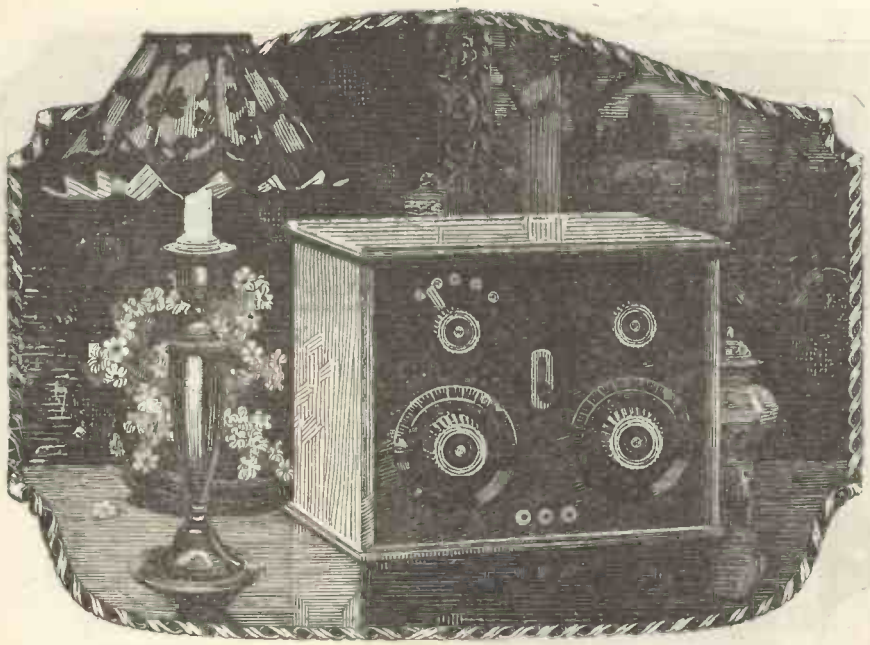
DUBILIER GUARANTEE.

Your only safeguard lies in purchasing the products which carry the guarantee of a firm with a reputation to maintain.

All Dubilier fixed condensers are guaranteed to be within 15% of their stated capacity, and where desired they can be manufactured and guaranteed within still closer limits. The type 600 illustrated here and the type 600a are practically universal amongst manufacturers of complete sets, whilst experienced home constructors continually assure us that they can feel complete confidence in the working of their sets when—and only when—they have fitted Dubilier Condensers. See that they are in your set as well.

E.P.S. 82



—a cheap Panel may be the most expensive item in your Set

IF you have built a Set, you may have experienced the mortification of having spent several hours in drilling a panel and wiring it up only to find that not a note can be obtained from it. You may remember how, at great inconvenience, you looked carefully over the whole circuit. How you tested every component and still never a sound from your Set. And then, perhaps, you discovered you were using a low grade piece of leaky ebonite for your panel.

Not everything masquerading as ebonite is worth using as a panel—in fact, it is difficult to conceive a greater test for any insulation material than to use it in a Wireless Set.

The extremely weak impulses received upon your aerial, when conveyed to your Set, so readily leak away that the greatest care must be taken to preserve them if you are going to receive any signals at all. That is why a cheap panel can be easily proved to be a waste of time and money.

Radion is the highest grade of insulation in the world, and has been specially developed for wireless use. Its highly polished surface, **which need not be removed before use,** enhances the appearance of the finished instrument and prevents the formation of dust.

Radion is sold in black and mahoganite —a beautiful colour, very similar to old mahogany—with dials and knobs to match. It is packed in stout envelopes in the convenient sizes shown below. For your next Set choose Radion—every panel is stamped—then you can be certain that it will look better and work better.

Radion Sizes and Prices

Size	Black	Mahoganite	Size	Black	Mahoganite	Size	Black	Mahoganite
6″ × 7″	3/6	4/3	7″ × 14″	8/-	10/3	8″ × 26″	17/6	21/3
6″ × 10½″	5/3	6/6	7″ × 18″	10/6	12/9	9″ × 14″	10/6	12/9
6″ × 14″	7/-	8/6	7″ × 21″	12/3	15/-	10″ × 12″	10/-	12/-
6″ × 21″	10/6	12/9	7″ × 24″	14/-	17/3	12″ × 14″	13/3	16/-
7″ × 9″	5/3	6/6	7″ × 26″	15/-	18/6	12″ × 21″	19/9	24/3
7″ × 10″	5/9	7/3	7″ × 30″	17/9	21/6	14″ × 18″	19/9	24/3
7″ × 12″	7/-	8/6	7″ × 48″	28/-	34/6	20″ × 24″	39/6	48/-

Special Note :—All ¼ thick—quite sufficient owing to Radion's tremendous strength.

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No matter which type of Set you are building, whether Crystal or multi-valve, and whichever type of tuning you will use, variometer or plug-in coils, you will find a wide variety of practical circuits shown in a manner even the veriest novice can readily understand.

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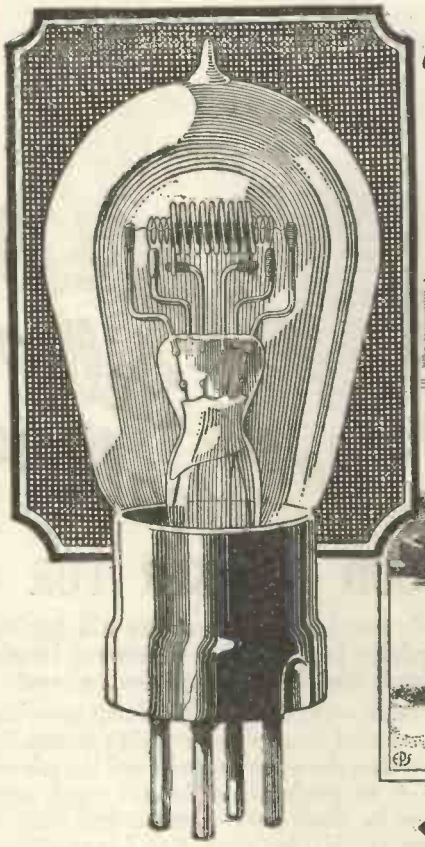
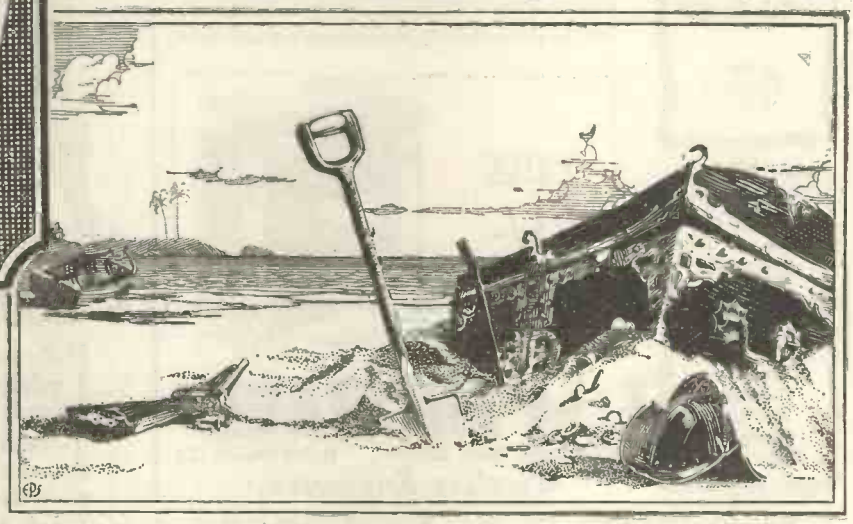


Louden



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The search for hidden treasure was formerly one of the recognised methods of acquiring wealth.

Unfortunately most of the treasure has now been found, so we have got to fall back on the adage "A penny saved is a penny gained," and amass our treasure by not spending it.

The two chief sources of expense in Wireless are the recharging of accumulators and the replacement of valves. The Louden Valve reduces these to such an extent that, reckoned by the money it saves, it is a fortune in itself. To begin with the Louden Valve costs only 10/–.

It takes only 0.4 ampere in the filament, *enabling your accumulators to last twice as long on one charge* as with the ordinary bright filament valve taking 0.75 amp. You have, in fact, very nearly the advantage of a dull emitter valve at a cost of 10/–.

It gives its maximum volume at about 4.9 volts on the filament. Increasing the brilliance of the filament beyond this point causes a slight drop in the volume. Thus there is no temptation to run the valve "all out" and a long life results.

Finally the filament enjoys great length of life because the harmful charges which otherwise would continuously bombard it are forced through the spiral anode out of harm's way.

All these advantages are yours when you buy a 10/- Louden Valve, and this takes no account of the Silver Clear reproduction which alone makes the Louden Valve worth twice what is asked for it.

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The Plain Louden for Detecting and Low Frequency Amplifying.

Filament Volts ... 4.8-5
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The Blue Louden for H.F. Amplification.

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E.P.S.3.

wire round the room. This can be done most conveniently by using good quality bell wire and fixing it by means of insulated staples to a cornice or picture rail. This kind of aerial may be used either as a loop (by attaching its two ends to aerial and earth terminals) or as a simple aerial, in which case one end is attached to the aerial terminal of the set whilst a connection to a water pipe or some similar metallic object is taken from the earth terminal.

Attic Aerials

A collector which usually does extremely well can be made by slinging a number of wires (generally the more the better) between spreaders up in an attic. The greater the length and height obtainable, the better will results be. The lead-in of this aerial should consist of stout stranded wire well insulated brought down in the most direct possible way to the receiving set. A good earth is essential.

Other Forms

Sometimes extraordinarily good results can be obtained by slinging a single wire diagonally across the room in which the receiving set is situated, fixing it as near the ceiling as possible. Here again the quality of the earth is of the utmost importance. I know of one case in which very good reception is obtained in a high block of flats from a single wire which hangs in the well of the staircase. In another, after various forms of indoor aerial had been tried, it was found that the best results were obtained by using the lead covering of the electric light wires as a collector, a wire being taken from this to the aerial terminal of the set. It should be noted that gas pipes should never be used as earths. Whether or not there is any actual danger in doing so is a question on which there are two opinions; but apart from this the sealing compound used in making joints of gas pipes is a very efficient insulator and offers a high resistance to the passage of current. An excellent earth is provided by any ascending water main, and as a rule by radiator systems. If no such earth is handy, a very good substitute can be made simply by attaching one end of a coil of insulated wire to the earth terminal and allowing it to lie loosely on the floor under the table which supports the set. This forms quite an effective counterpoise.

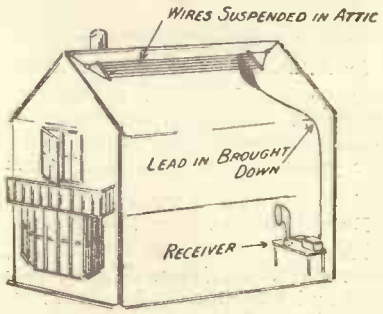
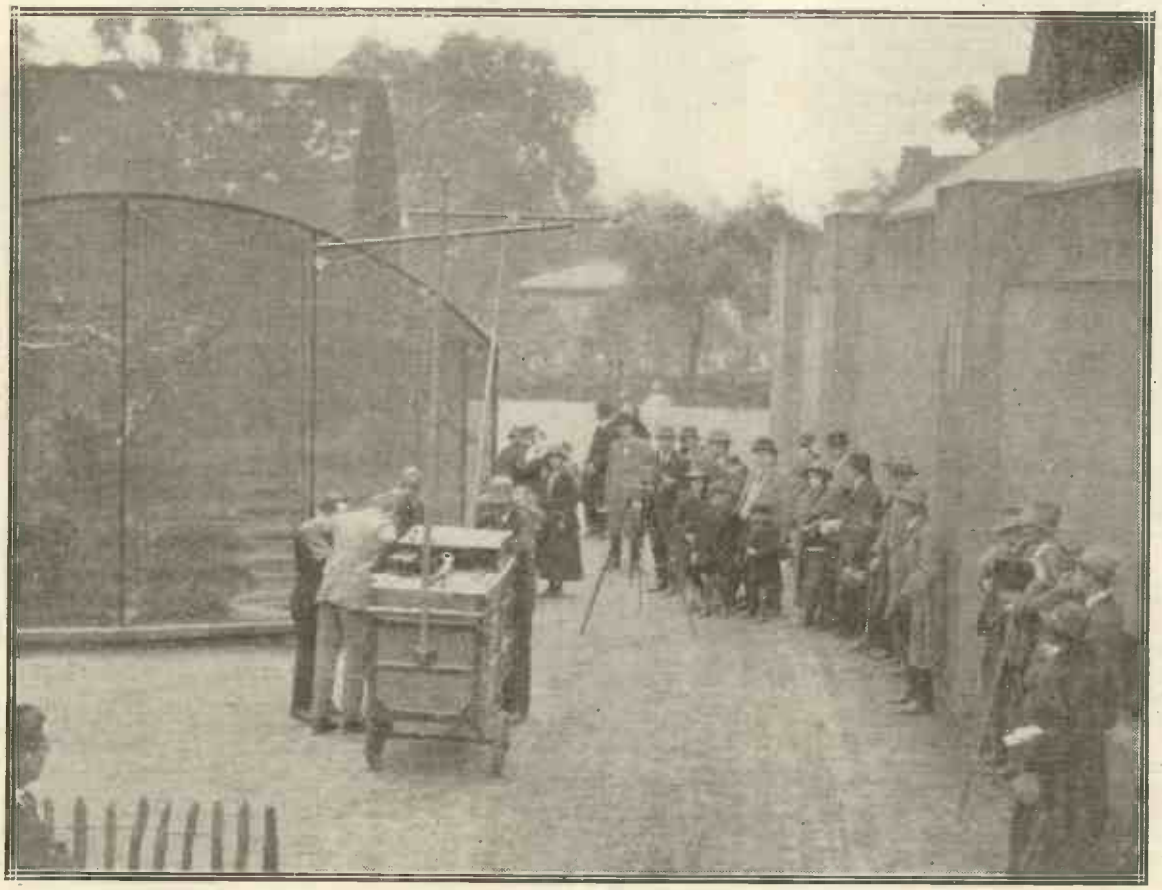


Fig. 3.—An attic aerial.

ZOO RADIO.



A successful feature in a recent afternoon programme was the broadcasting of animal cries from the Zoological Gardens. Our photograph shows the portable broadcasting apparatus in operation.

Apparatus we have tested

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

Battery Switches

Some neat switches for panel-mounting, suitable for controlling L.T. current, have been sent for our inspection by Messrs. R. A. Rothermel, Ltd. These are similar to some reported on previously in these columns; a polished rectangular metal plate, 2 in. by 2¼ in. in the case of the double switch, and 1⅝ in. by 1⅛ in. for the single, carries behind it a cylinder of insulating material about 1 in. diam. by ¾ in. deep for each switch-point, in the interior of which the gear is mounted. Small terminal-screws, further isolated by a ridge formed in the cylinder-end, are provided for electrical connections, a brass bus-bar making common the one side of the double switch.

On test, the insulation proved excellent on high voltage, and the switches operated in a smooth and satisfactory manner.

"Royal" L.F. Transformer

A L.F. inter-valve transformer of high finish and of small dimensions, but in which performance has not been sacrificed for compactness to the extent which is too common with this type of instrument, is the "Royal," a sample of which has come to hand from Messrs. R. A. Rothermel, Ltd.

This is only about 2½ in. square by 1⅝ in. wide, and is of the enclosed type. Small terminals are provided on the two vertical strips of insulation in front. The general appearance is decidedly attractive. Insulation-resistance showed up satisfactorily in a severe test.

On trial in actual reception, in comparison with several other standard makes, and with our own standard, the tone was not markedly inferior to the best; the degree of amplification, observed aurally and measured on a fairly uniform passage from De Groot's band *via* the London station (time-average of R.M.S. value of actual signal-volts across the 'phones, in a two-valve set with this as L.F. coupling) fell a little short of the standard. The performance was, however, very good indeed for a small transformer. As a second-stage transformer, with moderate power amplification, similar results were observed. Care had to be taken, in the latter case, to arrange the I.P.-O.P. connections aright to avoid self-oscillation at audio-frequencies, and heavy negative grid-bias was, of course, called for.

Box Spanners for B.A. Nuts

Messrs. Accles & Pollock, Ltd., have sent us specimens of some very neat and business-like box spanners of a size suitable especially for the small nuts used in radio-construction. These are in the form of small steel tubes, 3 in. long, with one end shaped to give a broad, flat handle which gives a good grip to the fingers, and the other formed in a hollow hexagon shape of .220 in., .282 in., and .338 in., measured across hexagon flats respectively, thus fitting the commonest sizes of B.A. nuts used in such work.

Practical trial of these tools soon showed the great convenience of the

The new Burndept Grand Receiver

Announcement

SO great has the demand been for Claritone Loud Speakers and Headphones that we fear considerable disappointment has been felt throughout the trade owing to our inability to meet your valued commands. Messrs. The Automatic Telephone Manufacturing Co. have just completed an extension to their plant and, in consequence, have more than doubled their output. You can now get supplies at your nearest dealer. If not, a postcard to us is all that is necessary.

PRICES :

Large Model Claritone	2000 ohms. / 120 ,,	£5 : 15 : 0
Junior Model ,,	2000 ,, / 120 ,,	£2 : 15 : 0
Claritone Head Gear	.. ..	25/-

THE ASHLEY WIRELESS TELEPHONE COMPANY,

69, Renshaw Street, LIVERPOOL.

Distributing Agents for The Automatic Telephone Manufacturing Co., Ltd.

Mars Aerial Facts

The super-aerial for amateurs and experts —improves radio reception by 50% over 7/22's

TO THE TRADE
Please order the "Mars" through your usual wholesaler, but if he cannot supply, write direct to us for terms on your letter heading. At present we are 7 days behind with deliveries, but every effort is being made to get abreast of the demand.

The Mars Aerial consists of 84 strands of fine hard-drawn phosphor bronze wire, SPIRALLY wound, so that each wire is AIR-INSULATED. It has the lowest ohmic resistance yet attained. Thoroughly tested it has been proved to give 50 per cent. greater efficiency than 7/22's when used for reception; 90 per cent. greater efficiency than 7/22's when used for transmission.

Introduced at the beginning of September, nearly 10,000 were sold during the month.

Hundreds of letters have been received, giving evidence of remarkable results attained, and the variety of experiences related indicate that the full extent of the "Mars" usefulness has not yet been fully ascertained.

From the time you fix the "Mars" you will get the results we definitely claim, and in the "Mars" you will find a most interesting line of experiment—let us know the results you secure.

THE MARS AERIAL

Price 9/6 from all leading wireless dealers; or from the sole manufacturers and patentees:

E. & W. G. MAKINSON LTD.,

Wellington Wrks., Wellfield Rd., PRESTON.

Established over 40 years.
Telephone No.: Preston 122.
Telegrams: "Gold," Preston."

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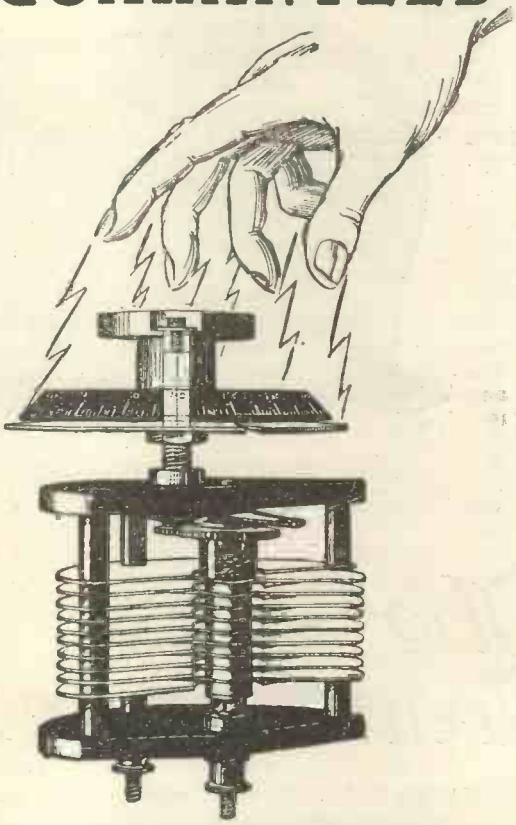


TO ABOLISH HAND CAPACITY

The Naylor "Fulstop" Condenser is the only Condenser which entirely eliminates hand capacity effects. That irritating distortion you hear every time your hand approaches the operating knob cannot exist if you have a 'Fulstop' Condenser.

The abolition of hand capacity effects is ***guaranteed unconditionally*** by the makers and money will be refunded if any instrument does not give absolute satisfaction. Get the best out of your set by getting a

'Fulstop' Square Law Principle Condenser

Prices	.001.....13/6	.0003.....10/3
	.0005 .....11/3	.0002..... 9/6

Stocked by most Wireless Dealers, but if you have any difficulty send direct to

J. H. NAYLOR, Ltd., Central Brass Works, WIGAN

Fulstop VARIABLE CONDENSER

WIRELESS WEEKLY SMALL ADVERTISEMENTS.

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.

BATY Condenser, High Max., Low Min., High insulation, Min. weight, 5/3 post free. Coil to match, 230/4,000 metres, 6/9 post free. Combined space 4"x1", weight 2 oz. Suitable for all circuits. Technical reprints giving circuits, 1/3 post free. Ernest L. Baty, Luton

DON'T SCRAP YOUR VALVES.—Wireless Valves repaired equal to new. Dull emitters and ordinary 6/- each, guaranteed delivery 14 days. Traders write for terms.—Hall & Co., Engineers, 70/2, Chancery Lane, London.

FOR Sale, 1,000 shares fully paid in Burndept's, Ltd. Sound investment, last two dividends 25 per cent. and 20 per cent. Price 35/- each.—Donald McCall & Co., Ltd., 27, Greenwich Road, S.E.10.

PARTNER or Director required for Involute Helical Inductor Cylinder Generators and Motors, D.C. (Self-commutated) and A.C. Adapted for press tool mass products, suitable all sizes and purposes. Patented in all countries. Great opportunity to obtain large or controlling interest (£5,000 upwards) in British Patent as affecting aircraft and wireless, for which large orders are promised. Invaluable first hand knowledge and experience could be acquired.—Reply to Box A.22, "Wireless Weekly," Barclays, Sentinel House, Southampton Row, W.C.1.

RADIO PRESS INFORMATION DEPT.

2/6 QUERY COUPON

WIRELESS WEEKLY.
Vol. 4. No. 24. Oct. 15, 1924.

(This coupon must be accompanied by a postal order for 2/6 for each question, and a stamped addressed envelope.)

box-spanner type for reaching otherwise inaccessible nuts, such as those close behind a panel in some remote corner of a finished receiver.

Francis Two-way Coil Holder

A two-coil holder of novel design has been submitted for test by J. Francis. In this, the coil-plugs slide on four parallel bars arranged in the form of a rectangular frame with ebonite end-plates, and are moved endways by a differential screw action, the necessary right- and left-hand threads of different pitch being cut on a centre-controlling spindle. An ebonite knob at one end actuates the device; a scale graduated from 0 degree to 100 degrees indicates the relative positions of the coils, which are kept parallel throughout their movement. The whole mechanism is just over 6 inches long, and the range of variable coupling from about $\frac{3}{4}$ inch to $3\frac{5}{8}$ inch centres. The frame is fixed on the panel by four small screws, and four convenient terminals are provided on one end-plate. Connections are made to the moving coils in an ingenious and effective manner by means of spring-backed contact-plugs bearing against and sliding along the longitudinal rods of the frame, which act as bus-bars for this purpose. This makes for silent operation and low resistance, and is manifestly superior to the usual short flexible leads. Workmanship and finish were found satisfactory.

Whilst it is not very clear what particular advantage this differential screw arrangement offers over a simple fine-pitched screw for adjusting the relative position of the two coils, in practical trial the holder certainly operated very smoothly and gave fine regulation of coupling, as well as a good range of the same, and could carry the largest sizes of plug-in coils with ease.

Condenser Case with Permanent Label

From Messrs. Shermays, Ltd., come samples of moulded composition fixed condenser cases in which are incorporated a capacity indicator in the form of a white engraved label with clear black figures which is actually inlaid or moulded into the top of the case, and cannot therefore be torn off or effaced in use, as is the case with some of the customary types of markings on fixed condensers. We understand that the method has been suitably protected, and that it is available to condenser manufacturers. From inspection of the samples, though the composition was of the ordinary dull brittle type, the figures certainly stood out in an unmistakable and pleasing manner.

Radio Notes

Broadcasting the Niagara Falls

An American station will shortly be broadcasting the Niagara Falls. If this is KDKA, perhaps we have some interesting items to hear in London on a crystal set.

* * *

Dance Music from Radio-Paris

The Compagnie Française de Radiophonie recently appealed to its audience to find out whether they would prefer jazz music or the old kind of dance music, consisting of polkas, mazurka, waltz, etc.

The Company are proposing three nights of dance music a week, and the total number of replies was 5,684. The result of the referendum showed :—

1 evening of jazz, 2 evenings of old dances, 2,215 votes.

3 evenings of old dances, 1,884 votes.

It is doubtful if old dances would be so much in favour in this country.

The "Wireless Constructor"

A New Publication by Radio Press, Limited

THE many thousands of readers of *Wireless Weekly* who have to-day purchased the first number of *The Wireless Constructor* will need no introduction to the new paper, for its aims and objects are made perfectly clear in its opening pages. For the benefit of those who have not yet seen a copy, some explanation will perhaps be of interest.

The Wireless Constructor is, frankly, designed to obtain a very large circulation by publishing special features which appeal to a very wide public. The price (sixpence) is, of course, remarkably low, and in these days brings the publication within the reach of even the humblest schoolboy. The low price is made possible by the very wide appeal, and no less than 175,000 copies of the first issue have been printed. *Wireless Weekly* at sixpence appeals to a certain section of the wireless public, and *Modern Wireless* at one shilling has also its special appeal. *The Wireless Constructor* is planned on lines different from the two journals just mentioned, and consequently there will be no clashing between the three magazines issued by Radio Press, Limited.

It is unnecessary to remind our regular readers of the unique facilities which Radio Press, Limited—a firm which devotes itself exclusively to the publication of wireless literature—possesses for the publication of such a journal. The famous experts who write exclusively for Radio Press publications will also contribute to the new magazine from time to time. Mr. Percy W. Harris, who has been appointed Editor of *The Wireless Constructor*, needs no introduction to *Wireless Weekly* readers. Mr. Harris is the originator of the modern "How To Make" articles, and his reputation as a wireless designer and his knowledge of what the home constructor needs are unrivalled.

Whilst *The Wireless Constructor* will interest hundreds of thousands who are just taking up the great new art, it will also contain a number of features making strong appeal to the more advanced amateur. Thus full constructional details are given by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., for the construction of a two-valve Resistoflex Receiver, utilising the remarkable new circuit which has created so much interest in wireless circles. Mr. Harris himself is describing a novel neutrodyne receiver of extreme sensitivity and selectivity, a free blue print being given away with every copy. Incidentally Mr. Harris states that this is the best three-valve set he has yet made. Mr. E. Redpath and Mr. G. P. Kendall, both popular contributors to this journal, also figure in the list of writers in the first number of *The Wireless Constructor*. Readers should therefore lose no time in obtaining their copies, as it is anticipated that even the huge first issue will be completely sold out within the first few days of publication.

The Spirit of Pioneering

The spirit of Pioneering—that driving force which compelled such men as Cook, Livingstone, Stanley, Scott and others, to write their names boldly in the pages of our national history—has also its counterpart in industry.

There is not one invention that has not been seized upon and improved almost out of recognition because some keen-witted scientist realised that following in the beaten track meant an end to progress.

Take Wireless Valves as an example. For a considerable period it seemed obvious that the most practical design for the three components of the valve was a long straight filament operating within a spiral Grid—the whole surrounded by a tubular Anode.

That such a design has the disadvantage of permitting a certain proportion of the electron stream to leak out of each end of the Anode without doing any work is quite apparent. Yet not until the Cossor Valve—with its arched filament and hood-shaped Grid and Anode—was placed on the market that any serious attempt was made to effect an improvement.

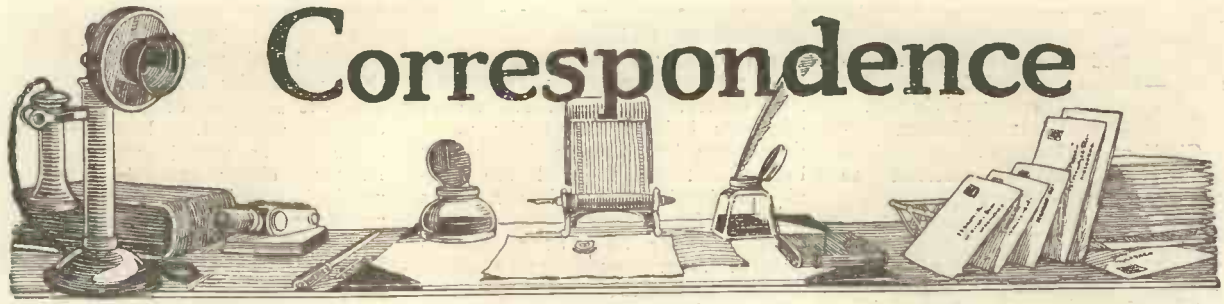
And the same spirit of pioneering is apparent in the clever method of packing Cossor Valves now being introduced. In future, all Cossor Valves sold will be in sealed cartons, and by means of an electrical device the Dealer can demonstrate that the filament is intact, *without breaking the seal*. This patented method is an exclusive Cossor feature, and a definite guarantee that the valve you buy is new and unused.

Cossor Valves

P.1 For Detector and L.F. amplification 12/6

P.2 (With red top). For H.F. amplification 12/6

Advertisement of A. C. Cossor, Ltd., Highbury Grove, N.5. Gilbert Ad. 1566



Correspondence

THE "WIRELESS WEEKLY" OFFER

The President,
The Radio Society of Great Britain,
53, Victoria Street,
Westminster, S.W.1.

SIR,—With reference to your remarks of last night regarding the growing restrictions of the Post Office in respect of experimental wireless transmission, I am, on behalf of *Wireless Weekly*, placing at your disposal the sum of £500 towards fighting a test case with the British Post Office, should such action be taken by you.

This sum has been deposited at the Fleet Street branch of Barclays Bank, and will be available should you desire to take advantage of this offer.

I attach no conditions whatever to the use of this sum, and should any further sums be required, the matter would receive our very sympathetic consideration.—Yours faithfully,

JOHN SCOTT-TAGGART,
Editor.

53, Victoria Street,
Westminster,
London, S.W.1.
October 2, 1924.

SIR,—With reference to your letter ST/DT. dated September 25, and further to this office letter of the same date, I am directed to convey to you the thanks of the Council for your very generous offer to support the Society financially to the extent of £500 in the event of it deciding to fight a test case with the British Post Office in connection with experimental wireless transmission, and to state that the Council has great pleasure in accepting the same.

A sub-committee has been set up to investigate the question, and has been authorised to obtain counsel's opinion.—Yours faithfully,

H. A. ROCK,
For Hon. Secretary.

WIRELESS IN SCHOOLS

SIR,—I enclose a photograph of my senior class listening to the lecture by Mr. Geoffrey Shaw on Monday, September 29.

The set consists of three valves (one Det., two L.F.), and the loud-speaker (full size Amplion low-resistance with transformer) is connected to telephone terminals with long "flex" leads, thus enabling one to carry it to each classroom in turn. The set itself is a fixture in the school hall.

We have developed the "wireless idea" from crystal set to three valves, and find the latter is of about

the average requirement for the classroom, although a stage of H.F. would be a further refinement.—Yours faithfully,

ALEXANDER GROVE.
(Head Master.)
Chalfont St. Peter C.E. School.

[The photograph referred to appears on page 785.]

MODIFIED SETS

SIR,—I note with interest Mr. Kendall's various remarks on "modified" R.P. sets, and in view of the vital importance of the disposition of components, your policy is admirable for the man who wants to build one set for steady use.

Some of us, however (like yourselves!) find little interest in making slavish copies, and of the twenty odd R.P. circuits I have made up, few correspond in lay-out to the published design where given. Some have been re-built several times until they equal, or generally far exceed, the modest results guaranteed, and I find that when that process has been carried as far as possible, the set is usually put on one side in favour of something which puts up problems for solution.

It would seem that lay-out is a painful compromise between electrical efficiency, convenience and appearance (in the order named). One wishes to have tuners handy but remote and coils still more remote, and yet one must severely repress the necessity for long leads. Appearance, a dangerous fetish, demands balance above the panel and wiring bent to nice right-angles below. Incidentally, I am convinced the latter is often a great mistake, for it necessitates the use of more wire and, owing to its parallel arrangement, more interaction than does direct point-to-point work.

Apart from the interest of design from the theoretical circuit, I find two factors dictate it. My sets are often used on the car or in a small yacht, and the usual tray-and-panel type is too vulnerable for this work. With due care I do not find the enclosure of components in a case detrimental to performance in broadcast circuits, and even for home use it is certainly desirable to have delicate valves and condensers safely protected from accident and dust.

The second factor concerns coils. Few of your designs permit the use of coils wound with thick wire on the X formers devised by Mr. Percy W. Harris. I get better signals and sharper tuning with these coils, and should be sorry to revert to ordinary commercial coils. Although it is difficult to decide whether these coils give actually louder signals or not, they certainly seem to make reception both louder and clearer. In addition to their electrical and structural advantages, they are easily and rapidly made, and the number of turns can be quickly adjusted. I often wish some maker would supply the X frames, either moulded or as notched strips. The constructor could easily slot these as desired and wind the coil with thick wire in less time than it takes to wind a basket coil.

The mounting of X coils is the knotty problem if one wishes to avoid the stray capacities introduced by adaptors in the usual coil-holder. I notice some makers of the latter are endeavouring to eliminate loose wire connections by using massive metal strips and bars for contacts. With these it is often possible to pass strong signals without any coils in the holder, and this seems hardly a step in the right direction.

After experiment I find the plane of entry between coil fields makes little practical difference. I have sometimes thought that the electrical symmetry of direct parallel approach should show a theoretical advantage, but in practice it seems to make no difference to the quality or strength of signals whether coils are coupled by a radial or sliding movement either edgewise or face to face. An authoritative opinion on this point would be welcome.

A real Square Law Condenser at a moderate price

ALTHOUGH every experimenter realises the tremendous advantages of square law Condensers many who would otherwise use them are deterred by the necessarily higher price. The new Peto-Scott square Law Condenser shown here is an attempt to place on the market a really good instrument possessing most of the advantages of higher priced condensers at a figure within the reach of all.

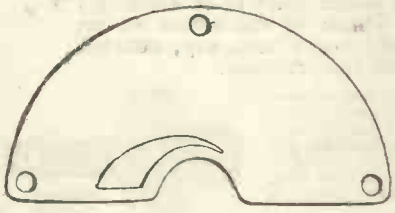
It is substantially made with fine spacing washers and solid ebonite end pieces—both ends of which are brass bushed to prevent wear. It is affixed to the panel with one hole only—a great convenience to the home constructor.

A special feature is its two-piece dial which is absolutely self-centreing. Any dial that must be set on its shaft with some form of set screw cannot be true and develops an unsightly wobble.

Remember that such authorities as Mr. Percy W. Harris and others emphatically state that every Variable Condenser ought to be of the square law type.

PRICES :

.0001 mfds.	7/-
.0002 mfds.	8/6
.0003 mfds.	10/-
.0005 mfds.	10/6
.001 mfds.	11/6
Dual Condenser for two stages of H.F. Each half .0003 mfds.	15/6



Note the novel design of the special Peto-Scott Square Law Plate (registered design No. 707587). Actual tests have proved that the Peto-Scott Square Law Condenser gives absolute straight line reading over the whole of the Dial.

Send for our large Illustrated Catalogue.

Forty-eight pages fully illustrated—every possible component described. Should be in the hands of every experimenter for reference purposes. Sent post free together with other literature on receipt of 3d. in stamps.

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IN VARIOUS DESIGNS, and WOODS

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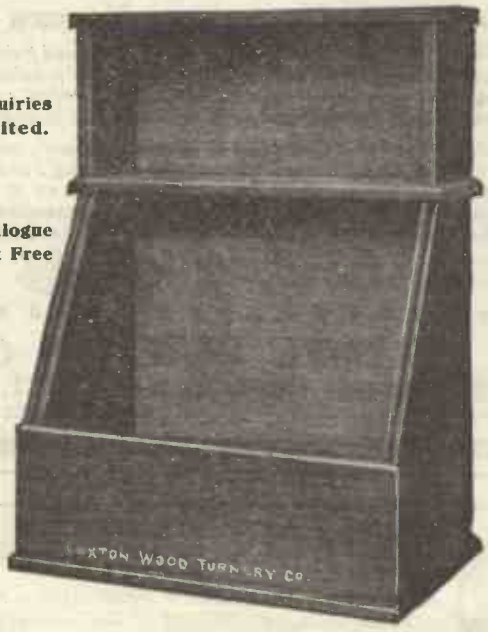

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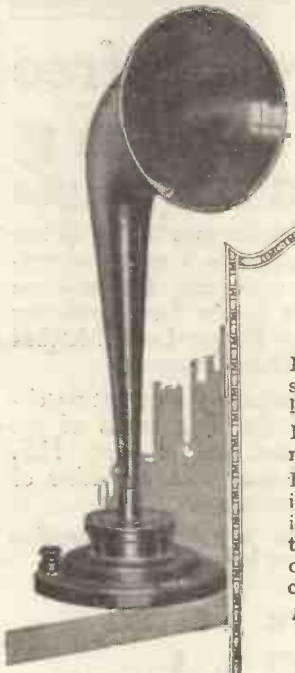

Ask to see the

TrueMusiC JUNIOR

Loud Speaker.

Before you decide on the Loud-speaker for your Set, see, and listen to a TrueMusiC Junior.

Its clear, pure tone is a revelation.

Reproduction of Broadcasting is so faithful, because the metal in the Horn is not stretched or twisted. It is made in one piece of electrolytically deposited copper.

Drop us a Post Card for our Catalogue.

TrueMusiC Junior.
£2 : 17 : 6

The Telephone Manufacturing Co., Ltd.,
Hollingsworth Works, West Dulwich, London.

British Empire Exhibition, Wembley, Palace of Engineering, B.E.A.M.A. Section, Stand C1. Avenue 11, Bays 6 and 7.

B.P.S. 104

It will pay you always to watch WIRELESS WEEKLY *Advertisements.*

In practice I generally couple X coils by sliding them edgewise. The bevelled strips of ebonite slide on the panel and the coils are inserted between the little brass spring clips. Four connection holes are drilled in the two lower legs of the X frame and the wire ends are passed through these five or six times. These turns are tinned over with the soldering iron to provide a large clean contact for the spring clips. I have tried sliding the coils with rack and pinion and also with quick motion screw threads, but a simple wooden push rod with a knob on the end is quite satisfactory, besides being free from the capacity of any metal parts used for this purpose. When employed in an enclosed set the push rods project through the side or front of the case and a very delicate control is obtained.

A very practical fitting which I always use in a multi-valve receiver is a master rheostat.

For the double purpose of reducing metal masses on the panel and safeguarding valves and batteries I find it useful to omit the usual terminals for H.T. and L.T. connection. Instead, lengths of stout flex are permanently soldered to the panel wiring and brought out through holes in the case. These carry spade tags and wander plugs for the L.T. and H.T. respectively, and render a wrong connection impossible.—Yours faithfully,

DONALD STRAKER.

Bembridge, I.O.W.

RANDOM TECHNICALITIES

SIR,—I agree with everything that Mr. Brockway says in October 1 issue of *Wireless Weekly re* Mr. Harris and gramophones.

The modern gramophone is at least equal to the best of loud-speakers, and in many cases it is much better, while from a musical point of view there is no comparisons between the mediocre music transmitted by the B.B.C., with the exception of occasional symphony concerts, and the wonderful lists of celebrity records available for gramophone users. If, as he says, Mr. Harris possesses a good modern gramophone, I can only conclude that his motive in sneering at gramophones is to try to popularise the loud-speaker at the expense of another instrument.—Yours faithfully,

N. LILLEY.

Leek.

[Perhaps our correspondent had not an opportunity of hearing the loud-speaker reproduction at the Albert Hall during the Wireless Exhibition. No gramophone has ever equalled this.—P. W. H.]

SIR,—With reference to Mr. Ed. A. Brockway's letter, headed "Random Technicalities," I take the liberty of suggesting that Mr. B.'s wireless receiver is not really satisfactory, and my advice therefore is, don't blame the loud-speaker until every possible wireless circuit (H.F. and D. side) has been tried.

As the owner of a good gramophone, the reproduction by wireless is practically perfect, which I cannot say of my gramophone, in that it always has the well-known gramophone sound.

I will grant to Mr. B. that one can select records for a gramophone to suit one's own taste, and I think that my own list is, on the whole, on a very much higher level than the B.B.C. programmes. When we have persuaded the B.B.C. to compete for the best in the entertainment line, then, and not until then, will the gramophone become extinct.

In this I am going to back up Mr. Percy W. Harris. I am at present using an experimental set he described months ago in *Modern Wireless*, which in my hands gives the most perfect reproduction I have been able to get; this after months of trial and elimination.

I cannot afford to use resistance coupling and have the usual transformers, etc.—Yours faithfully,

ARTHUR F. WILLIAMS.

Timperley.

P.S.—I am far from being a "highbrow," but enjoy the best in most lines of entertainment from Mme. A. Galli-Curci to the late George Formby or John Henry.

AN APPRECIATION

SIR,—Many thanks for the return of my Family four-valve set which I sent up to you for test. Following your suggestions, I am pleased to say the set is now working A1, and I have much pleasure in enclosing herewith your test fee (10s.), and can with confidence recommend this set to anyone desiring range and volumes.

With renewed thanks for your very practical help and advice.—Yours faithfully,

C. E. BEWICK.

A NOVEL SINGLE-VALVE RECEIVER

SIR,—I am sure you will be pleased on hearing the excellent results I have obtained with "A Novel Single Valve Receiver," using electrostatic reaction described by Mr. Stanley G. Rattee in *Wireless Weekly* of January 23, 1924.

Using a sheltered and low aerial, I have already obtained Aberdeen, Birmingham, Glasgow, Nottingham and Bournemouth.

The reception has been noted for its clearness and the set's freedom from self-oscillation.

The only alteration made upon the circuit described was a variable grid leak, and the whole set was enclosed in a cabinet.

Would you be kind enough to inform me a suitable method of lowering my wavelength, also of raising it?

I am using at present a .0003 μF variable condenser for reaction with a 100-turn "Tangent" coil.

The A.T.I. is as described in the article. Congratulations on your two wonderful periodicals.—Yours faithfully,

S. A. LEWERS.

Leicester.

[For the reception of the shorter waves the radio choke should be a No. 50 or 75 coil. For the higher wavelengths, say, 1,600 metres, a No. 100 coil should be added in series with the A.T.I. between the switch and the grid leak and a No. 150 or 200 coil used as a choke.—S. G. R.]

THE OMNI RECEIVER

SIR,—I wish to add my tribute of appreciation of your papers, *Wireless Weekly* and *Modern Wireless*, especially with reference to the Omni Circuit Receiver and the various hints on construction given. I may say that at the beginning of this year I knew nothing of wireless, and the whole of my knowledge has been obtained from your papers.

To an absolute novice it was somewhat difficult to understand the technical details of the articles, but by constant reading I came to see the value of the Omni Receiver, and decided to construct the same. I adhered strictly to every detail of your design. The various photographs of the wiring proved invaluable. With such clear instructions what at first seemed a big task, chiefly on account of the soldering, became quite easy.

As to results, the set works admirably. I have at present only wired up the ST45 circuit, and it works a loud-speaker quite well. On the 'phones I get all stations at very good strength, there being very little difference between Glasgow, Manchester, Bournemouth or London. Also Madrid and Berlin have come in at good strength. These results are on an aerial, 47 ft. high at one end and 30 ft. at the other, and of 60 ft. length.

As you publish each new circuit I enter details in a book, cutting out and pasting the diagrams in it, so that eventually it will form a most valuable handbook to the set.

I trust that you will still continue to publish your fortnightly articles, as it is the fact of continuous development of the set that makes it have such intrinsic interest.

Thanking you very much for such excellent papers,—Yours faithfully,

Lincoln. E. WAINWRIGHT.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

D. F. [BLACKBURN] asks how one can tell whether the supply mains are A.C. or D.C.

The supply meter will be marked so many periods per second if the current is alternating, and if you have a valve receiver you can readily tell by touching one end of the grid leak with your finger, when a loud hum will be heard in the telephones. This indicates that the supply is A.C.

C. H. W. [CROWTHORNE] asks questions about the correct H.T. voltage to use with certain valves.

The statement that you should readjust the H.T. voltage for each additional valve used is rather misleading, as an increase in the anode voltage is generally only desirable where additional potential is required for low-frequency valves. The H.T. battery would therefore be of a value of, say, 60 volts, whether the receiver had one valve or six, provided that 60 volts was the correct working pressure for the valves in question.

P. E. H. [WINCHESTER] wishes to know how to construct a small spark coil giving a spark about 1/4 of an inch long.

An iron wire core $\frac{3}{8}$ths of an inch in diameter and 4 inches long, composed of soft iron wires, driven into a fibre tube, should be wound with 100 turns of No. 20 S.W.G. double cotton covered wire. Another fibre tube with thin walls should be driven over this, and 20,000 turns of No. 44 S.W.G. single silk covered wire wound on. This will give about $\frac{1}{4}$ of an inch spark with 4 volts. The make and break should be shunted by a condenser of not less than 1 μF.

T. H. F. [SHEFFIELD] asks [1] What valves might be recommended as amplifiers and detectors respectively. [2] What sort of results might be obtained with a 2-valve set using a high-frequency and a detector-valve with an aerial only 20 ft. long and 16 ft. high. [3] How many turns of No. 26 gauge enamelled copper wire would be required to cover the Broadcast band of wavelengths if wound on a 3-inch former.

(1) We cannot recommend any particular make of valve, but in general a soft valve should be used as a rectifier whenever possible and a hard valve as an amplifier. (2) The result you might obtain on this aerial would be in the neighbourhood of 50 miles for the reception of broadcasting under favourable circumstances. (3) You will require 70 turns of No. 26 gauge enamelled wire on this former, which should be tapped at every 10 turns.

J. L. T. [HOVE] has an inductively-coupled crystal receiver, and wishes to know whether this could be extended to work in conjunction with 2 valves.

Circuit ST27, *Practical Wireless Valve Circuits*, Radio Press, Limited, might be used, or Circuit ST35, which is somewhat better. In both of these cases the secondary of your inductively-coupled tuner should be connected where the coils L1 are shown. There is no necessity to have unit tappings if variable condensers are used to tune the circuit.

W. G. L. [DULWICH] refers to the loose-coupled crystal receiver described in "MODERN WIRELESS," Vol. 1, No. 3, and asks [1] What happens to the ends of the windings of the primary and secondary coils. [2] How many turns of wire are there between each of the tappings of the secondary tube. [3] What kind of wire should be used for connecting the component parts of this receiver.

(1) One end of each winding is free in both the primary and secondary coils, the connections being effected to the other end and the movable contact. (2) There are approximately 20 turns of wire between each tapping on the secondary winding. (3) Insulated flexible wire, such as electric light cable, might be used for connecting the various components of this set together.

C. B. [FORT HOUSE] asks [1] Whether a certain gauge of wire—a specimen of which he sends us—is suitable for winding an inductively coupled tuner for a crystal set. [2] Whether a cylindrical former may be used in place of a rotor to produce reaction effects.

(1) The wire you have submitted, which is No. 36 S.W.G. double cotton covered, is rather on the thin side for winding the inductance you suggest. Nos. 24 to 28 are suitable gauges for this purpose. (2) A cylindrical former may be used to obtain reaction effects if desired, but it will not give quite the same ease of control.

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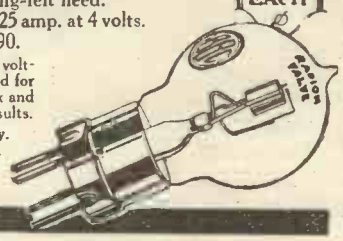

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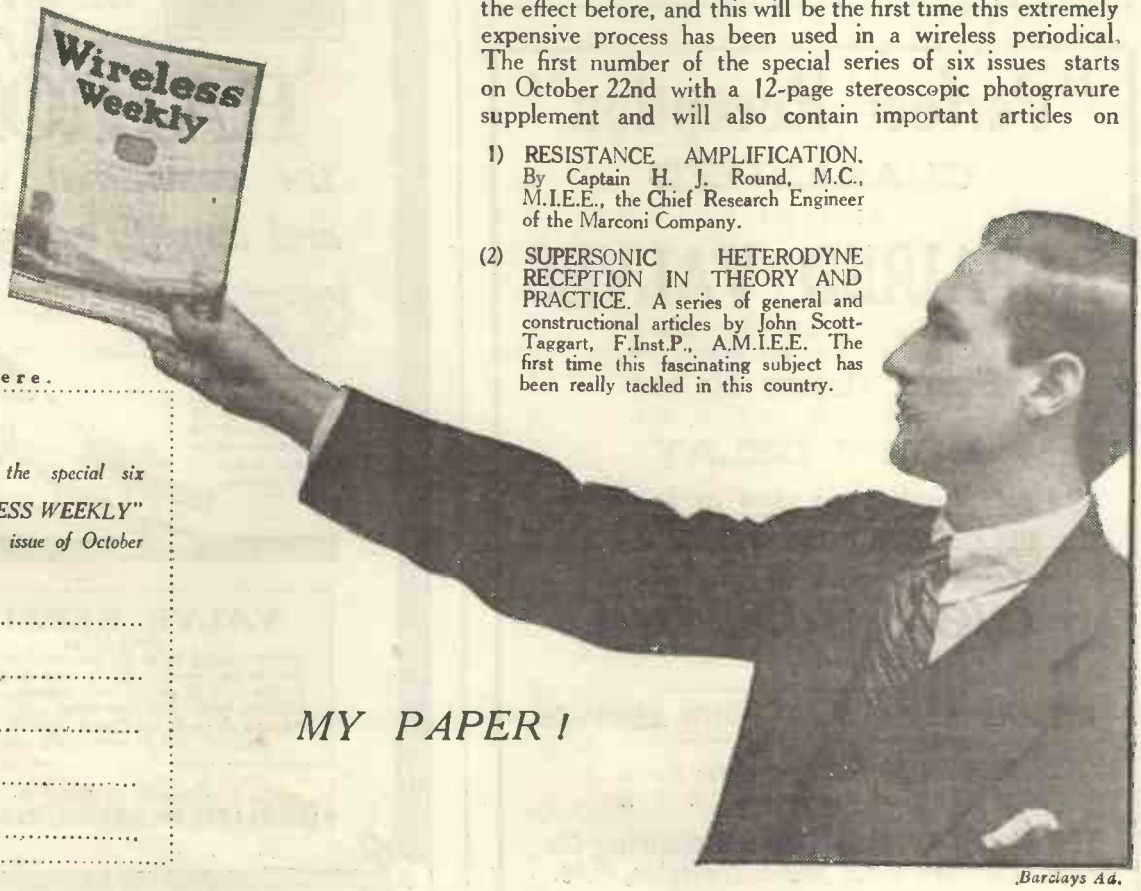

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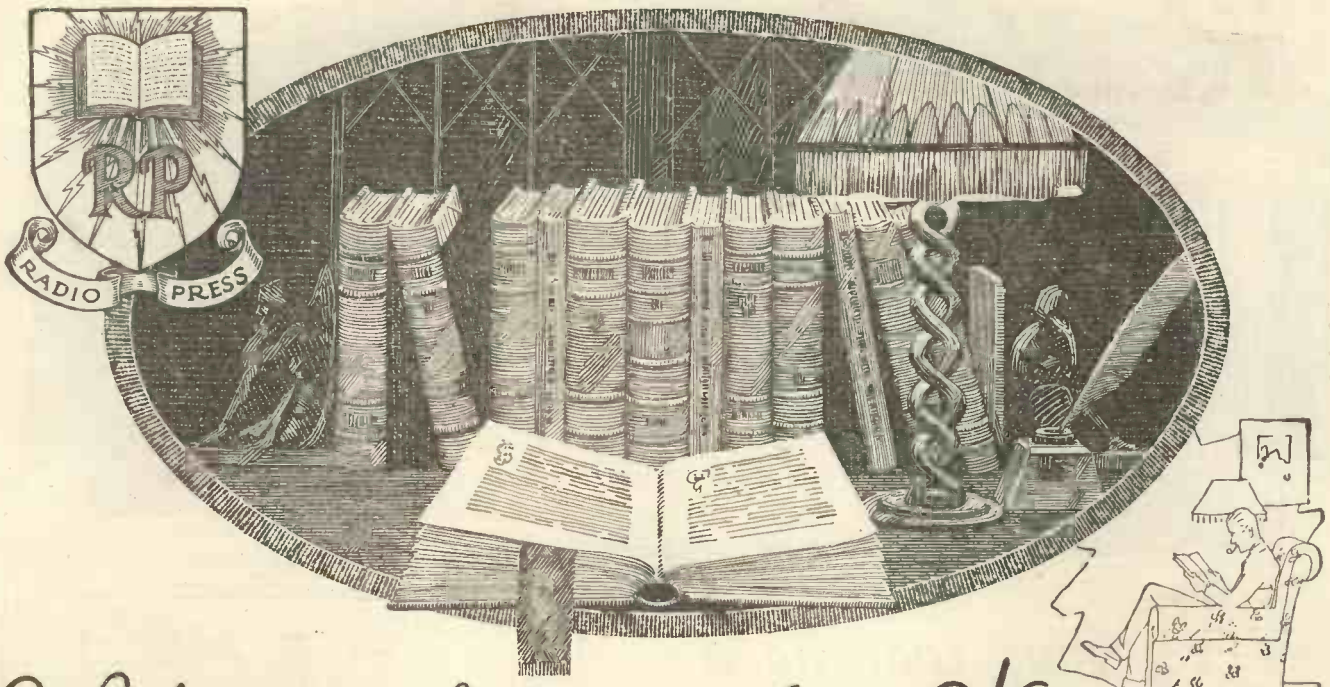

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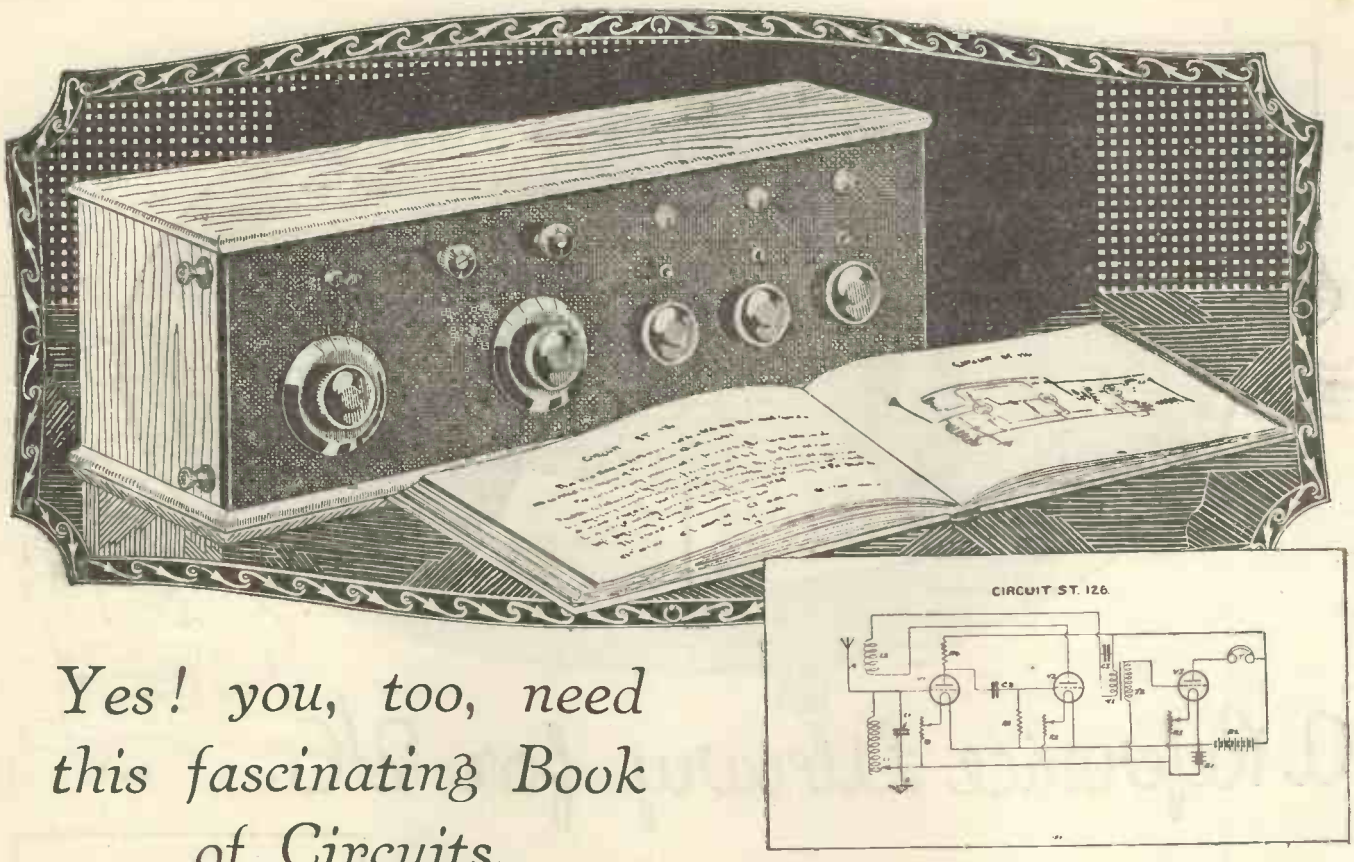

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Wireless Weekly

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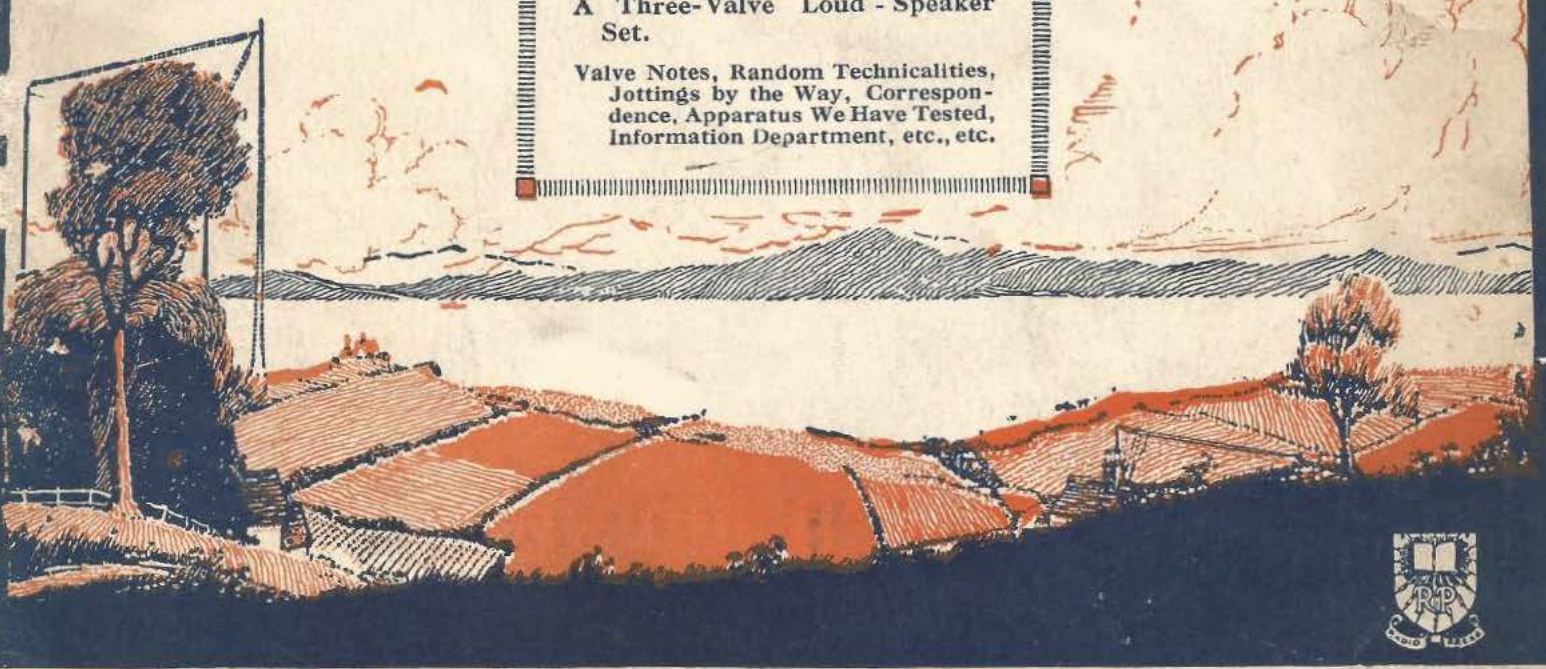

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Our Photogravure Supplement

WE are pleased to be able to present to readers of *Wireless Weekly* a new feature unique in British wireless journalism. The twelve pages of photogravure reproduction which appear in this issue, represent the latest advance in reproduction and show in a way heretofore impossible the minutest details of the wireless sets for which Radio Press, Ltd., are so well known. It is perhaps unnecessary to add that never before in any British wireless periodical has the photogravure process been used.

So far as we are concerned, the use of this process is by way of an experiment. The process is extremely expensive, and the high cost of production is one of the reasons why such supplements have never before been given in British wireless periodicals. It is our present intention to present a series of these photogravure sections in alternate issues, and the next will therefore appear in *Wireless Weekly* for November 5. The process, of course, from the reader's point of view, has many advantages—it enables him to see every detail of the apparatus in almost stereoscopic relief, just as if he had an original photograph before him. It is, in fact, the nearest that can be reached to delivering sets for inspection with every copy of the paper! We therefore cordially invite readers to give us their opinion on the matter, and to state whether they consider that the reproduction is a decided advantage. If we feel that the new method of reproduction is widely appreciated we will see whether it is possible to make this feature permanent. It should be pointed out that, in any case, until the cost of photogravure reproduction is considerably reduced, it will not be practicable to print the whole of *Wireless Weekly* by this process.

CONTENTS

The Supersonic Heterodyne

Readers will welcome, we are sure, the commencement of a new series of articles on Supersonic Heterodyne reception. This method, unlike many freak methods which have been presented with great claims within the last few years, is steadily gaining in popularity throughout the world, whereas many schemes which promised well in the first few months of their history have now been relegated to the limbo of forgotten things. As it is quite impossible to give practical instructions for the building of a Supersonic Heterodyne receiver until the reader is fully acquainted with the principles involved, the first one or two articles will be of a theoretical nature, and should be carefully studied by every experimenter who intends to begin work in this fascinating field. Much of the present popularity of Supersonic Heterodyne receivers in the United States is due to the fact that really efficient dull emitter valves are now obtainable. In the early days of the Supersonic receiver—and it should be remembered that the principle does not begin to show real merit until a number of valves are used—it was impracticable for the average experimenter to supply the necessary filament current, for with, say, eight valves, using up to an ampere each, the low-tension supply was a serious problem. Nowadays, using the .06 ampere valves, a 10-valve set can be run from an accumulator which, a year or two ago, would have been barely large enough to run a single valve set.

The Design of Resistance— Capacity Coupled Low Frequency Amplifiers

By H. J. ROUND, M.C.

A most important contribution to radio work by the famous research engineer of the Marconi Company.

I AM going to consider that useful wireless device called the resistance amplifier, and chiefly that part of it which comes before the last or power valve, and I hope to show how easy it is to consider the device quantitatively and, in fact, design it on paper with every expectation of its performance agreeing with the calculation.

Certain practical precautions, in addition to those calculated, have to be taken, such as shielding when using many valves, anti-microphonic mounting, etc., but these have no doubt been

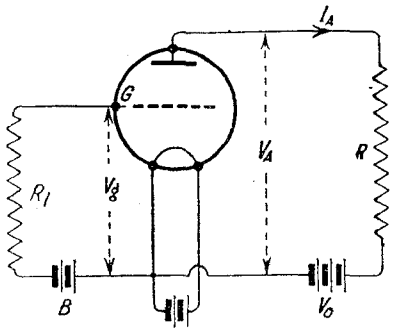


Fig. 1.—A resistance amplifier unit.

dealt with elsewhere, and if not can be handled later on.

As I cannot, of course, give characteristics for all valves in common use, these will either have to be obtained from the maker or experimentally determined—quite an easy job, if you have milliammeters and voltmeters. The makers may possibly send you the characteristic of the valve as a series of curves plotted between grid volts and plate current at a fixed value of plate volts.

An Interesting Conversion

A little consideration will show you how to convert and redraw to the much more useful characteristic which I am going to use.

The unit of a resistance amplifier (Fig. 1) consists of a valve the plate of which is connected to a resistance. The other end of the resistance is connected to the high-tension battery Vo. In most cases the grid will be connected to a resistance R1, this in turn to a grid bias battery B. Sets of units are coupled together by condensers, as shown in Fig. 2.

Voltage Drop

We will always assume that the grid can be set at any required static potential by means of B (Fig. 1), and that on this potential as a base point the variable potential to be magnified can be applied. Suppose G is set at such a potential Vg that a current of IA amperes is flowing through the plate circuit of the valve, then this current flows through R, and, reasoning directly from Ohms law, there is a voltage drop down the resistance R of IAR. If the voltage of the H.T. battery is Vo, obviously what voltage is left is Vo−IAR, which is the voltage VA across the valve. If G is raised positively in potential then IA is increased and IAR is increased, and the voltage VA

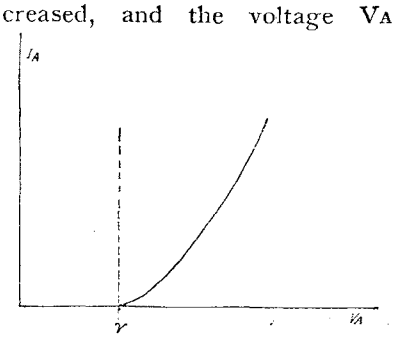


Fig. 3.—The first curve.

across the valve is reduced. This is the chief peculiarity of nearly all valve circuits—as the voltage of the grid is raised then the voltage across the valve falls.

I am going to show how you can determine, more or less exactly, what this change of voltage across R is for any change of voltage on the grid, and, incidentally, how you can compare different valves, different values of resistance, and also determine the grid negative bias to use with any particular arrangement.

Three Variables

We have dealt with three variable quantities—the grid voltage Vg, the plate voltage VA, and the plate current IA. Suppose we fix Vg by means of a dry-

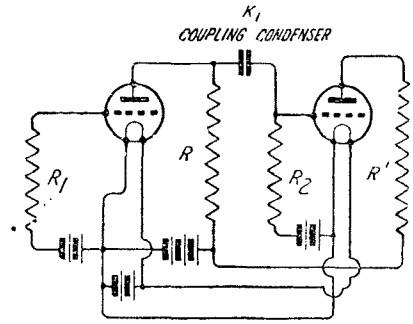


Fig. 2.—How units are coupled.

cell battery at some arbitrary potential—a negative one, as we shall see, is more useful—and now remove or short circuit our resistance, and step by step alter Vo (the battery voltage and the plate voltage now are the same), in each case taking by means of a milliammeter the value of IA. A curve shown in Fig. 3 is obtained. The valve does not start conducting until we reach a value v of the plate voltage, and then the current rises with increasing rapidity.

Suppose we alter Vg to another value, again taking a curve, we shall end up with a series of curves against each of which we can mark the value of Vg (Fig. 4).

Now Fig. 5 is a concrete curve

which I drew for an ordinary R valve. You will notice that in all cases I have the filament sufficiently bright to prevent saturation within the limit of working. All the curves are similar and parallel as long as Vg is zero or negative, but they get more and more away from this standard

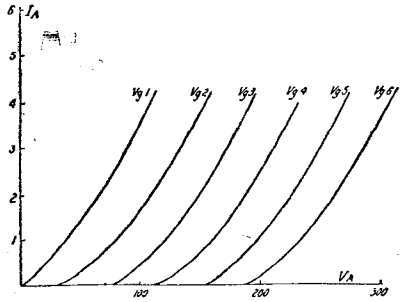


Fig. 4.—A series of curves for different values of Vg.

shape as Vg becomes more and more positive. I have drawn one curve at Vg = +4. As in general we keep the grid of a resistance amplifier always negative, for reasons which I will later show, we need only consider those curves to the right of the one marked Vg=O.

A Simple Calculation

Let us now go back to the unit circuit with battery voltage Vo and resistance R in the plate. If we fix on some value of IA we can calculate IAR, which is the voltage across the resistance, then we can say that the plate voltage VA is Vo–IAR, and plotting on our sheet of curves IA and Vo–IAR we find a point from which we can read off Vg. If we assume a number of values of IA we shall plot a number of points which will be found to lie on a straight line which crosses the horizontal and vertical axes when

IA = O and therefore VA = Vo – IAR = Vo and

VA = O and therefore O = Vo – IAR, that is when

$$I_A = \frac{V_o}{R}$$

Careful plotting will show that the line is always straight. Now we can definitely state that whatever change of Vg we make we shall always be on this line unless Vo or R are changed. If Vo is changed to a smaller value our working line will be parallel, but underneath the line, and *vice versa,* but if R is changed we shall change the slope of this line, the slope being less if R is greater. We can now read off from the valve characteristics and the line our amplification.

The "M" Value

By taking two points on the line (Fig. 6) at two different values of Vg we can, by dropping perpendiculars on the VA axis, determine the change of VA for a definite change of Vg (of course, the change of VA is the same as the change of voltage across R), and now we can see clearly that

Increase of R increases the ratio of $\frac{\text{change of VA}}{\text{change of Vg}}$

and this arrives at a maximum when R = ∞, that is, when the resistance line becomes a horizontal line.

In general, several practical considerations prohibit going too high with this resistance. Leakage, ionisation in the valves, capacity effects, and incorrect manufacture of valves are amongst these, but 50,000 or 100,000 ohm resistances are useful values to work with, and if

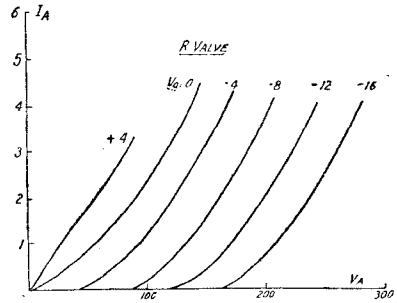


Fig. 5.—Curves for an R valve.

wire wound produce very stable results free from spurious noises.

We will take the case of the R valve first and then that of the D.E.5 B, and see what the results are, and what resistances and voltages are necessary.

I have drawn 4 lines at a voltage Vo of 150 volts (Fig. 7) :—

Vo U is for 10,000 ohms
Vo X ,, ,, 20,000 ohms
Vo Y ,, ,, 50,000 ohms
Vo Z ,, ,, 100,000 ohms

then, noting that the grid lines are 4 volts apart, so that we have to divide the horizontal length by 4 :—

Vo U change of VA for 1 volt change Vg is $\frac{10}{4}$ = 2.5

Vo X change of VA for 1 volt change Vg is 3.5

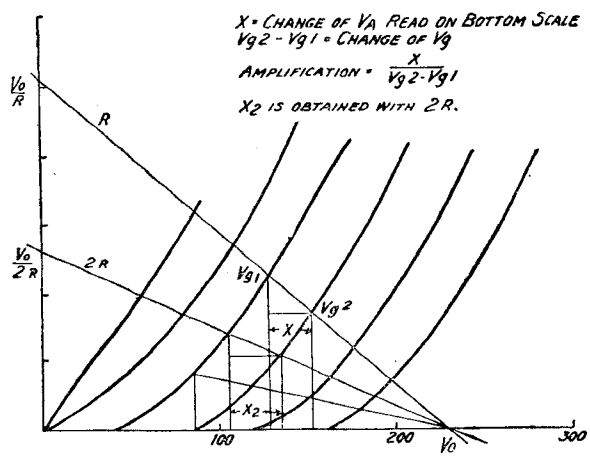


Fig. 6.—Calculating "M" value.

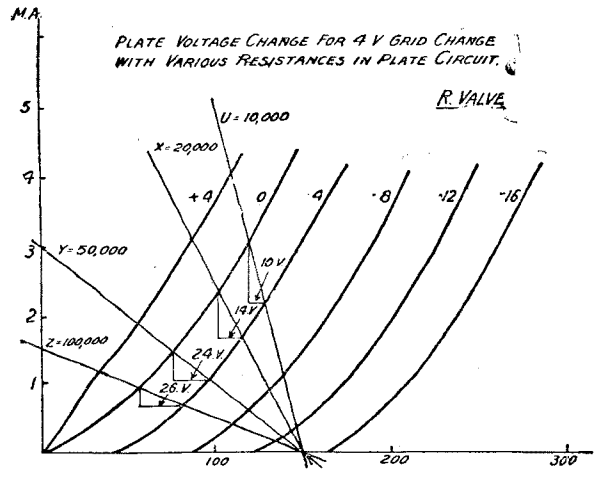


Fig. 7.—Plate voltage change for 4-volt grid changes with various resistances.

The ratio of $\frac{\text{change of VA}}{\text{change of Vg}}$ in this extreme case is called the "m" value of the valve.

Vo Y change of VA for 1 volt change Vg is 6.

Vo Z change of VA for 1 volt change Vg is 6.5.

The maximum possible change with an infinite resistance (or its equivalent, the choke) is about 9.

Suppose we choose the 100,000 ohms as our working resistance,

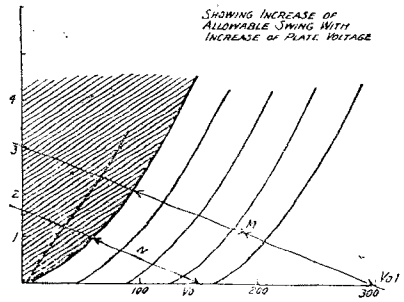


Fig. 8.—Relation of allowable swing and plate voltage.

what influence has Vo on our reception?

In Fig. 8 I have shaded an area to the left of Vg = O. We must not work in this area because current to the grid will flow there and will usually disturb the potential applied. It is also obvious that we must not try to work below the VA axis (where no current flows), therefore, in general, if we pick on points M and N halfway on our resistance lines between the horizontal axis and the curve Vg = O, it will give us a grid bias setting with an equal swing of grid potential either way before running into danger. Now the top line is the same resistance as the bottom line, but Vo1 is smaller than Vo, and obviously Vo gives possibilities of a greater swing without running into danger. Our magnification is not much more, but we can put a bigger signal into the valve and get it out magnified and undistorted by raising our plate volts with suitable resetting of the grid bias.

As another example we will take a D.E.5 B valve, which is a tube with a very high " m " value, but because of a more modern construction of grid and plate is almost as low a resistance as the R valve (Fig. 9). Here we see that we get in the output circuit with 100,000 ohms resistance a voltage swing about the same as the R valve, but the applied volts to the grid need only be less than half of our previous value. We have a much better valve for voltage amplification, as with 1 volt grid change and 100,000 ohms resistance we get 13 volts change in the plate.

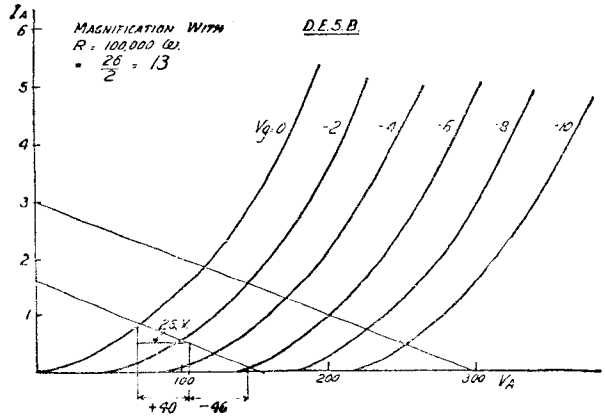


Fig. 9.—Curves for the D.E.5B valve.

The maximum swing possible is 18–20 with infinite resistance.

It is interesting to speculate and follow out on the diagram the effect of steadily increasing R to infinity, then from infinity (or – infinity) to – R; as this is not entirely a theoretical speculation, certain circuits using the Hull dynatron and more commonly tuned anode circuits with reaction (over limited ranges of frequency) can be reasoned out this way.

The simple case of the one valve having been worked out, let us work out two valves in cascade. In Fig. 2 coupled to R is a condenser K1 and a leak R2. The impedance of the condenser K1 $\frac{10^6}{2\pi nC}$ where C is in mfds., is made so low, compared with R2, at whatever frequency one uses the set, that it can be neglected, and R2 can be considered as in parallel for all alternating changes with R. This effectively lowers R for calculating purposes, but by making R2 250,000 ohms or .5 megohms it can very nearly be neglected, and we can assume that our calculated changes of potential in R are directly applied to the grid of the second valve.

We can say that our total amplification is the two separate amplifications multiplied together.

(To be Continued.)

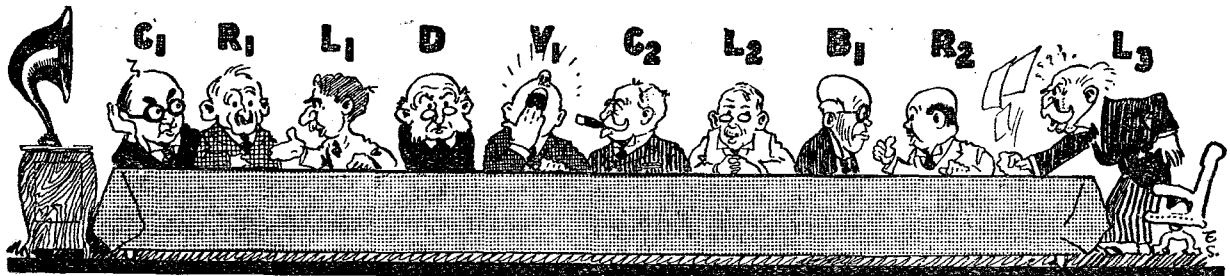
□ □ □

Will Valves Work from Dry Cells?

IT all depends upon what is meant by dry " cells," by " valves " and by " work." Ordinary bell cells are not specially designed to give a steady current, and if they are called upon to deliver more than a fraction of an ampere for any length of time, the output becomes unsteady owing to the effects of polarisation. Dull emitter valves are of various kinds, and the current required by their filaments varies from .06 ampere to .4 ampere. The " 06 " valves can be used quite satisfactorily with bell cells; in fact, three of these wired in series so as to give a total maximum potential of 4.5 volts will work two or three of the smallest dull emitters quite well. With valves requiring more than about .2 ampere I do not think that dry cells, unless they are of very large size, are ever really satisfactory. Those who are so situated that they *must* use dry cells because they cannot get accumulators charged should, I think, confine themselves to the " 06 " valve. It is better if you can possibly manage it to use an accumulator, which gives a perfectly steady output until it is discharged. After all, a 2-volt accumulator with an actual capacity of 40 ampere hours is not a very heavy thing to move about, and will give 80 hours' service with a couple of Wecovalves. Supposing that the set is in use for two hours a day, this means that the accumulator will require recharging only once in three weeks. For " 06 " valves two tiny cells with an actual capacity of 10 ampere hours apiece can be used in series. This will give over 80 working hours with two valves.

R. W. H.

□ □ □

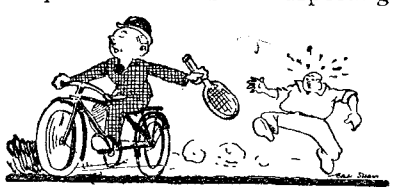


JOTTINGS BY THE WAY

By Wireless Wayfarer

Sympathy

"DON'T you pity me?" I said to Poddleby the other day, as I was taking my departure from the tennis courts at Little Puddleton. "You can stay here and pat balls about until you are blue in the face or any other colour you like, but I have got to go home and work, and the worst of it is that I cannot think of anything to write about." "You never can," said Poddleby, "so far as I can see; that's generally my grouse about the pages that you spoil every week." I took no notice at all of this hateful piece of rudeness, but merely seized Poddleby's racquet from his unsuspecting



Just ahead of stout Poddleby . . . .

grip, leapt on to my bicycle, and rode off, keeping just ahead of the stout figure that panted down the road after me, explaining amidst gasps that he was booked to play in two minutes in the men's doubles. I went severely on to my own house, at the gate of which I dismounted and walked to meet the faint but pursuing Poddleby. "I think you must have dropped this just now," I said, "and you look as though you had been hurrying. At your age and with your figure you should really be more careful. But I must thank you anyhow for one thing, which is that you have given me a theme for one paragraph at any rate." Then with a courtly bow I bolted in, shutting the door in Poddleby's face.

A Blow

Did I hear you say that this is not wireless? Really, reader, you are getting almost as unkind as Poddleby. If you go on in this way I shall have to find some means of dealing with you even as I dealt with him. Still, if you want wireless, very well, wireless you shall have, for I got it all right as soon as I had closed my door upon the secretary of the Little Puddleton Wireless Club. I was just preparing to do a bit of pen-chewing in an effort to work out an idea when there entered to me the handmaiden. "If you please, sir," said she, "your eerial's been and gone and

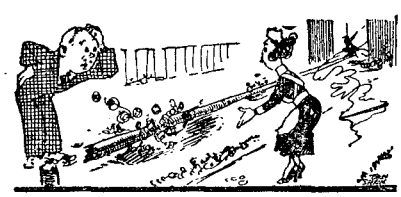
List of Components.

C_1	.. ..	Breadsnapp
R_1	.. ..	Snaggsby
L_1	.. ..	Dippleswade
D	.. ..	Gubbsworthy
V_1	.. ..	Wayfarer
C_2	.. ..	Admiral
L_2	.. ..	Bumpleby Brown
B_1	.. ..	Professor Goop
R_2	.. ..	Poddleby
L_3	.. ..	General

tumbled down." Being, as you no doubt know, a man of action rather than of words, I said nothing but merely strode out with squared jaw and a grim and determined look upon my face to view whatever disaster Providence had seen fit to inflict upon me. It was really rather a sad sight that met my eyes as I opened the French window and stepped further into the grounds. I like that word, don't you? It sounds much better than garden or backyard, and I don't in the least see why 30 yards by 20 yards should not be so described. I should explain that this summer my better half had decreed that the garden, that is to say, the grounds, should be a blooming mass. She wrote this to me in a letter whilst she was away at Easter, and her handwriting is a little difficult at times to decipher. I replied by return saying that it was already a blooming mess (for that is how I read the words), and that I was quite sure that she would be more than satisfied Anyhow, during the spring and the early summer the man Bugsnip, of whom I have told you before—he is the father, if you remember, of the lad Edward, who is inclined to ask posers—had laboured and toiled, digging here, planting there, until flowers were growing in profusion.

Havoc

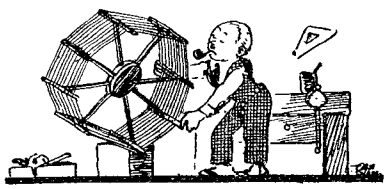
When I gazed further I saw that most of our garden was to



"Your eerial's tumbled down."

be counted among the has beens (or should one say the have beens?). Frankly, I do not know but as I like to please the most fastidious of grammatical tastes will you kindly take your choice and delete whichever you do not like? In other words, the garden (or grounds) was (or were) a was-er, a washout, a scene of havoc, desolation and ruin. Across two of the choicest beds lay my aerial mast, which had apparently bounced several times before it finally came to rest. The spreaders and the accompanying wires had played the very dickens with a fine bed of geraniums, and the insulators at the house end, swinging in glorious freedom as the pole fell, had pushed in effectively a very large and expensive window. About the garden I was, of course, sorry, though so far as I can remember no special

tear coursed down either cheek on its account. After all, the man Bugsnip would be able to repair to some extent the damage that had been done, and he would undoubtedly be the gainer, for would he not be able to spend several days on full pay in telling my wife exactly what ought to be done without having the hard work of doing it? The pole itself was a very different matter. It had broken off just at ground level, as poles will on occasion, and there was nothing for it but to obtain a new one, for the old one, if re-erected, would now be too short to qualify me to tell tall stories. It is, of course, generally accepted amongst wireless men that no man is really justified at drawing the long bow unless his aerial is at least forty feet in height.



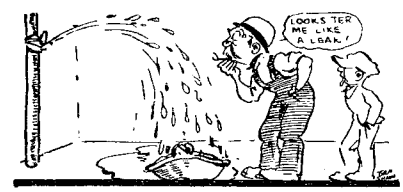
Gustavus, my trusty frame aerial.

The Hidden Hand?

What exercised me was to discover how all this had come about. The hurricanes and snowstorms of the typical English summer had, of course, been raging, but they had done so before, and the pole had merely smiled at them bowing gracefully before any particularly violent gust. No, I reasoned, it is not Nature that has smitten me in this way; some enemy has been at work. Of course, if one has a set that can be relied upon to bring in on any night of the week America, or even Timbuctoo if need be, there is bound to be a certain amount of local jealousy. I have noticed this before now at the wireless club, when I have been engaged in telling some particularly interesting story of my achievements in reception. More than once I have heard General Blood Thunderby remark in what he imagines to be a whisper, "I wish I could tell 'em like that." I have also caught at times stray words such as barefaced, unblushing, case-hardened, and the like. From this you will see that the worst form of jealousy was obviously rampant in the locality, and I therefore felt quite sure that some enemy had done this thing. Did I burst into tears? Did I tear my hair? Did I fling myself on the ground and gibber in an access of despair? Did I go out into the garden (or grounds) and eat worms? I did not. I merely surveyed the wreckage with a shrug of the shoulders, then went in and telephoned to Messrs. Guffle and Snarp, at one time plumbers of the plummiest kind, but now the leading professional experts in wireless in Little Puddleton. To them I said in an airy way (and remembering that they send in their bills only once a year), "My aerial mast has collapsed. Would you very kindly get me a new fifty-foot pole and put it up as soon as you can?" That was precisely that.

Resolution

I was determined that even though the hidden hand had thus played the dirty upon me I would not be defeated by its machinations. I pulled out Gustavus, my trusty frame aerial, who had never yet brought in an audible signal, and told him that now was his chance to do or die. With the aid of a couple of good high-frequency valves I managed to persuade Gustavus to bring in 2LO at such strength that he was audible with the phones on the table, provided that your head, or rather mine, was inside them as they lay there. Then, having dined lightly, as befits a brain worker, I went round to the wireless club where most of the members were assembled. Without saying too much I let it be clearly understood that some enemy had cut down my aerial, and that I was pretty sure I knew who had done it in a contemptible fit of jealousy. On the following evening I told them that I was rather glad that my aerial had been cut down for I had never before investigated the possibilities of the frame. "You will hardly believe me," I said (I *think* I heard the General murmur, "We don't"), "when I tell you that with a 2-foot frame I got WGY, WJZ, WHAZ, and KDKA on the loud-speaker early this morning. And so I went on telling the tale of Gustavus's prowess, some admiring, some gaping, some merely raising the eyebrows of scorn. I was getting on quite well when Snaggsby, who lives next door to me, came in. "Hullo, Wayfarer," he said, "I have not seen you for days. I see your jolly old aerial has come down. I am very much relieved that the wind was blowing nor-nor-east instead of sou-sou-west, for otherwise it would now be resting in my greenhouse. I have been expecting the crash for months, and I actually saw it happen." "Oh," I said, "oh, and perhaps you can tell us who it was who did this thing?" "Well," said Snaggsby, "I can, I think. You know the five swallows that usually sit on it in the evening?" "Yes," I replied, "I know them well, but



Plumbers of the plummiest kind.

what of them?" "What, indeed?" said Snaggsby; "they were quite comfortable until a sixth, an entire stranger to me, settled beside them on the wire. That did it. No sooner had his little feet grasped the wire than the whole thing immediately crashed to earth."

WIRELESS WAYFARER.

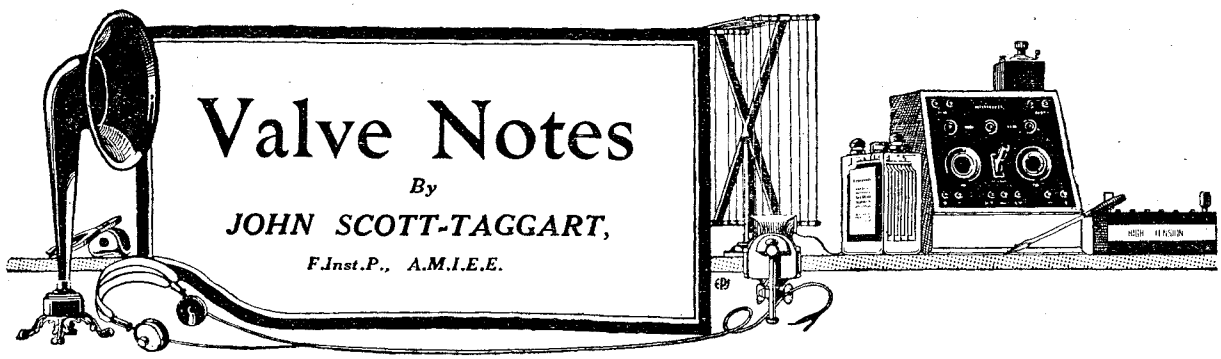
The Vienna Broadcasting Station.

The official opening of the Vienna station took place on October 1. All the local prominent personalities of the political and scientific world were present.

The station is now working regularly on a 530 metres wave, using 1 k.w.

Listeners were asked to send in suggestions for an identification call. That finally adoped is Radio-Wien, which carried 86 per cent. of votes. The next was Sender-Wien, and others suggested included Dorian-Radio, Wiener - Musik - Radio, etc. The identification call of the station is "Hallo, Hallo, Hier Radio-Wien, Welle 530."

Particulars of hours of transmission may be found in the Continental time table in this issue.



Valve Notes

By

JOHN SCOTT-TAGGART,

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

Liquid Valves

EVERY now and again, in the semi-technical press, appear reports of a liquid valve which will amplify, detect and do all the other sorts of things that a vacuum valve will do.

Unfortunately, these reports, although so definite and precise, are based on foreign reports. I have investigated the position thoroughly through scientific friends in these countries, and have not found any evidence of any amplification having been obtained with a liquid valve.

Colloidal Solutions

I have also tried colloidal solutions in combination with electrodes for the purpose of seeing what effects are obtainable. No results, however, have been obtained which in any way would encourage any work to be accomplished with such a liquid (so-called) " valve."

Whether a valve will ever be produced which will work with a minimum of " internals " is a doubtful question, but much can be done by reducing the filament consumption and lowering the anode voltage. Excellent progress has been made in the direction of reducing the filament current consumption, but valve manufacturers have not done much to reduce the anode voltage, except in the case of power valves.

As Detectors

Liquid valves, of course, may be used as detectors, and this form of detector was one of the very first to be used about 20 years ago. The crystal detector, however, displaced the liquid rectifier. By liquid rectifier I am not referring to the detector commonly known as the electrolytic detector, which depended principally for its action on a small globule of gas on the end of a fine platinum point. I am referring simply to the detector which consists of metallic electrodes dipped in some form of electrolyte.

A New Neutrodyne Type of Circuit

Readers of *Wireless Weekly* will be interested to hear that Mr. A. D. Cowper, M.Sc., has produced a very effective scheme for neutralising undesirable reaction in a wireless receiver, and

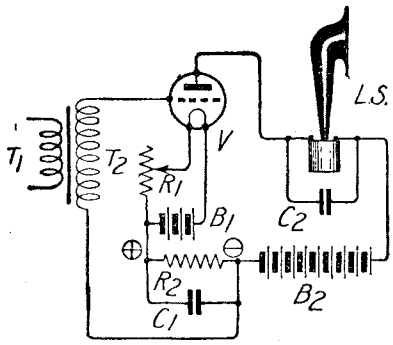


Fig. 1.—An interesting method of obtaining grid bias.

this ingenious circuital arrangement will be described in the next issue of *Wireless Weekly*.

The arrangement is particularly applicable to a two-valve circuit, and loose coupling is employed on the aerial side without any tendency for the valve to oscillate.

Obtaining Grid Bias

Two years ago the average experimenter did not bother about applying grid bias to his low-frequency amplifying valves, but the growing tendency to improve purity is resulting in greater interest being taken in methods of applying a negative grid potential.

The usual method is to use three or four volts obtained from a dry battery.

Many weeks ago I explained the use of including an anode resistance between the negative terminal of the anode battery and the filament of a low-frequency amplifying valve. This arrangement is shown in Fig. 1, and it will be seen that the steady anode current flowing through the resistance R2 will set up a potential difference across this resistance, resulting in the right-hand side of R2 being made negative with respect to the left-hand side. In other words, the grid of the valve will be given a negative potential depending upon the value of R2 and the value of the steady current flowing through it.

Use of Condenser

If the valve were a power valve, and the steady anode current were 10 milliamps, and we desired to give a bias potential of − 5 volts to the grid, the resistance R2 should have a value of about 500 ohms. The condenser C1 has a large capacity of the order of 2 μF, and is for the purpose of obtaining a substantially steady normal voltage on the grid. If the condenser C1 were not in place there would obviously be a low-frequency reverse reaction effect, the anode current variations through R2 causing varying low-frequency potentials to be communicated to the grid of the valve.

Even a large condenser in the position of C1 will not altogether overcome a small ripple of low-frequency, and it is therefore interesting to note British Patent

220727 of E. A. Graham and W. J. Rickets.

These inventors propose to use an iron-choke coil in the grid bias circuit for the purpose of smoothing out any low-frequency ripple.

A New Arrangement

Fig. 2 shows a circuit in which the idea is shown incorporated. I have shown simply the ordinary detector with reaction followed by two stages of low-frequency amplification. The resistance R2, it will be seen, is connected between the negative terminal of the high-tension battery and the negative terminal of the filament accumulator. Across the resistance is shunted the iron-core choke coil Z1 and the condenser C1 of about 2 or more microfarads capacity. The grid connections are taken to the point Y.

The condenser and choke coil smooth out any low-frequency ripple, the principle being that the potential variation across the condenser will be considerably less than those across the choke-coil, and that therefore the potentials across the condenser will only be a negligible fraction of the total potential variations across the resistance R2. This resistance may, in addition, have shunted across it a big capacity fixed condenser.

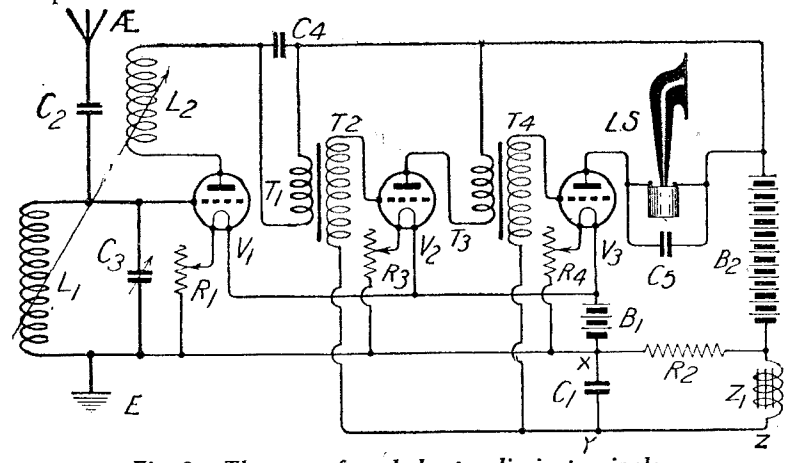


Fig. 2.—The use of a choke to eliminate ripple.

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Telephone Leads

SEVERAL amateur constructors are not acquainted with the method which should be employed when mending or making telephone leads. The writer

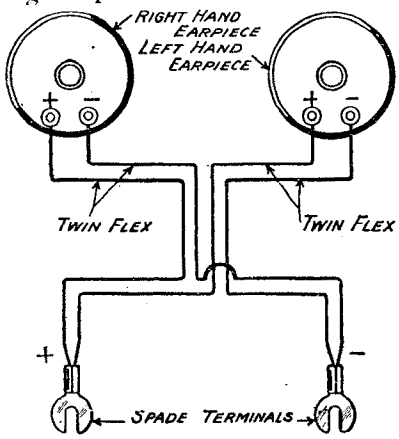

Fig. 1.—Telephone lead connections.

intends this article to be helpful to those who are so placed. The theoretical connections of a pair of head 'phones are shown in Fig. 1. It will be seen from the drawing that both the right-hand and left-hand ear pieces are equipped with two terminal connections each. In each case one is a positive connection and the other a negative connection. If it is intended to make a pair of leads, some silk-covered twin flex will be required. On removing the outer covering of the flex it will be found that one strand is wrapped with red cotton and the other with white. This is to

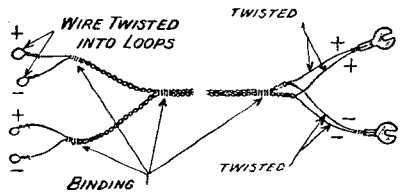

Fig. 2.—Method of making phone leads.

facilitate the recognition of the leads at the other end, the red representing the positive lead and the white the negative lead. First proceed by baring the end of the flex and twisting into loops, as shown in Fig. 2. Connect the red-covered lead of one length of twin flex to the positive connection of the right-hand earpiece and the white-covered lead to the negative connection. Repeat the process with another length of twin flex on the left-hand earpiece. Now bind all four strands together at about 18 in. from the earpiece connections, with some cotton or silk thread. Twist the strands together from this point for a length corresponding with the length of lead desired, and bind once more as before. Now pick out the two red-covered flex leads and secure to a spade terminal in the usual manner, and finish by binding with red silk to indicate that this is the positive connection. The two remaining will be the white-covered ones. These are connected to a further spade terminal and bound with white silk to indicate the negative connection.

It should be noted that the above method connects the earpieces in parallel, which in the case of a pair of 2,000-ohm earpieces makes the total resistance 1,000 ohms—quite a good value for crystal sets using the modern treated galena crystals. For valve sets the leads are better in series, i.e., the lead goes from the positive tag to the positive terminal of one earpiece, another lead from the negative of this earpiece to the positive of the next, and a third lead from the negative terminal to the negative tag.

H. B.

Filling Panel Holes

WHEN a panel has been erroneously drilled, the problem of filling the hole up presents itself. This may be done by dissolving some beeswax in turpentine, adding lampblack until the mixture is fairly stiff, when the hole in the panel may be filled in, and smoothed off with a flat scraper. Old panels may be treated with this mixture, which hardens with time.

H. B.

Supersonic Heterodyne Reception in Theory and Practice

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

The first of a series of general and constructional articles on a most fascinating type of receiver, the operation and design of which has never been really tackled in this country.

I
Introductory Remarks

MULTI-STAGE high-frequency amplification is one of the most fascinating problems in radio to-day. The reason is not far to seek. It is due almost entirely to the inefficiency of the average detector and to the peculiar property of detectors which results in them being more sensitive to strong signals than to weak. Hence the importance of having the signals sufficiently strong before they are applied to the detector which, in most modern receivers, will be a three-electrode valve.

Signal strength depends upon the output of the rectifier, and this output is proportional to the square of the amplitude of the incoming signals. To take a simple case, if we double the amplitude of the incoming signals we will get four times the output from the rectifier. This rule is not an absolutely exact one, but is approximately so, and it is borne out in practice. One would expect that if the amplitude of the incoming high-frequency oscillations were doubled, the final signal strength would be doubled, whereas actually it is quadrupled, due to the peculiar action of detectors.

Another important factor to remember is that there is a kind of minimum threshold amplitude below which a detector will not operate. This threshold depends very largely upon the curvature of the characteristic curve of the detector.

Any experimenter has proved for himself that once a signal is obtained, however weak, it may be strengthened by low-frequency amplification, but if a signal is "not there" without low-frequency amplification, the latter process, even if carried to several stages, will frequently not bring in the desired signals.

Under these circumstances, the only solution is to bring up the amplitude of the high-frequency oscillations to a sufficiently large value to operate the detector valve effectively.

High-frequency amplification is consequently indispensable if long ranges are to be obtained, but unfortunately high-frequency amplification technique is only beginning to be studied now, and even at this stage the more ordinary methods of amplification are not by any means at a stage of perfection.

Particularly great obstacles stand in the way of the amplification of very short wavelengths, i.e., current of very high frequency. The higher the frequency of the currents to be amplified, the greater are the difficulties which have to be overcome. A multi-stage high-frequency amplifier designed to work on short wavelengths will oscillate more readily than a long wave amplifier. Not only is trouble experienced through self-

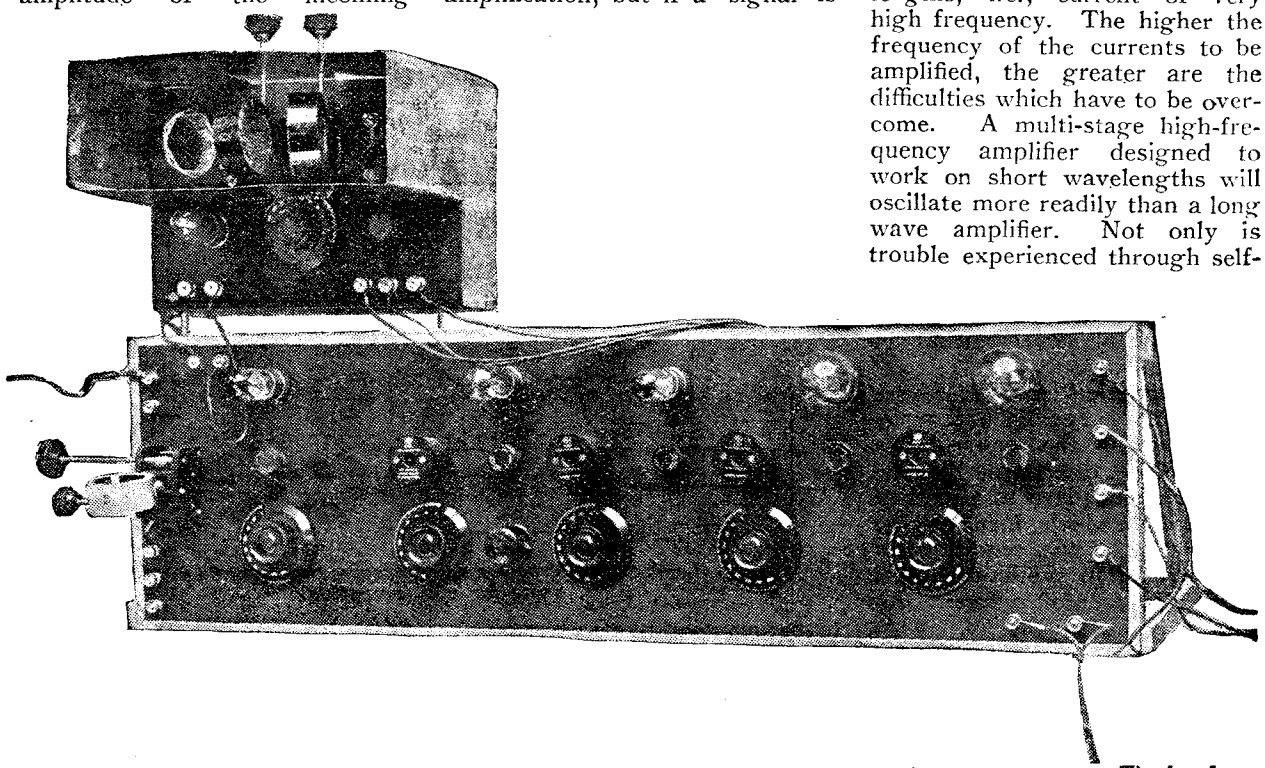

Fig. 1.—An experimental supersonic heterodyne receiver used by the author in his experiments. The local oscillator is contained in the metal screened box on top of the instrument.

oscillation, but, what may conveniently be termed leakage effects, are very much more prominent, and also losses due to inefficient coils, unsuitable fixed and variable condensers, etc., arise.

It is therefore not surprising that a great deal of the reception

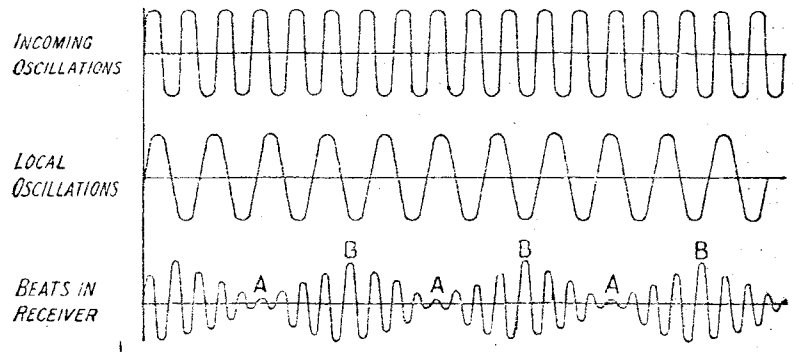

Fig. 2.—Principle of " beat " production.

on very short wavelengths of the order of, say, 60 metres to 150 metres, is carried out by means of a simple detector valve using reaction followed by one or two stages of low-frequency amplification. This is not because high-frequency amplification is undesirable, but simply because such amplification is being shirked because of the difficulties attending its use.

It was chiefly the troubles of high-frequency amplification on short wavelengths which led to the development of what is generally known as the " supersonic heterodyne " method of reception.

I do not propose to go into the patent history of this method of reception, but the invention is generally attributed to E. H. Armstrong, whose name has been so closely associated with several very practical developments in radio.

" Supersonic " means : Above the ordinary audible frequency which the ear can conveniently hear, while " heterodyne " is the peculiar name given to a method of reception which involves the combination of two sets of varying currents to produce a third varying current of different frequency.

The system, briefly, consists in combining incoming oscillations in a wireless, or similar, receiver, with locally produced oscillations of a different frequency. These two frequencies interfere with each other and produce a third frequency, which is of an alternating wave form but of a peculiar nature.

The third type of varying current produced is not useful until it has been rectified, and the output of the rectifier, which output is of a varying nature, is then used as the final signal current to be amplified and employed in the usual way.

Ordinary Continuous Wave Reception

Before dealing specifically with supersonic heterodyne circuits, I propose to give a brief explanation of what are known as " beats," together with a broad outline of the ordinary method of receiving continuous waves, i.e., waves which resemble ordinary alternating currents of fine wave form. There are, of course, numerous continuous wave transmitters in the country, such as those at Leafield, Northolt and other stations, and, of course, the carrier wave of a broadcasting station is a continuous wave transmission until this wave is modulated by the speech or music. Similarly, the waves radiated from a receiving station which is " oscillating " are continuous waves, and I propose to explain the usual method of receiving these waves, which is known as the heterodyne system. This explanation will be old to the experienced reader, but many will require to study the following notes carefully before a technical explanation of supersonic heterodyne reception can be clearly understood.

The principle on which heterodyne reception depends is briefly as follows : Let us imagine two sets of alternating currents flowing in a certain circuit. Each set of alternating currents will tend to cause a current to flow in the circuit, first in one direction and then in the other. If the two currents are in step or *in phase*, the currents will always be flowing in the same direction at any given moment. If the currents each had a value of 1 ampere, the resultant current would be 2 amperes. If the currents are a half-cycle out of step (or 180° out of phase) one set of alternating electromotive forces will be trying to pass a current in a certain direction, while the other will try to pass a current in the opposite direction at the same moment; consequently, the two sets of alternations will neutralise each other and no current will flow through the wire. If one set of alternations is less than half a cycle ahead of the other, the result will be an alternating current of constant amplitude having a value between zero and the sum of the two individual currents,

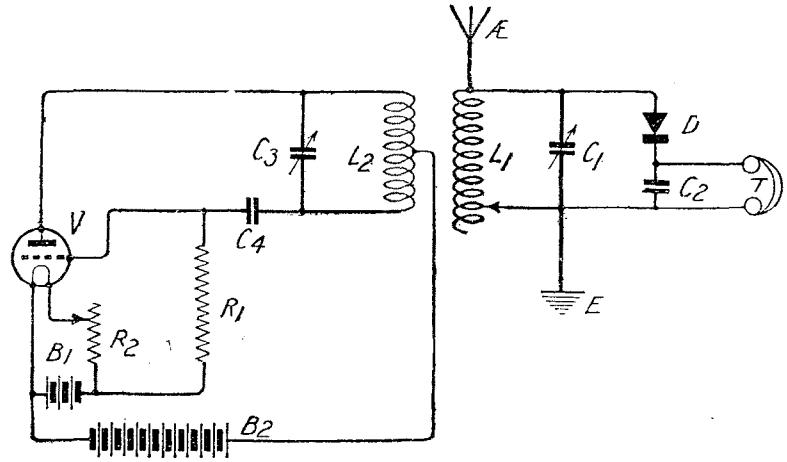

Fig. 3.—A crystal receiver using a valve oscillator to produce beats for c.w. reception.

according to the *phase difference* between the two sets of alternations. The phase difference will always remain the same, and because of this the resultant current will be a constant alternating one. If we had two sets of alternating currents of different amplitude the resultant current would be a constant alternating one, which would have a value somewhere between the difference between the individual amplitudes and the sum of the individual amplitudes; the least value of resultant current would be produced when the two sets of currents always opposed each other, that is to say when they were 180° out of phase; if the two currents have an amplitude of 1 ampere and 3 amperes respectively, when the phase difference is 180° the resultant current will be 2 amperes. If the currents are absolutely in phase the resultant current will be 4 amperes. Intermediate phase differences will give intermediate amplitudes of resultant current.

These rules only apply when the two sets of alternations are of the same frequency. When the frequencies are different the phase difference never remains the same; the currents will at some moments be helping each other, while at other moments the currents will be opposing each other. There is, however, a certain amount of regularity in the way the two sets of alternations *interfere* with each other. The resultant current is of an alternating nature, but it rises and falls in amplitude at regular intervals. At certain points the resultant current amplitude falls to zero, and at other times the current rises to a maximum. Fig. 2 illustrates the action; the top line shows one set of alternations, while the second line shows alternations of slightly different frequency, the third line showing the resultant current produced by the interaction of the two sets. It will be seen that there are points, *A*, where the current amplitude falls to zero, and that there are regular points, *B*, where the amplitude increases to a maximum; these latter points are known as *beats*. The same phenomenon is obtained with sound; if two notes of slightly different pitch be struck at the same time a resultant beat note will be produced. Fig. 2 shows the conditions when the two sets of alternating currents have the same amplitude. The beats have a maximum amplitude equal to the sum of the individual amplitudes. The same sort of beats are produced if the two sets of alternations have different amplitudes. This time, however, the amplitude at the *minimum* points *A* is not zero but equals the difference between the two individual amplitudes. The frequency with which the beats occur is equal to the difference in frequencies between the two sets of alternating currents. If one of these sets of alternating currents has a frequency of 500 cycles and the other a frequency of 400 cycles, the resultant *beat* frequency will be 100; that is to say, there will be 100 points of maximum amplitude per second.

The phenomenon of beats is obtained when dealing with radio-frequency currents as well as with low-frequency alternating currents. We take advantage of this effect to receive continuous waves. The incoming oscillations are combined with oscillations locally produced at the receiving station and having a frequency slightly different from the incoming frequency. Fig. 3 shows a simple crystal receiving circuit in which a crystal detector *D* and telephones *T* are connected across the oscillatory circuit *L*1 *C*1. Coupled to the inductance *L*1 or placed near it is a valve *oscillator* which, as we have explained, is capable of producing continuous oscillations; the frequency of the oscillator may be adjusted. A valve has an oscillatory circuit *L*2 *C*3 connected across grid and anode. A middle connection is taken from *L*2 through the high-tension battery *B*2 to the positive side of the filament accumulator *B*1. A grid condenser *C*4 and leak *R*1 are provided so as to avoid a high positive grid potential. A circuit of this character will oscillate of its own accord and produce continuous oscillations which are caused to affect the receiving circuit *L*1 *C*1.

When signals are not arriving, the detector *D* does not respond to the continuous oscillations from the valve oscillator. When continuous wave signals are received, however, they combine with the local oscillations induced into *L*1 *C*1 and produce a resultant current which takes the form of the third line of Fig. 2, and which is now split up into groups rather similar to those obtained when receiving spark signals, except that a very much larger number of oscillations are found in each group. The beats are rectified by the detector and pro-

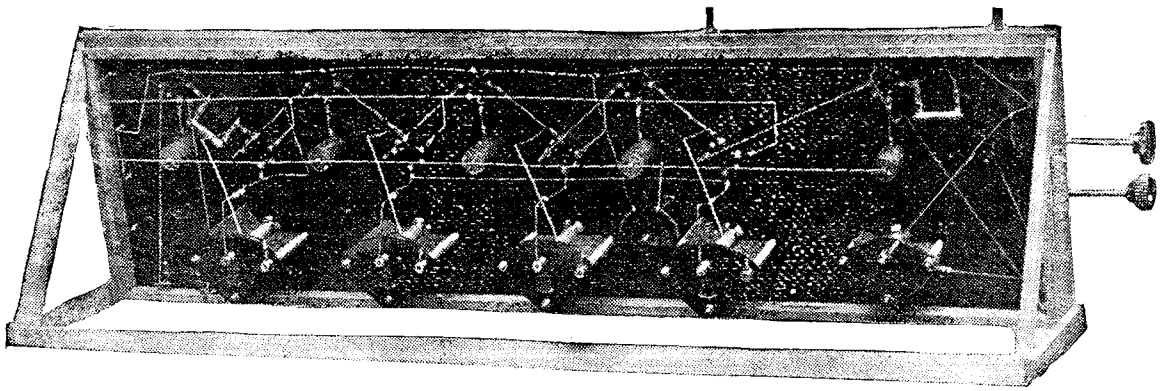

Fig. 4.—Rear view of the supersonic receiver with local oscillator detached.

duce pulses of current through the telephones *T*. A musical note is in this manner produced and the pitch of the note may be adjusted by altering the frequency of the local oscillations supplied by the circuit *L2 C3*. If the local oscillations only differ in frequency from the incoming oscillations by, say, 100, the beat frequency will be 100 and a low note will be the result. If the local frequency be made different from the incoming frequency by 1,000 cycles per second, the pitch of the note heard in the telephones will be equivalent to 1,000 beats per second; that is to say, a high note will be obtained.

Audibility Limits

The human ear will only respond to a certain range of note frequencies. This range, in extreme cases, is from 30 to 40,000. In most cases, however, the human ear can only respond to a much narrower range of notes. The lower limit may remain at 30, but the upper limit may be taken as 10,000. These figures vary a great deal in textbooks and the actual figure does not really concern us. Signals above 3,000 frequency produce no material effect on the human ear, but 10,000 may be taken as the *limit of audibility* for the purpose of the explanations.

Fig. 5 shows the scale of the variable condenser, *C3*, which controls the frequency of the oscillations produced by the valve of Fig. 3. The scale is shown divided into 180 divisions or degrees as is frequently the case. An increase in capacity of the condenser *C3* is indicated by a higher figure opposite the arrow-head in Fig. 5. It is now proposed to show the effect on the telephones *T* of gradually increasing the capacity of the condenser *C3*.

We will assume that the incoming signals have a wavelength of 1,000 metres. This is equivalent to a frequency of 300,000 (300,000,000—the speed of electric waves in metres per second—divided by 1,000). Let us suppose that the condenser *C3* is first set to 100°. The local frequency, we will now suppose, is equal to 265,000. This frequency will combine with the incoming frequency of 300,000 to give beats of 35,000 frequency. These beats will be produced, but when rectified will not give an audible signal in the telephones; they are *above audibility*. Let us now gradually decrease the capacity of the condenser, *C3*; when we get to 90° we can begin to hear a very high weak note; the local frequency will now be about 290,000. This frequency will produce beats of 10,000 which are just audible. As we continue to turn the condenser round, the local frequency increases and approaches 300,000; the result is that the note of the signals gradually becomes lower although still very high. At 85° we get a very clear note of 1,000 frequency which is probably most suitable for general reception purposes; this is produced when the local frequency is 299,000. If now we continue to turn the condenser round so as to decrease the

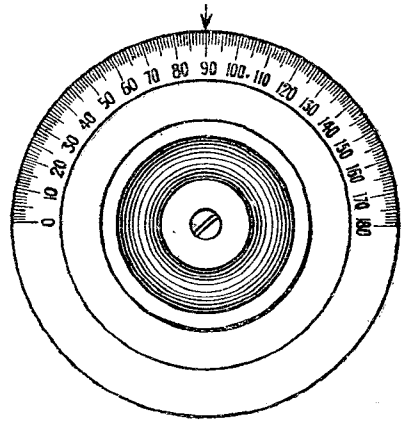

Fig 5.—Variable condenser scale.

capacity and therefore increase the frequency of the local oscillations, the note becomes lower and lower until it reaches the lower audible limit, beyond which nothing is heard in the telephones. For example, when the condenser is at 81° the local frequency is 299,975 and the beat frequency is only 25. As we very gradually turn the condenser round the beats are still produced, but remain inaudible. At 80° the local frequency is 300,000; this frequency being equal to the frequency of the incoming signals produces no beats at all and we continue to hear nothing in the telephones. As we decrease the capacity of the condenser further, beats are once more formed, but are of such low frequency as to be inaudible; for example, at 79° the local frequency is 300,025, the beat note being consequently only 25. If we decrease the capacity of the condenser still further, the beat note increases in frequency and becomes audible. A low note is heard which gradually rises as the condenser is turned round further. At 75° we once more get a good note of 1,000 frequency, the frequency of the local oscillations being 301,000. At 70° the local frequency is 310,000 and we obtain a very high note at the upper audible limit for practical purposes. At 60° the local frequency is 335,000 and the beats of 35,000 frequency are inaudible.

The effect, then, of turning round the condenser of our local oscillator is to bring in gradually a very high note which decreases until it becomes inaudible for a fraction of the scale on the condenser, and then becomes audible again as a very low note, which gradually rises as we turn the condenser, until the note becomes too high to be audible. We adjust the condenser so as to give, preferably, a beat note of about 1,000, and we will see that we can obtain this note at two points on the condenser, one on each side of the silent interval, since we obtain the beat note with two different values of local frequency. If we turn the condenser rapidly a note like a " chirp " is heard.

NOTE.—*A further instalment of this interesting series will appear in next week's issue.*

□ □ □

FOREIGN NOTES

Germany

We are informed that the latest arrangements installed at Konigswusterhauzen, the high-powered Berlin station, permit this station to send out 21 messages simultaneously.

United States

The American station, WEAF, of New York, is making arrangements to broadcast the important football matches this season. A chart will be distributed to listeners to help them to follow the speaker, who will be on the field.

LISSENIUM

THE RIGHT WAY TO JUDGE Low Frequency Amplification

PURITY FIRST—VOLUME AFTERWARDS. All too readily moderate tone quality has been accepted as good, but sooner or later the right means of obtaining pure low frequency amplification will be used universally, instead of by those who are sufficiently discriminating, as at present.

The right way to obtain pure low frequency amplification is to use a coupling at each stage which has been designed to meet the technical requirements of the position. For instance, the importance of the first stage transformer cannot be over-estimated, for any distortion here is magnified many times with each succeeding stage. But the expensive transformer which is ideal for the first stage need not be used throughout unless superlative amplification is desired, for it is not so necessary to have such high impedance in the second and third stage transformers as in the one used for the first stage. Where power amplification is used, however, the first stage transformer should be employed.

Apart from the usual transformer coupling, another interesting coupling to use is the LISSEN L.F. CHOKE COUPLING. To the keen enthusiast the comparisons possible are very instructive. One can, for instance, see how many stages of LISSEN CHOKES can be used in cascade.

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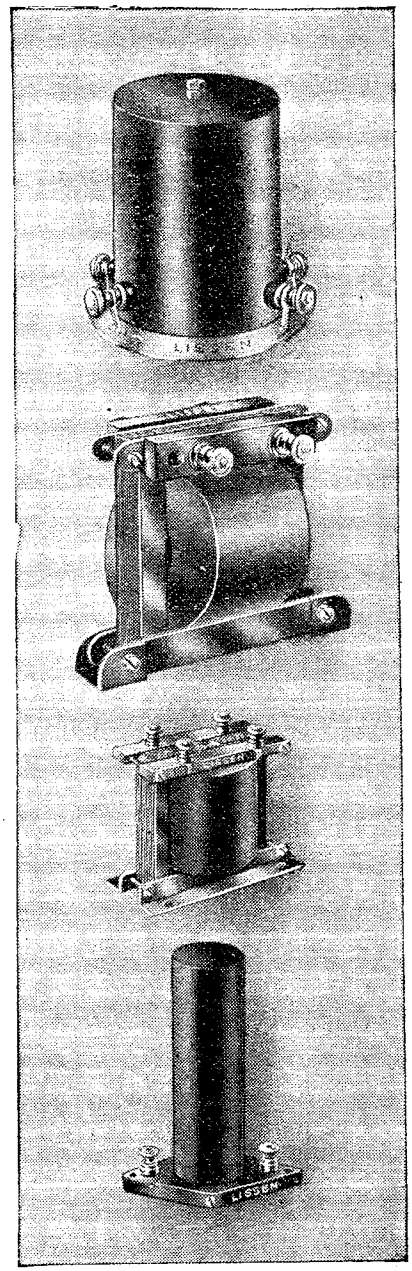

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Random Technicalities.

By PERCY W. HARRIS, Assistant Editor.

Some Notes of interest to the Home Constructor and Experimenter.

A CORRESPONDENT, who is kind enough to express appreciation of the criticisms I have been making in these columns, asks me if I have noticed that even in the best makes of high-tension batteries the sockets are often very dirty, corroded, and at times filled with wax, in such a way that it is impossible to make contact with them. By a strange coincidence, I had experienced just the same trouble myself about a couple of days before receiving his letter—at least, as far the presence of wax in the sockets is concerned. So many thousands of dry batteries are made in these days that inevitably a few get through in which the waxing has been carelessly done. If you seem to have a disconnection in your circuit, and the set is apparently all right, make sure that your wander plug is making contact with the socket and is not insulated from it by a layer of wax.

One More Grumble

Looking back over what I have recently written, I have the uncomfortable feeling that this column is degenerating into a catalogue of grumbles, and so I must try and think of something more cheerful. However, here is just one more. When is some manufacturer going to give us a really serviceable and large change-over switch for disconnecting the aerial and connecting it to earth? I know there are a lot of switches designed for this purpose, but all of them, without exception, are far too small. The ordinary copper battery switches on china bases are quite convenient, but for short wave work it is most undesirable to bring the earth connection so near to the aerial. What we want is a blade at least six inches long, so that when the aerial is connected to the set it is well away from the earth connection on the other contact. You may think I am carrying matters to an absurd extreme in asking for a switch of this size. If you work on very short waves, such as those which are coming into popularity for long-distance transmission (well below 100 metres), you will be astounded how much energy can be bye-passed through tiny stray capacities.

Strange Aerials

Of late there has appeared on the market a large number of strange aerial devices for which equally strange claims have been made. Many of these claims are based on a complete

misunderstanding of the subject, so that it is perhaps worth while to explain one or two matters in relation to aerials.

The Strip Variety

We have, for example, a number of strip aerials of various kinds. These are quite satisfactory, although mechanically they sometimes give trouble through twisting and breaking at the bent part. When, however, we find claims made that these aerials must be superior to ordinary wire because " they intercept a much greater quantity of the waves," we are on very dangerous ground. Experiments quite early in the history of wireless showed conclusively that an aerial wire absorbs energy not only from the part of a wave which impinges directly on it, but from quite an appreciable space around that part. This is proved by the fact that a number of wires placed vertically and separated a foot or so from one another can act as a complete screen to oncoming wireless waves. Any virtues which strip aerials may possess are due to their having a lower high-frequency resistance than some other forms. Then, again, take the question of the stranding of aerial wire. It has been proved quite conclusively by experiments made at the Bureau of Standards in the United States that for wavelengths of the order of those used for broadcasting solid wire is just as good as the most elaborate stranded product, and unless this latter is most carefully made, and has every separate strand soldered to the others, the high-frequency resistance may be even higher than the solid wire of equivalent gauge.

The ordinary 7/22 aerial wire is a good sound job easy to handle. The stranding is valuable in giving flexibility, although it is doubtful whether such wire is electrically more efficient than the equivalent gauge in solid wire.

Non-Directional Frames

I notice that frame aerials hoisted from the top of a pole are being used here and there, there being only one down lead from one end of the frame winding. A frame aerial used this way ceases to be a frame aerial so far as directional properties are concerned, and we are simply concentrating inductance at the top end of the aerial, thus lessening that available in the tuner. Personally, I cannot see why such an aerial arrangement should be superior to a single vertical wire of the same height, but long experience in the game

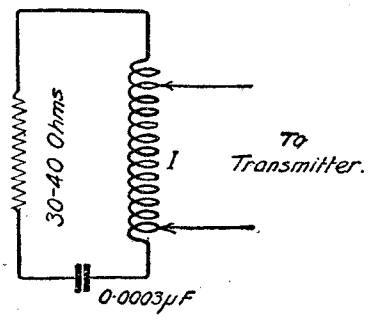
has shown me that theorising on such matters is of very little use, and it is quite conceivable that virtues may exist in this arrangement which at present are unexplainable in theory. If this paragraph should meet the eye of any reader who has erected such an aerial and can give a clear opinion as to whether or not it is superior to a vertical wire I should certainly like to hear from him. It is no use writing that such an aerial gives better results than a previous one which was half the height but horizontal; the only true comparison is between a vertical wire of the same height in the same position, and the frame scheme.

Upstairs Efficiency

Using a frame aerial in this way must not be confused with using it on the upper floor of a house. Very often it is found that a frame aerial will work far better upstairs than down; this being due to the fact that upstairs rooms are generally less screened than downstairs.

Madrid

The extraordinary way in which the Madrid transmissions are now coming in is a topic of conversation in all experimental circles. On any reasonable outdoor aerial Madrid is easily audible on a single valve, and in several cases, for which I can personally vouch, it has been heard clearly on a crystal. The modulation is very good, and if



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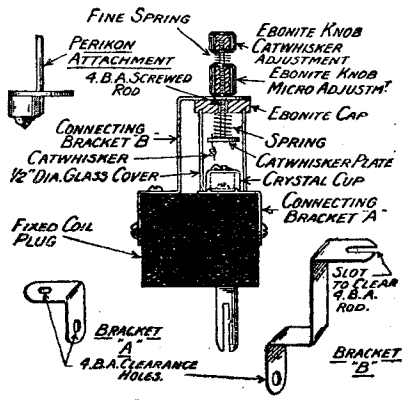
you know the language every word can be clearly understood. The wavelength is slightly shorter than that of Newcastle, so that the station can be heard by leaving the set adjusted at the Newcastle wavelength and then searching just below this point after London closes down. It is a good exercise in long-distance reception, as the station transmits for some time after the British stations have closed down. Unfortunately the Hamburg station works on the same wavelength, and frequently one station heterodynes the other.

It was rather surprising that Capt. Eckersley's broadcast from KDKA failed to be received by the British Broadcasting Company on Sunday evening, the 12th inst., as this was an extraordinary good night for American reception. After 1 o'clock in the morning WGY on the ordinary broadcast wavelength came through with extraordinary power, and on a new receiver which I have just completed for *Modern Wireless* (H.F. detector and one note-magnifier) was audible all over the house on a loud-speaker. Although atmospherics are rather troublesome these days, the speech broadcast was so clear that every little intonation of the speaker's voice was audible. When I went to bed soon after half-past two, WBZ (Boston) was coming through strongly. Two or three friends of mine who were listening on only one stage of high-frequency reported that they got the programmes quite well at the same time.

□

A Crystal Detector with Novel Points

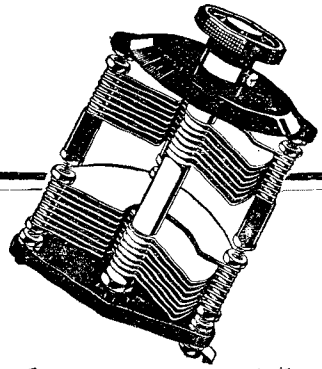
A CRYSTAL detector with some novel points is shown in the accompanying diagram. It is built up on an ordinary coil plug. This is a distinct advantage, as it may be readily plugged into a fixed coil holder. The diagram shows how the idea may be adapted to either a perikon or a catwhisker detector. Two brass brackets should first be made, as shown, one being secured by the existing coil plug screw, which makes contact with the socket. This bracket also holds the glass cover in place. The other bracket is also secured by the coil plug screw which makes contact with the pin. The other end of the bracket secures the crystal cup in the manner shown in the drawing. An ebonite cap is made to fit over the glass cover, and both are adjusted in position underneath the first bracket. The ebonite cap should have a centre drilling, to clear 4 B.A. rod, The micro adjusting knob should be of ebonite, having a centre hole drilled and tapped 4 B.A. The catwhisker adjusting knob should also be of ebonite, with a centre



Showing details of construction of the crystal detector

hole drilled and tapped 4 B.A. half-way down. A short length of 4 B.A. rod will next be required, to one end of which is soldered a round brass disc, to which the catwhisker in turn is also fixed. This may be done by soldering, or, alternatively, by drilling a fine hole and wedging the catwhisker in it by means of a taper pin peg. Over the other end of the 4 B.A. rod pass a fine spring, next place the ebonite cap over, and then pass the free end of the rod through the slot in the bracket, having the glass cover ready in position. Now screw on the micro adjusting knob, slip over a further fine spring, and finally secure the catwhisker adjusting knob. The alternative suggestion for a perikon fitment is made by soldering a large condenser spacer washer on to the brass disc, in place of the catwhisker. The spacer washer acts as a crystal cap, the crystal being secured with Woods metal. To operate, the catwhisker knob is held with the left hand, while the correct tension is applied with the right hand by means of the other knob. The position of the catwhisker is changed by turning the upper knob.

H. B.



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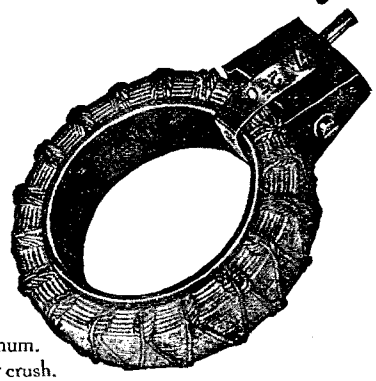

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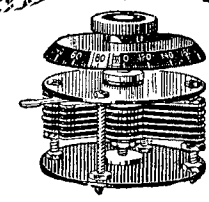
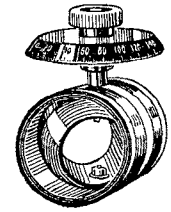


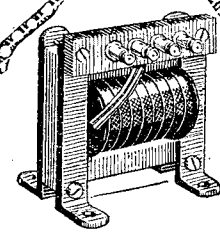
GECOPHONE Variable Condensers.

·001 M.F.D. 20/-
·0005 " 14/-
·0003 " 12/-
·0002 " 11/-



GECOPHONE Variometers

300-750 metres, unmounted **10/6** in polished Mahogany Cabinet **25/-**



GECOPHONE Intervalve Transformers.

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Advertisement of The General Electric Co., Ltd. (Manufacturers & Wholesale only), Magnet House, Kingsway, London, W.C.2.

Regular Programmes from Continental Broadcasting Stations

Telephony except when otherwise stated. Corrected up to October 15th, 1924.

Edited by CAPTAIN L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R Met.S.

W=Weather forecast. N=Stocks, Shares, Markets and/or News. T=Time Signal. C=Concert, Dance Music, Children's Stories.

Ref. No. of Transmission.	G.M.T.	Name of Station.	Call Sign and Wave-length.	Locality where situated.	Nature of Transmission.	Closing down time or approx. duration of Transmission.	Approx. Power used.
			WEEK DAYS				
	a.m.						
1	6.25	Hamburg	—— 392 m. ...	Germany ...	T ...	5 minutes	700 Watts.
2	6.40	Eiffel Tower ...	FL 2600 m. ...	Paris	W ...	5 minutes	5 Kw.
3	6.55	Munster	—— 407 m. ...	Westphalia ...	T ...	5 minutes	1.5 Kw.
4	7.05	Lausanne	HB2 850 m. ...	Switzerland ...	W ...	5 minutes	500 watts.
5	7.55	Persbureau M.S. Vaz Dias.	PCFF 2125 m. ...	Amsterdam ...	N ...	10 minutes	2 Kw.
6	9.00	Voxhaus	—— 430 m. ...	Berlin	N ...	3 minutes	700 Watts.
7	9.15	Voxhaus	—— 430 m. ...	Berlin	N ...	10 minutes	700 Watts.
8	9.23	Eiffel Tower ...	FL 2600 m. ...	Paris	T (spark)	3 minutes	—
9	9.55	Persbureau M.S. Vaz Dias.	PCFF 2125 m. ...	Amsterdam ...	N ...	10 minutes	2 Kw.
10	10.00	Eiffel Tower ...	FL 2600 m. ...	Paris	T (spark)	5 minutes	—
11	10.30	Lyons	YN 470 m. ...	Lyons ...	C ...	Until 11 a.m.	500 Watts
12	10.30	Kbel	—— 1150 m. ...	Czecho-Slovakia.	N ...	10 minutes	1 Kw.
13	10.44	Eiffel Tower ...	FL 2600 m. ...	Paris	T (spark)	3 minutes	—
14	10.55	Eiffel Tower ...	FL 2600 m. ...	Paris	N ...	10 minutes	5 Kw.
15	10.55	Frankfurt	—— 467 m. ...	Frankfurt ...	T ...	10 minutes	1 Kw.
16	11.00	Stuttgart	—— 437 m. ...	Wurtemburg ...	N ...	10 minutes	1 Kw.
17	11.10	Persbureau M.S. Vaz Dias.	PCFF 2125 m. ...	Amsterdam ...	N ...	Until 11.30	2 Kw.
18	11.14	Eiffel Tower ...	FL 2600 m. ...	Paris	T ...	5 minutes	5 Kw.
19	11.15	Konigsberg ...	—— 460 m. ...	East Prussia ...	T ...	5 minutes	1 Kw.
20	11.15	Voxhaus	—— 430 m. ...	Berlin	N ...	5 minutes	700 Watts.
21	11.55	Voxhaus	—— 430 m. ...	Berlin	T ...	15 minutes	700 Watts.
22	11.55	Leipzig	—— 452 m. ...	Germany ...	N ...	10 minutes	700 Watts.
23	11.57	Nauen	POZ 3100 m. ...	Berlin	T (spark)	8 minutes	—
	noon						
24	12.00	Persbureau M.S. Vaz Dias.	PCFF 2125 m. ...	Amsterdam ...	N ...	10 minutes	2 Kw.
25	12.00	Kbel	—— 1150 m. ...	Czecho-Slovakia.	N ...	10 minutes	1 Kw.
	p.m.						
26	12.15	Geneva	HB1 1100 m. ...	Switzerland ...	N ...	One half-hour.	400 Watts.
27	12.30	Lausanne	HB2 850 m. ...	Switzerland ...	W T & N	15 minutes	500 Watts.
28	12.45	Radio-Paris ...	SFR 1780 m. ...	Clichy	N ...	15 minutes	8 Kw.
29	12.45	Kbel	—— 1150 m. ...	Czecho-Slovakia.	N ...	10 minutes	1 Kw.
30	12.45	Stockholm	—— 440 m. ...	Sweden ...	W ...	5 minutes	500 Watts.
31	12.45	Persbureau M.S. Vaz Dias.	PCFF 2125 m. ...	Amsterdam ...	N ...	10 minutes	2 Kw.
32	1.00	Radio-Paris ...	SFR 1780 m. ...	Clichy	C & N	2 p.m.	8 Kw.
33	1.00	Haeren	BAV 1100 m. ...	Brussels ...	W ...	5 minutes	150 Watts.
34	1.00	Munich	—— 485 m. ...	Bavaria ...	N ...	10 minutes	1 Kw.
35	1.00	Komarow	—— 1800 m. ...	Czecho-Slovakia.	N ...	10 minutes	1 Kw.
36	1.00	Stockholm	—— 440 m. ...	Sweden ...	T ...	3 minutes	500 Watts.
37	1.15	Voxhaus	—— 430 m. ...	Berlin	N ...	5 minutes	700 Watts.
38	2.40	Persbureau M.S. Vaz Dias.	PCFF 2125 m. ...	Amsterdam ...	N ...	10 minutes	2 Kw.
39	2.45	Eiffel Tower ...	FL 2600 m. ...	Paris	N ...	8 minutes	5 Kw.
40	2.45	Munster	—— 407 m. ...	Westphalia ...	C ...	Until 4 p.m.	1.5 Kw.
41	3.00	Centocelle	ICD 1800 m. ...	Rome	W ...	10 minutes	1.5 Kw.

Ref. No. of Transmission.	G.M.T.	Name of Station.	Call Sign and Wavelength.	Locality where situated.	Nature of Transmission.	Closing down time or approx. duration of Transmission.	Approx. Power used.
	p.m.		**WEEKDAYS (Contd.)**				
42	3.30	Frankfurt	—— 467 m. ...	Germany ...	C ...	Until 5 p.m.	1 Kw.
43	3.30	Konigsberg ...	—— 460 m. ...	East Prussia ...	C ...	One hour	1 Kw.
44	3.30	Voxhaus	—— 430 m. ...	Berlin	C & N...	5.30 ...	700 Watts.
45	3.30	Munich	—— 485 m. ...	Bavaria ...	C ...	Until 4.30 p.m.	1 Kw.
46	3.30	Leipzig	—— 452 m. ...	Germany ...	C ...	Until 5 p.m.	700 Watts.
47	3.35	Eiffel Tower ...	FL 2600 m. ...	Paris	N ...	5 minutes	5 Kw.
48	3.55	Persbureau M.S. Vaz Dias.	PCFF 2125 m. ...	Amsterdam ...	N ...	10 minutes	2 Kw.
49	4.0	Kbel	—— 1150 m. ...	Czecho-Slovakia.	N ...	10 minutes	1 Kw.
50	4.0	Hamburg	—— 392 m. ...	Germany ...	N ...	30 minutes	700 Watts.
51	4.30	Radio-Paris ...	SFR 1780 m. ...	Clichy	N C & N	Until 5.45 p.m.	8 Kw.
52	4.30	Eiffel Tower ...	FL 2600 m. ...	Paris	N ...	8 minutes	5 Kw.
53	4.45	Stuttgart	—— 437 m. ...	Wurtemberg ...	C & W	Until 6 p.m.	1 Kw.
54	5.00	Radio-Belgique ...	SBR 265 m. ...	Brussels ...	C & N	6 p.m. ...	2.5 Kw.
55	5.55	Lausanne	HB2 850 m. ...	Switzerland ...	W & N	10 minutes	500 Watts.
56	6.00	Zurich	—— 650 m. ...	Switzerland ...	W & N	10 minutes	1.5 Kw.
57	6.15	Kbel	—— 1150 m. ...	Czecho-Slovakia.	C & N	Until 7.15 p.m.	1 Kw.
58	7.00	Eiffel Tower ...	FL 2600 m. ...	Paris	W ...	8 minutes	5 Kw.
59	7.00	Munster	—— 407 m. ...	Westphalia ...	C & N	Until 8.30 p.m.	1.5 Kw.
60	7.00	Radio-Wien ...	—— 530 m. ...	Vienna	C ...	Until 9 p.m.	1 Kw.
61	7.00	Konigsberg ...	—— 460 m. ...	East Prussia ...	C & N	Until 8.30 p.m.	1 Kw.
62	7.00	Hamburg	—— 392 m. ...	Germany ...	C & N	Until 9.50 p.m.	700 Watts.
63	7.00	Stuttgart	—— 437 m. ...	Wurtemberg ...	C & N	Until 9.30 p.m.	1 Kw.
64	7.15	Zurich	—— 650 m. ...	Switzerland ...	C & N	9.15 p.m.	1.5 Kw.
65	7.15	Leipzig	—— 452 m. ...	Leipzig	C & N	8.35 p.m.	700 Watts.
66	7.15	Lausanne	HB2 850 m. ...	Switzerland ...	C ...	8.30 p.m.	400 Watts.
67	7.30	Frankfurt	—— 467 m. ...	Frankfurt ...	C & N	Between 9 and 10 p.m.	1 Kw.
68	7.30	Stuttgart	—— 437 m. ...	Wurtemberg ...	C & N	Until 8.30 p.m.	1 Kw.
69	7.30	Breslau	—— 415 m. ...	Silesia	C ...	Until 10 p.m.	1.5 Kw.
70	7.30	Leipzig	—— 452 m. ...	Germany ...	C & N	Until 10 p.m.	700 Watts.
71	7.30	Zurich	—— 650 m. ...	Switzerland ...	C & N	9.15 p.m.	1.5 Kw.
72	7.30	Voxhaus	—— 430 & 500 m....	Berlin	C N & W	Until 9.15 p.m.	700 Watts and 1.5 Kw.
73	7.30	Munich	—— 485 m. ...	Bavaria	C & N	8.40 p.m.	1 Kw.
74	8.15	Radio-Belgique ...	SBR 265 m. ...	Brussels... ...	N C & N	Until 10.10 p.m.	2.5 Kw.
75	8.30	Ecole. Sup. des Postes et Telegraphes.	FPTT 450 m. ...	Paris	C ...	Two or three hours.	500 Watts.
76	8.30	Radio-Paris ...	SFR 1780 m. ...	Clichy	N ...	One half hour.	8 Kw.
77	9.00	Radio-Paris ...	SFR 1780 m. ...	Clichy	T & C	9.50 p.m.	8 Kw.
78	9.30	Radio-Iberica ...	—— 392 m. ...	Madrid	C ...	Until mid-night.	3 Kw.
79	10.00	Eiffel Tower ...	FL 2600 m. ...	Paris	T ...	5 minutes	5 Kw.
80	10.10	Eiffel Tower ...	FL 2600 m. ...	Paris	W ...	5 minutes	5 Kw.
81	10.44	Eiffel Tower ...	FL 2600 m. ...	Paris	T (spark)	3 minutes	—
82	11.57	Nauen	POZ 3100 m. ...	Berlin	T (spark)	8 minutes	—
	a.m.		**SUNDAYS**				
83	7.00	Frankfurt	—— 467 m. ...	Germany ...	C ...	One hour ...	1 Kw.
84	7.55	Hamburg	—— 392 m. ...	Germany ...	T ...	5 minutes	700 Watts.
85	8.00	Leipzig	—— 452 m. ...	Germany ...	C ...	One hour ...	700 Watts.
86	9.00	Komarow	—— 1800 m. ...	Czecho-Slovakia.	C ...	One hour ...	1 Kw.
87	9.23	Eiffel Tower ...	FL 2600 m. ...	Paris	T (spark)	3 minutes	—
88	9.50	Konigswuster-hausen.	LP 680 m. ...	—	C ...	One hour ...	6 Kw.
89	10.00	Eiffel Tower ...	FL 2600 m. ...	Paris	T (spark)	5 minutes	—
90	10.00	Kbel	—— 1150 m. ...	Czecho-Slovakia.	C ...	One hour ...	1 Kw.

3 Additional models to the AMPLION "Dragon" range.

Representing a most important advance in the production of small and medium size Loud Speakers, the three new AMPLION models illustrated and briefly described will be found of exceptional interest to the Technician, the Wireless Enthusiast and to the Listener-in desirous of "Better Radio Reproduction."

Although all the advantageous constructional features distinguishing Standard AMPLION models are provided in these designs, the prices are not merely moderate but extraordinarily low, and possible only by manufacture at the hands of specialists upon the most approved lines experience can suggest.

THE NEW "DRAGONFLY."
An Amplion Baby.

A perfect replica on a reduced scale of the famous "Standard" Dragon model. For a miniature Loud Speaker the "Dragonfly" is outstanding in its efficiency—affording considerable volume, coupled with extreme clarity and "full" tone. The electro-magnetic unit incorporating the new "floating" diaphragm, and the non-resonating sound conduit, are exclusive Amplion features.

AR101, 120 ohms; AR102, 2000 ohms; diam. of trumpet, 5½"; over-all height, 9".

Price 25/-

THE "NEW" JUNIOR.

In performance the "New" Junior is actually a "Senior" Loud Speaker, and compares favourably with instruments listed at twice and thrice the figure. All the latest improvements are embodied in the assembly, which reveals an efficiency not previously considered possible in a model so reasonably priced.

AR110, 120 ohms; AR111, 2000 ohms; diam. of trumpet, 10"; over-all height, 15½".

Price £2 : 10 : 0

The "NEW" JUNIOR-DE-LUXE

A Loud Speaker of high degree, the "New" Junior-de-Luxe can best be described as an aristocrat of Loud Speakers sold at a decidedly democratic price.

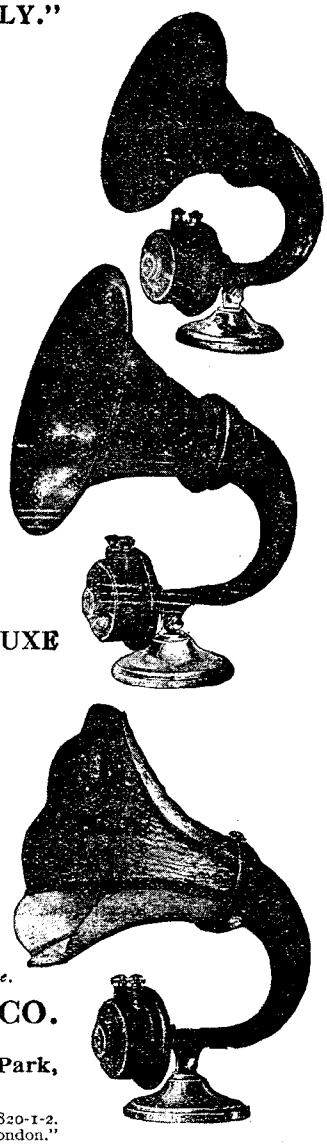
Corresponding in proportions to the "New" Junior type, the de luxe edition is provided with a wood trumpet of unique design. In this horn the oak or mahogany panels, as the case may be, are united by a series of metal ribs, affording an assembly of particularly attractive appearance.

AR113, 120 ohms; AR114, 2000 ohms; diam. of trumpet 10"; over-all height 15½".

Price £3 : 5 : 0

Mahogany Horn 3/6 extra.

Obtainable from all Wireless Dealers of Repute.



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BRANDES TABLE TALKER

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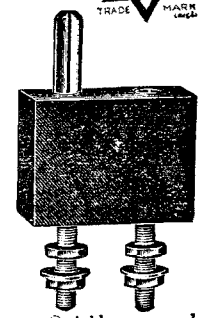
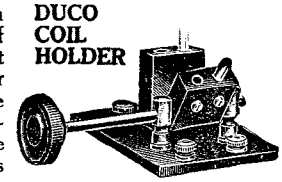


"Duco" Coil Plug. Quickly mounted on panel by means of two projecting screws. Suitable for any Standard Coil. No. 15271. Each 1/-

For mounting on panel or side of cabinet. A neat well-made holder of solid ebonite with brass fittings. Complete with terminals

DUCO COIL HOLDER



and anti-capacity handle.
No. 15269, 2-way each 5/6
No. 15270, 3-way each 7/6

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All Concert-de-Luxe	26/-	15/-
Omni Circuit	27/6	24/-
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Extra for carriage and packing on post orders ..	1/6	9d.

All cabinets are best seasoned walnut, hand-made and polished. Panels are guaranteed electrically, matt non-metallic finish, edges squared, accurately drilled and engraved.

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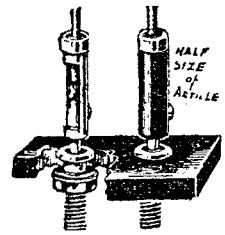

Plug and Socket Terminals.

S.A.C. "Tapa" Plug and Socket Terminals

"the gadget of a thousand uses," in red or black and five other colours. "Once used always used." **1/- per pair. Sample pair free to all Clients ordering panels or cabinets.**

S.A.C. Fireside Plug.

The last word in comfort and efficiency, for plugging in distant headphones, loud speakers, etc. **2/6 each.**

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Ref. No. of Transmission.	G.M.T.	Name of Station.	Call Sign and Wavelength.	Locality where situated.	Nature of Transmission.	Closing down time or approx. duration of Transmission.	Approx. Power used.
			SUNDAYS (Contd.)				
	a.m.						
91	10.00	Breslau	—— 415 m.	Silesia	C	1 hour	1.5 Kw.
92	10.00	Radio-Wien	—— 530 m.	Vienna	C	2 hours	1 Kw.
93	10.30	Lyons	YN 470 m.	Lyons	C	Until 11 a.m.	500 Watts.
94	10.30	Stuttgart	—— 437 m.	Wurtemburg	C	1 hour	1 Kw.
95	10.44	Eiffel Tower	FL 2600 m.	Paris	T (spark)	3 minutes	—
96	10.50	Konigswusterhausen.	LP 2800 m.	Berlin	C	Until 11.45 a.m.	6 Kw.
97	10.55	Eiffel Tower	FL 2600 m.	Paris	N	5 minutes	5 Kw.
98	11.00	Stockholm	—— 440 m.	Sweden	C	Until 12.15 p.m.	500 Watts.
99	11.10	Zurich	—— 650 m.	Switzerland	C	1 hour	1.5 Kw.
100	11.15	Konigsberg	—— 460 m.	East Prussia	T	5 minutes	1 Kw.
101	11.57 p.m.	Nauen	POZ 2800 m.	Berlin	T (spark)	8 minutes	—
102	1.00	Radio-Paris	SFR 1780	Clichy	C & N	2 p.m.	8 Kw.
103	3.00	Ned. Radio Industrie.	PCGG 1070 m.	The Hague	C & N	Until 5.20 p.m.	1.3 Kw.
104	3.00	Breslau	—— 415 m.	Silesia	C	Until 3.45 p.m.	1.5 Kw.
105	3.00	Stuttgart	—— 437 m.	Wurtemburg	C	Until 5 p.m.	1 Kw.
106	3.00	Radio-Wien	—— 530 m.	Vienna	C	2 hours	1 Kw.
107	3.00	Frankfurt	—— 467 m.	Germany	C	1 hour	1 Kw.
108	3.30	Munich	—— 485 m.	Bavaria	C	Until 5 p.m.	1 Kw.
109	4.00	Hamburg	—— 392 m.	Germany	C	30 mins.	700 Watts.
110	4.45	Radio-Paris	SFR 1780 m.	Clichy	C & N	5.45 p.m.	8 Kw.
111	5.00	Radio-Belgique	SBR 265 m.	Brussels	C	6 p.m.	2.5 Kw.
112	6.00	Eiffel Tower	FL 2600 m.	Paris	N	10 mins.	5 Kw.
113	6.00	Voxhaus	—— 430 m.	Berlin	C	30 mins.	700 Watts.
114	7.00	Radio-Wien	—— 530 m.	Vienna	C	Until 9 p.m.	1 Kw.
115	7.00	Stockholm	—— 440 m.	Sweden	C	Until 10 p.m.	500 Watts.
116	7.00	Munster	—— 407 m.	Westphalia	C	Until 9.30 p.m.	1.5 Kw.
117	7.00	Voxhaus	—— 430 & 500 m.	Berlin	C	Until 9.15 p.m.	700 Watts.& 1.5 Kw.
118	7.00	Konigsberg	—— 460 m.	East Prussia	C	Until 8.30 p.m.	1 Kw.
119	7.00	Hamburg	—— 392 m.	Germany	C	Until 9.45 p.m.	700 Watts.
120	7.00	Eiffel Tower	FL 2600 m.	Paris	W	8 mins.	5 Kw.
121	7.15	Lausanne	HB2 850 m.	Switzerland	C	Until 8.30 p.m.	500 Watts.
122	7.15	Zurich	—— 650 m.	Switzerland	C & N	Until 9.15 p.m.	1.5 Kw.
123	7.15	Leipzig	—— 452 m.	Germany	C & N	Until 8.40 p.m.	700 Watts.
124	7.30	Breslau	—— 415 m.	Silesia	C	Until 10 p.m	1.5 Kw.
125	7.30	Stuttgart	—— 437 m.	Wurtemburg	C	10.30 p.m.	1 Kw.
126	7.40	Ned. Seintoestellen Fabriek	NSF 1050 m.	Hilversum	C	Until 10.10 p.m.	1 Kw.
127	8.15	Radio-Belgique	SBR 265 m.	Brussels	N C & N	Until 10.10 p.m.	2.5 Kw.
128	8.30	Radio-Paris	SFR 1780 m.	Clichy	N	Until 9 p.m.	8 Kw.
129	8.30	Ecole Sup. de Postes et Telegraphes	FPTT 450 m.	Paris	C	Between 10.30 and midnight	500 Watts.
130	9.00	Radio-Paris	SFR 1780 m.	Clichy	C	Until 10.45 p.m.	8 Kw.
131	9.30	Petit Parisien	—— 340 m.	Paris	C	Until 12.30 a.m.	400 Watts.
132	9.30	Radio-Iberica	—— 392 m.	Spain	C	Until 12.30 a.m.	3 Kw.
133	10.00	Eiffel Tower	FL 2600 m.	Paris	T (spark)	5 mins.	—
134	10.44	Eiffel Tower	FL 2600 m.	Paris	T (spark)	3 mins.	—
135	11.57	Nauen	POZ 3100 m.	Berlin	T (spark)	8 mins.	—
			SPECIAL DAYS				
	p.m.						
136	3.00	Radio-Wien	—— 530 m.	Vienna	Mon., Wed. Fri. C	Until 5 p.m.	1 Kw.
137	4.00	Lausanne	HB2 850 m.	Switzerland	Wed., C	1 hour	400 Watts.

Ref. No. of Transmission.	G.M.T	Name of Station.	Call Sign and Wavelength.	Locality where situated.	Nature of Transmission.	Closing down time or approx. duration of Transmission.	Approx. Power used.
			SPECIAL DAYS (Contd.)				
138	4.30	Ecole.Sup.des Postes et Telegraphes.	FPTT 450 m ...	Paris	Thurs., C	2 Hours	500 Watts.
139	5.00	Komarow	—— 1800 m. ...	Czecho-Slovakia	Thurs., C	1 hour	1 Kw.
140	5.15	Zurich	—— 650 m. ...	Switzerland ...	Mon.,Wed., Fri., C	Until 5.50 p.m.	1.5 Kw.
141	5.15	Zurich	—— 650 m. ...	Switzerland ...	Thurs., Sat., C	1 half-hour	1.5 Kw.
142	5.40	Ned. Seintoestellen Fabriek.	NSF 1050 m. ...	Hilversum ...	Mon., C	Until 6.40 p.m.	1 Kw.
143	6.00	Eiffel Tower ...	FL 2600 m. ...	Paris	Mon.,Wed., Fri., & N	Until 6.50 p.m.	5 Kw.
144	6.00	Eiffel Tower ...	FL 2600 m. ...	Paris	Tues., Thurs., Sat., N	10 mins.	5 Kw.
145	6.00	Voxhaus	—— 430 m. ...	Berlin	Wed., C	30 mins.	700 Watts.
146	7.00	Svenska	—— 470 m. ...	Stockholm ...	Tues., Thurs., C	Until 10 p.m.	300 Watts.
147	7.00	Stockholm	—— 440 m. ...	Sweden	Wed.,Fri., Sat., C	Until 10 p.m.	500 Watts.
148	7.40	Smith & Hooghoudt	PA5 1050 m. ...	Amsterdam ...	Wed., C	Until 9.40 p.m.	500 Watts.
149	8.10	Middelraad ...	PCMM 1050 m. ...	Ymuiden ...	Sat., C	Until 9.40 p.m.	300 Watts.
150	8.40	Ned. Radio Industrie	PCGG 1070 m. ...	The Hague ...	Mon., C	Until 10.10 p.m.	1.3 Kw.
151	8.40	Amsterdam ...	PX9 1050 m. ...	Holland... ...	Tues., C	Until 10.40 p.m.	600 Watts.
152	8.40	Ned. Seintoestellen Fabriek.	NSF 1050 m. ...	Hilversum ...	Fri., C ...	Until 9.40 p.m.	1 Kw.
153	9.00	Le Matin	SFR 1780 m. ...	Paris	2nd and 4th Sat. of month, C	Until 10.50 p.m.	10 Kw.
154	9.30	Petit Parisien ...	—— 340 m. ...	Paris	Tues., Thurs., C	11.30 p.m.	400 Watts.
155	10.00	Radio-Paris ...	SFR 1780 m. ...	Clichy	Wed., Fri., C	Until 10.45 p.m.	8 Kw.

TEST REPORT ON "A USEFUL THREE-VALVE RECEIVER."

The receiver to which this refers is described on p. 21.

This set was tested about 9 miles from 2LO on a 75-ft. twin aerial 45 ft. high.

Using constant aerial tuning, with a No. 50 coil in the aerial socket and a No. 50 in the reaction socket, good loud-speaking was obtained from London (2LO) with the condenser set at 44°.

A high-tension voltage of approximately 80 v. was used, and a grid bias of 3 volts. Very good and very clear speech was obtained in the loud-speaker, being audible outside the house with doors and windows shut. Louder results were obtained by the use of series condenser and a No. 75 coil in the aerial socket and a 75 in the reaction socket. The condenser dial read 120°. The same values of H.T. and grid bias were used.

Manchester was received very well on the 'phones, being audible in the loud-speaker, and speech read at 5 and 6 ft. The aerial coil used was a No. 50, constant aerial being employed, a No. 50 being used for reaction. The condenser reading was 24°.

Bournemouth could be heard when London was quiet with the same coils, and C.A.T. with the condenser set at 52°.

Birmingham was received with the condenser set at 128°, using the same coils as above, at rather weak signal strength, but speech was perfectly intelligible. On changing the coils to 75's little better results were obtained, the condenser reading then being 60°.

Aberdeen was received with the same coils in position, the condenser dial being set at 92°.

A LONG-RANGE TWO-VALVE SET

SIR,—In reference to the "Long-range Two-valve Set," by Mr. Underdown, details of which were given in your excellent paper of September 17, as soon as I read of it I started to assemble it. I did not keep strictly to instructions in that I did not use square-law condensers and I did not mount the coil-holder on the panel. Well, as soon as I turned on the filaments I started to receive signals. So far I have logged all B.B.C. stations, except Aberdeen and Newcastle, the latter being very difficult to hear in this district; Brussels, Radio Paris, Ecole, Berlin, and at this moment I have got another German station I do not know the name of. To-night or, to be more correct, to-morrow morning, I am going to try for America. I will let you know results later.

B. ALCOCK.

Bedford.

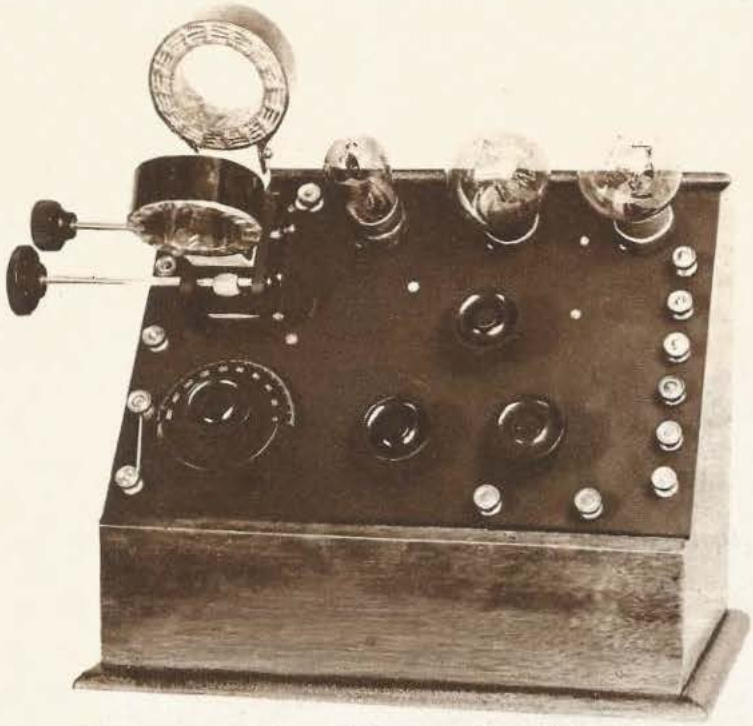


Fig. 1.—Any of the well-known makes of plug-in coils and valves may be used.

A Useful Three-Valve Receiver

By HERBERT K. SIMPSON

Simplicity of adjustment and purity of reproduction are outstanding features of this instrument.

MANY readers, while preferring the purity of tone and absence of distortion produced by the resistance-capacity method of low-frequency amplification, deplore, to some extent, the fact that an extra valve is needed to produce the same effect as when transformer coupling is used, two stages of resistance coupled note magnification being, roughly, equal to 1½ of transformer coupling.

The effect of using one stage of transformer amplification and one of resistance was tried, and the results obtained justified the making of the receiver to be described.

The full benefit of a stage of transformer coupling is obtained, but the second stage of note magnification, consisting, as it does, of resistance coupling, prevents any trouble arising due to interaction between transformers, or any extraneous noises which are quite common with some of the cheaper transformers when used in two or more stages.

Owing to the voltage drop across the anode resistance, separate terminals for the application of high-tension voltage must be provided for the first and second valves. The last valve, in the anode circuit of which are the telephone receivers, may have a higher anode potential than the other two valves, as it is the last low-frequency amplifier; therefore, the same tapping on the H.T. battery will suffice for this valve as for the second, in the anode circuit of which we have a 100,000 ohm resistance which cuts the plate voltage down.

The Receiver

Some idea of the appearance of the finished receiver may be gathered from the photograph, Fig. 1, which shows the set complete with valves and coils. On the left of the receiver are seen four terminals, these being in the aerial circuit, and enabling series, parallel, or constant aerial tuning to be employed at will. At the back of the two-way coil holder are two more terminals, by means of which the connections to the reaction coil may be reversed. The valves are situated at the top of the panel, with the resistances in front, that at the top controlling the second valve.

The battery terminals are seen on the right of the receiver, the order being: two separate high-tension terminals, common H.T. negative and L.T. positive, L.T. negative and positive of grid biasing battery; while the last two terminals are for separate application of negative bias to the second and third grids. The telephone receivers or loud-speaker are joined up to the terminals in the front of the panel.

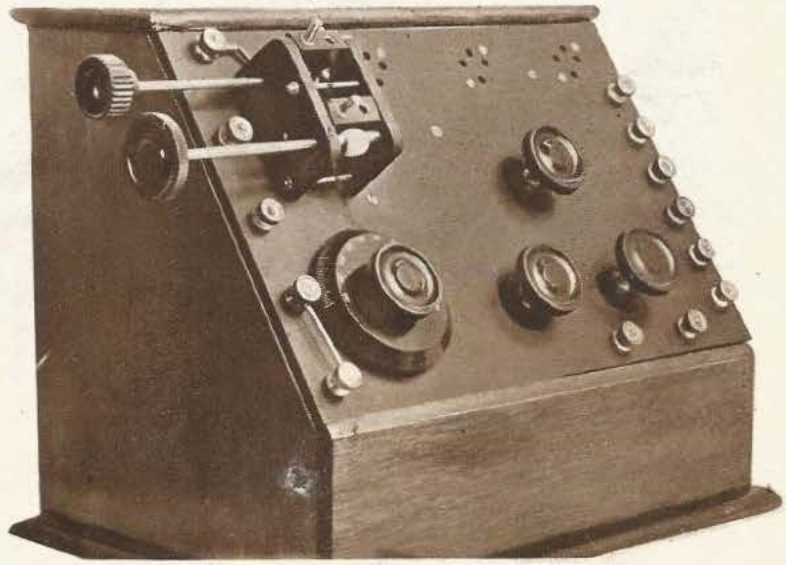


Fig. 2.—The set with valves and coils removed.

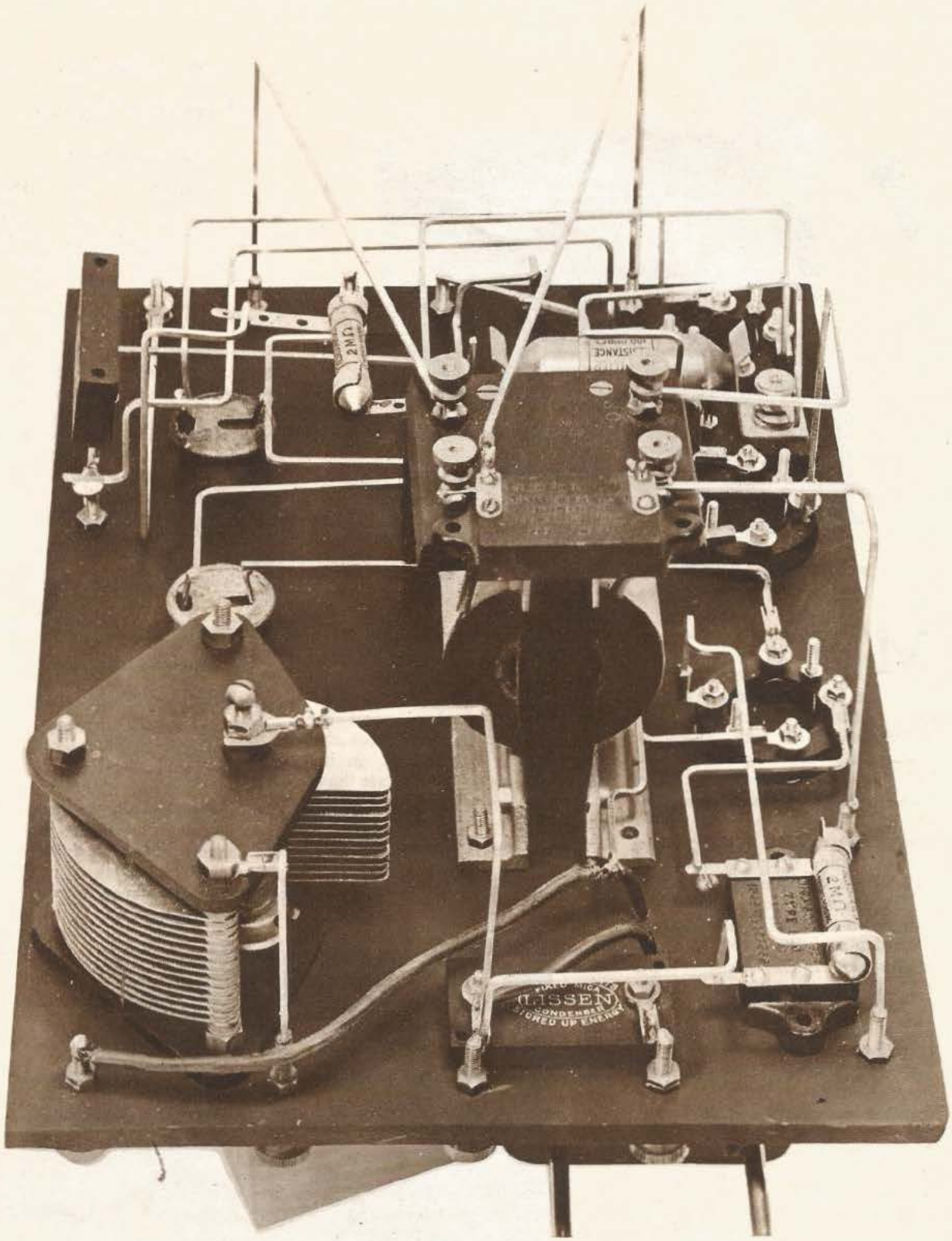


Fig. 3.—Low-capacity valve sockets and filament resistances for bright or dull emitters are refinements of value here.

The Circuit

Fig. 4 is a drawing of the circuit arrangements, and it will be seen that the first valve, V1, acts as a rectifier, the coil L2 serving to introduce reaction by coupling with L1 in the aerial circuit. A low-frequency inter-valve transformer constitutes the coupling between V1 and V2, while a 100,000 ohm resistance, R5, and a condenser, C4, of 0·2 μF capacity serve to couple the valves V2 and V3 together.

Constant Aerial Tuning

By connecting the aerial lead to terminal A, leaving A1 free, joining C and E together, and earthing the terminal E, constant aerial tuning, with parallel aerial tuning condenser, is applied to the circuit, while by joining the aerial lead to A1, leaving A free, and the earth to E, C and E being joined together by a piece of wire, ordinary parallel tuning is applied, the constant aerial tuning condenser, C.A.T., being omitted from the circuit In both these cases tuning is carried out by variation of the condenser C1, which is in parallel with the aerial tuning inductance L1.

Series Tuning

On the shorter wave-lengths it is often desirable to have the aerial tuning condenser in series with the coil L1. This may be effected in the present receiving set by joining the aerial lead to C, leaving both A and A1 free, and connecting the terminal E to the earth. For a given wave-length, a larger coil will be required when using series tuning than when the ordinary parallel connection of the aerial tuning condenser is employed.

Supply Arrangements

The arrangement of terminals for battery supply can be followed from the circuit diagram. It will be seen that the terminal H.T. +1 supplies the anode of the first valve, while H.T. +2 serves both the second and third valves. Two separate terminals for grid bias are provided, that labelled G.B.–1 being joined to the I.S. of the low-frequency transformer, the O.S. of which is connected to the grid of V2, while G.B.–2 is joined to the lower end of a 2-megohm leak, the upper end of which is connected to the grid of V3. By this means suitable grid voltage may be applied to the grids of each valve, and the experimenter may be sure that he is operating his valves to the best advantage.

Components Required

The components required are as follows :—

1 Ebonite Panel, 12 in. by 8 in. by ¼ in. (Paragon, Peter Curtis, Ltd.).
1 2-way coil holder (Goswell Eng. Co., Ltd., Cam Vernier).
3 Filament Resistances (Microstat, Wates Bros.).
1 L.F. transformer (Tangent).
1 0·0005 μF variable condenser.
3 valve holders (H.T.C. Electrical Co., Type C).
1 0·0001 μF fixed condenser (Lissen, Ltd.).
1 0·0003 μF condenser and 2-megohm leak (Dubilier, Ltd.).
2 0·002 μF fixed condensers (Dubilier, Ltd.).
1 0·2 μF T.C.C. condenser.
1 100,000 ohm resistance (Dubilier, Ltd.).

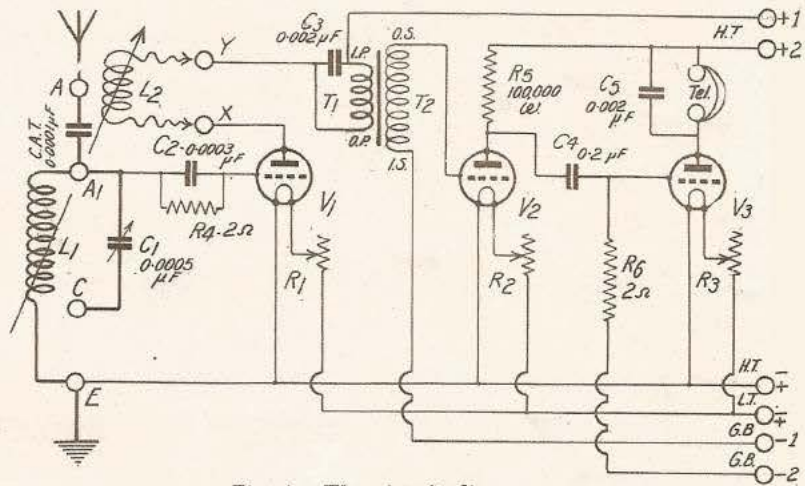


Fig. 4.—The circuit diagram.

1 2-megohm resistance, with clips (Dubilier, Ltd.).
14 terminals.

The names of the makers are given in the above cases; but it is not of essential importance that the parts used should be of the make specified, and the constructor may use such parts as he may already possess, provided these are of a good reliable make, and in proper condition.

The beginner who has any doubts about the matter is advised to follow the author's list if he wishes to obtain the same results.

Constructional Details

Fig. 6 shows the top-of-panel layout, and the necessary dimensions for drilling will be found thereon. In some cases the positions of screws are not dimensioned. This is because the component which they hold in place is likely to require different spacing when another model is purchased. For example, if the constructor drilled the holes in a dimensioned place for the transformer, he might quite conceivably find that his transformer would not fit, and he would, in the majority of cases, blame the drawing. In many cases, drilling templates are supplied, and these should be used where possible, as they make accurate drilling a much easier task.

The remainder of the construction is straightforward, and calls for no comment. Wiring, which is carried out in square section tinned copper wire, will be clear from the wiring diagram, Fig. 7, while the back-of-panel photographs will also prove of assistance to the constructor in his work.

The Containing Box

The panel, when completed, may be mounted in any suitable form of box or cabinet, to suit the needs of the individual. In the present case, a cabinet of the sloping front or desk type was chosen, and the whole presents a neat appearance.

Operating Details

Almost any good make of receiving valve will be found suitable for this receiver, and possibly the constructor may already possess three which will be found satisfactory. A voltage of 60 to 70 volts should be applied to the terminal H.T.+ 1, while about 100 volts may be required at the terminal H.T.+ 2. The voltage of the low-tension accumulator should be suited to the valves used, but either bright or dull

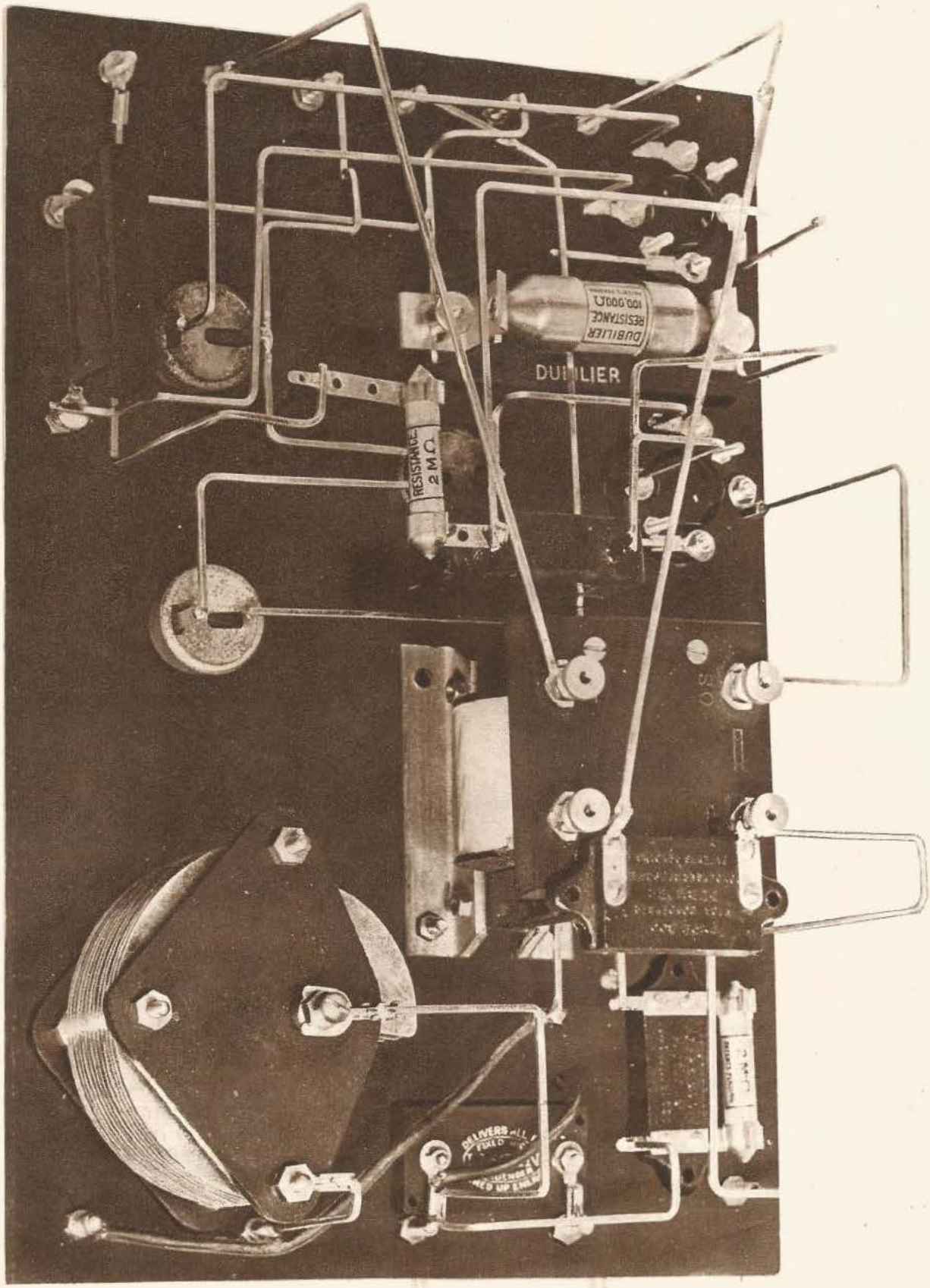


Fig. 5.—This view, from another angle, will give further assistance in wiring.

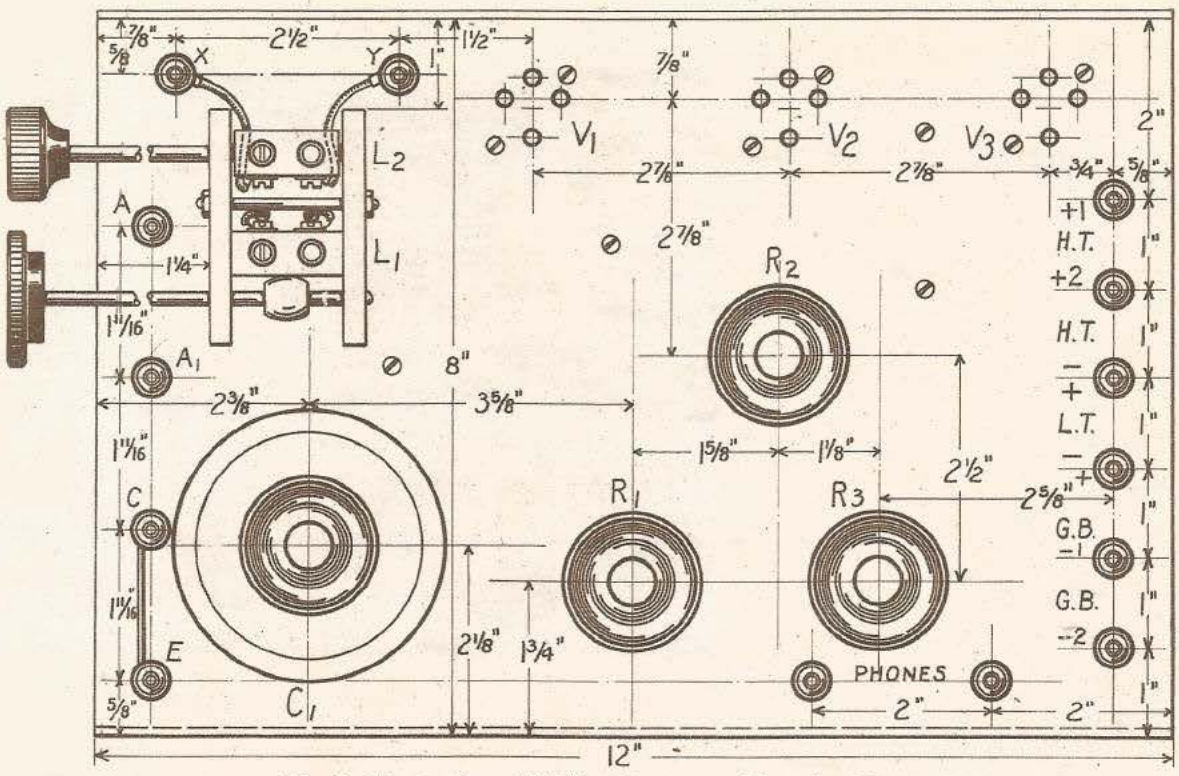


Fig. 6.—Front of panel drilling diagram. Blueprint 68a.

emitter valves may be used, as the filament resistances provided are capable of dealing with both patterns.

Testing the Set

When complete, the receiver may be joined up to an aerial and tested. Connect the accumulator and grid biasing batteries to the correct terminals, as shown in Fig. 6, and turn the filament

(Concluded on page 32)

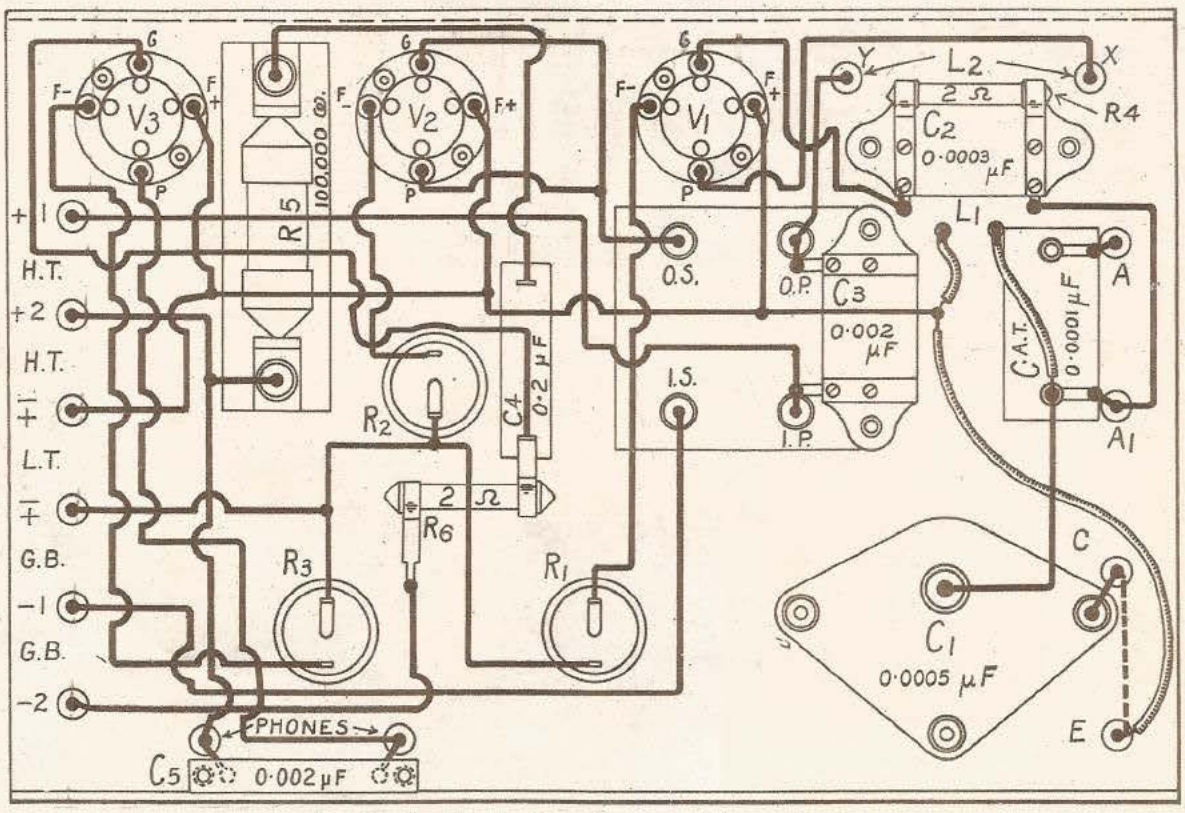
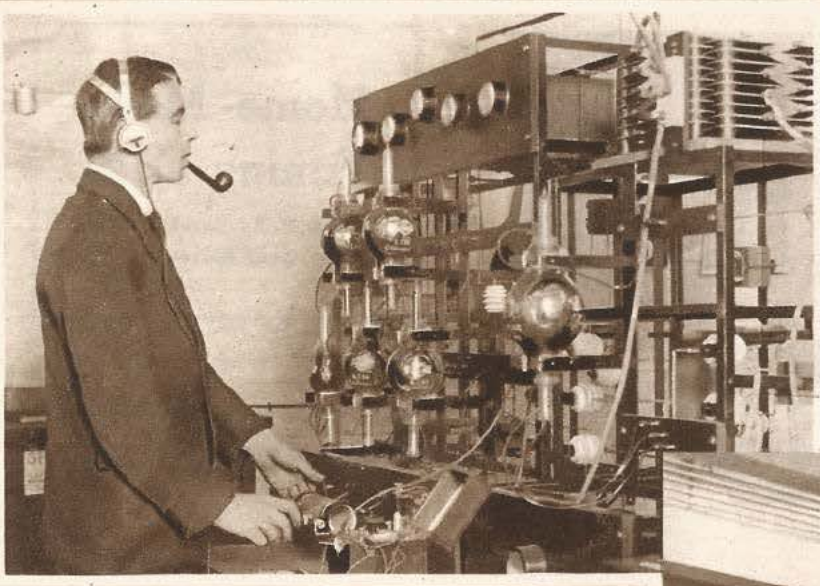


Fig. 7.—Practical wiring diagram. Blueprint 68b.

Our photograph shows Mr. G. P. Fox, the Director of the Leeds Relay Station, reading the news bulletin. Note the microphone on the right, resting in its crepe rubber cradle.

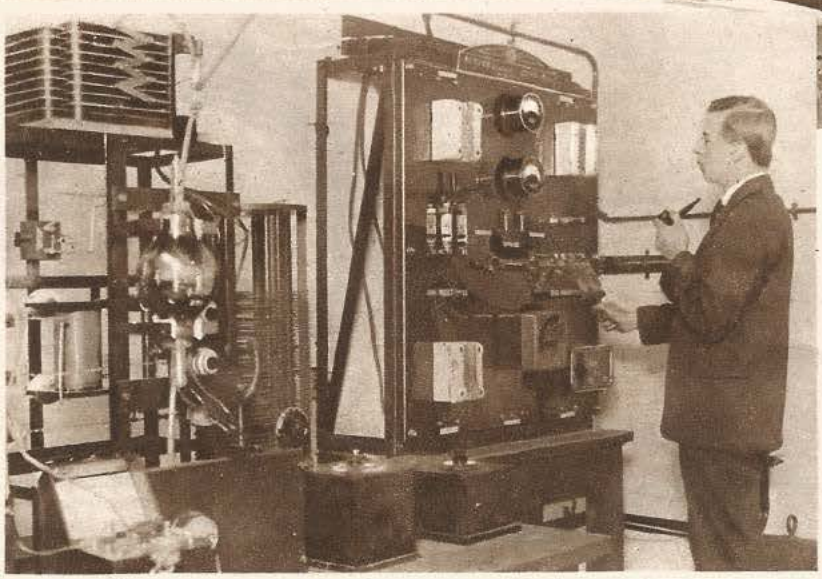
The Children's Hour at the Hull Relay Station in which Uncle Jerry (left), Auntie Ida, and Uncle Leslie are participating. This Station is becoming increasingly popular with the local children.

Mr. Harvey, the Engineer-in-Charge of the Leeds Relay Station, is here seen standing before some of the apparatus in the control room.



Mr. P. H. Cook, Assistant Engineer at the Hull Relay Station, adjusting the transmitter. This photograph gives a good idea of the size of valves used.

An American amateur building his neutrodyne receiver. This photograph clearly shows how the coils are staggered in relation to each other. Balancing the condenser values is a difficult matter in this design.



Another view of the Hull Relay Station showing Mr. Cook at the switchboard.

Home-Made Tuning Coils

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

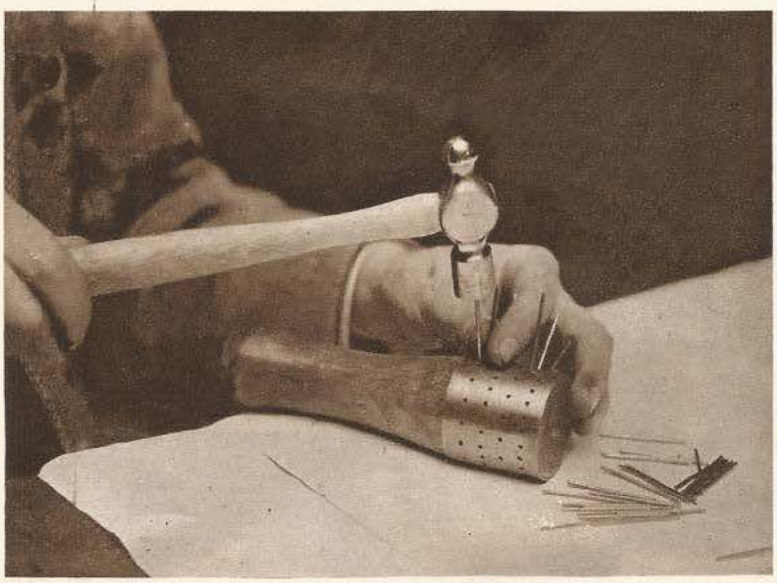
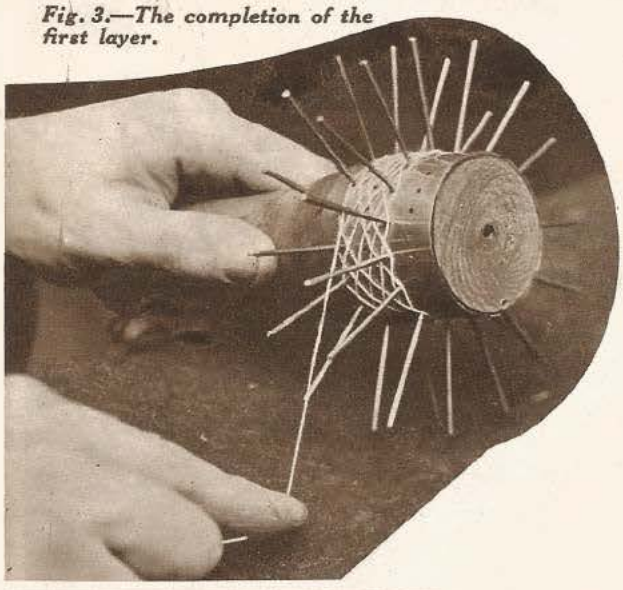


Fig. 1.—Preparing the former for use. The one illustrated is a commercial product known as the "E.C."

Fig. 3.—The completion of the first layer.



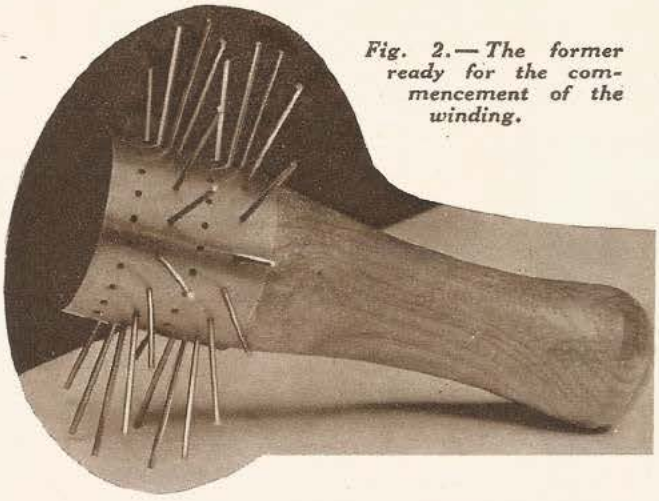


Fig. 2.—The former ready for the commencement of the winding.

Fig. 4.—Soldering the ends of the winding to the pin and socket of the plug.

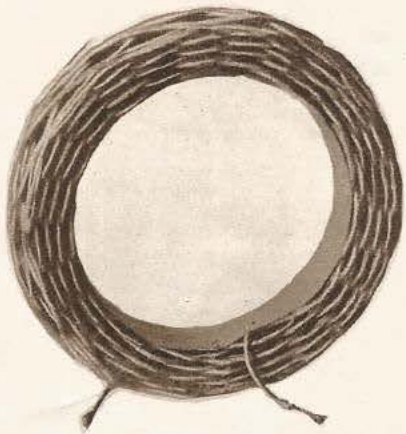


Fig. 5.—When the coil is complete it is impregnated with paraffin wax and taken off the former.

Home-made coils possess many virtues, and provide a most interesting line of research for the keen experimenter.

This series of illustrations gives a complete guide to the winding of a honeycomb coil.

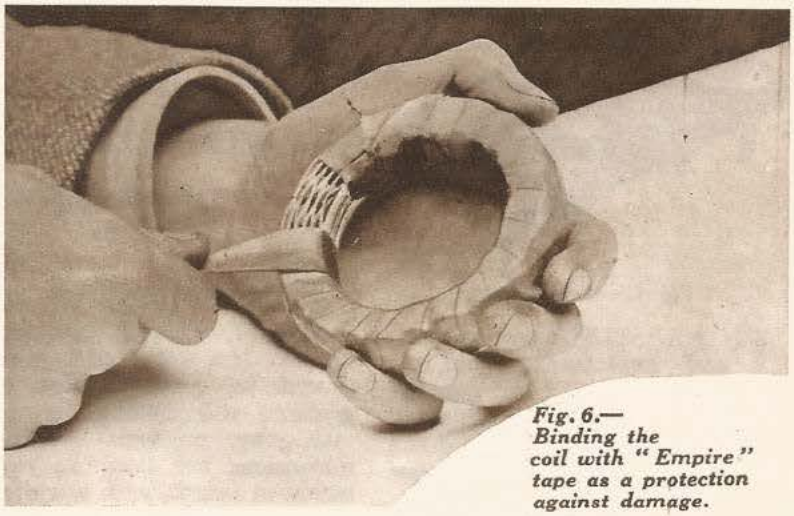
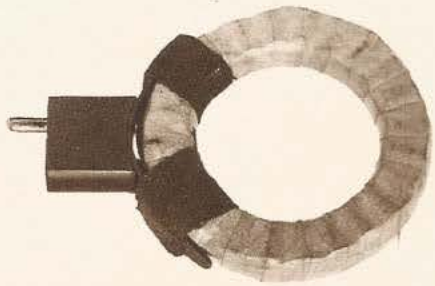


Fig. 6.—Binding the coil with "Empire" tape as a protection against damage.

Fig. 7.—The end of the tape is secured with Chatterton's compound.

Fig. 8.—The coil may be attached to the plug by means of a band and two screws.



Figs. 9 and 10.—This is a good method of attachment (covered by Burndept patents) employing a binding of adhesive tape and a segment of fibre.

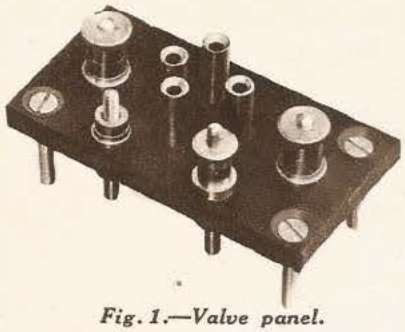


Fig. 1.—Valve panel.

A Useful Layout Board

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

INTERESTING new circuits and improvements on, or modifications of, old ones are always being published which all wireless enthusiasts keenly desire to try out. The difficulty is that

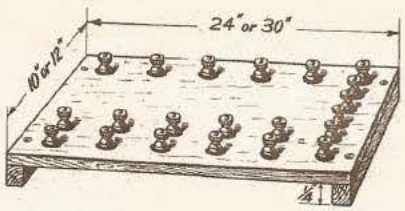


Fig. 2.—How the board is made up.

even if we have all the components required such as transformers, condensers, resistances, gridleaks, inductances, and the like, these things have to be mounted in some sort of way, and this takes time.

The layout board to be described in this article meets all the requirements of the experimenter. Both the board itself, and its fittings, are easy and cheap to construct, and once they have been made up one has at hand an outfit which is invaluable for experimental work of all kinds.

The board itself is merely a plank of ¾-inch wood—plain deal will do quite well, though polished hard wood, of course, looks much better. If a soft wood is used it should be ¾ inch thick, but ½ inch will suffice for oak, mahogany, or teak. Suitable dimensions are from 24 to 30 inches in length, with a width of 10 or 12 inches. A 24-inch board will enable practically any combination containing up to four valves to be wired up without crowding, whilst a 30-inch board gives ample room for five or six valves. Fig. 2 shows the way in which the board is made up. It

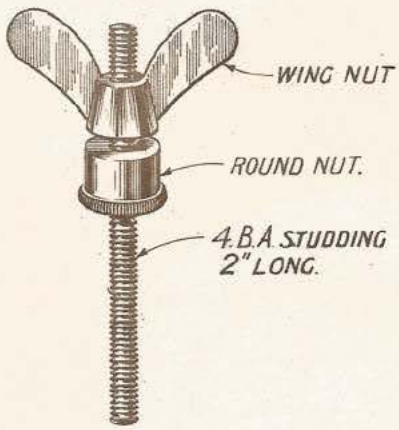


Fig. 4.—How terminals can be improvised.

is simply raised upon battens at either end, 1¼ inches deep, so that

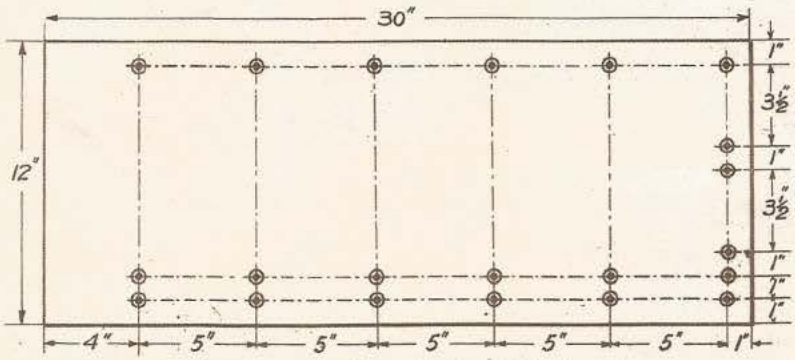


Fig. 3.—Drilling details of the board.

Fig. 5.—A gridleak unit.

there is plenty of clearance between its underside and the table upon which it stands.

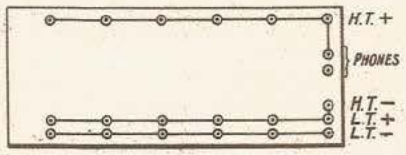


Fig. 6.—Wiring of terminals.

All holes shown are made with a ½-inch bit, preferably of the auger type. Each hole is provided with a pair of 4B.A. panel bushes in which a terminal of medium size is mounted.

Some difficulty may be experienced in obtaining ready-made terminals with shanks sufficiently long to enable them to be used in ¾-inch wood. The minimum length of shank required in this case is 1¼ inches. Terminals can,

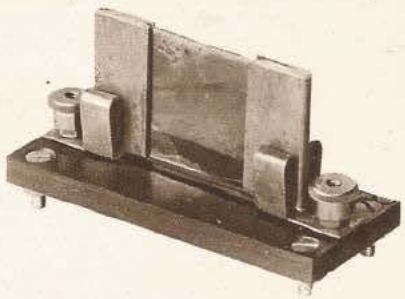


Fig. 7.—Clip-in condenser unit.

however, be made very easily and cheaply in the workshop from 2-inch lengths of 4B.A. studding, and milled-edged, or wing, nuts which are obtainable from any good tool shop. A simple home-made terminal is shown in Fig. 4. The round nut should be run on to the studding until its top is about ⅜ inch below the end of the rod. The nut should then be fixed firmly in position as shown by "prick-punching" with a fine-pointed centre punch.

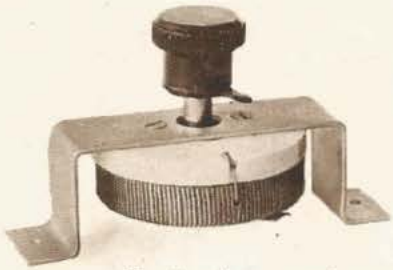


Fig. 8.—A mounted filament resistance.

Milled headed nuts may, of course, be used instead of the wing pattern for the top portions of the

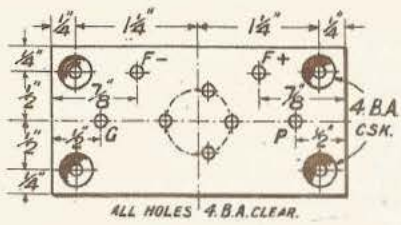


Fig. 9.—Drilling details of valve panel.

terminals, but I think personally, that wing nuts are to be preferred on a board designed for quick layouts, since they enable one to make sound-tight connections very quickly, and to undo wires in a moment. Fig. 6 shows the way in which the board is wired.

We now come to the various components and the mountings which are made up for them. The photograph shows a very useful type of valve holder which occupies little space and is not liable to be upset. It is made

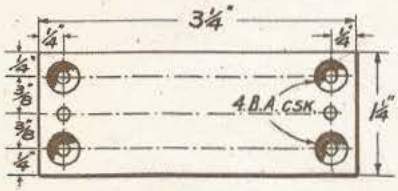


Fig. 10.—Base for anode resistances, etc.

from a piece of ¼-inch ebonite, 3 inches long and 1½ inches wide, laid out and drilled in the way shown in Fig. 9. All holes are 4B.A. and may be made tapped or clearance, according as the constructor prefers to screw in his terminals or valve legs or to fix them with nuts. The countersunk holes at the corners are for 1-inch 4B.A. screws, which serve

This article fills the requirements of the experimenter in a unique fashion, greatly simplifying the trial of new circuits.

as legs for the holder, raising it above the board upon which it stands and insulating the shanks of valve legs and of terminals.

Succeeding photographs show variable gridleaks and anode resistances ready for use on the circuit board. The various makes of these components differ slightly in design and in dimensions, but the same type of mounting will do for the majority of them. To make such a mounting we require a piece of ¼-inch ebonite 3½ inches in length and 1½ inches

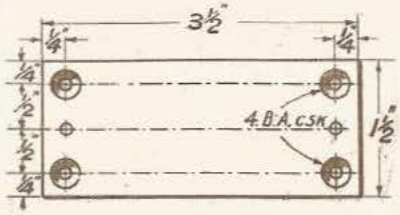


Fig. 11.—Base for clip condenser stands.

wide, the drilling layout of which is given in Fig. 10.

Clips which will suffice for practically every type of variable gridleak or anode resistance are shown in Fig. 14. These are made from sheet brass or German silver. Nearly every kind of anode resistance or gridleak of

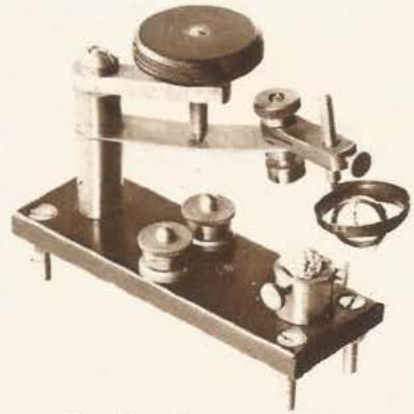


Fig. 13.—The crystal-detector stand.

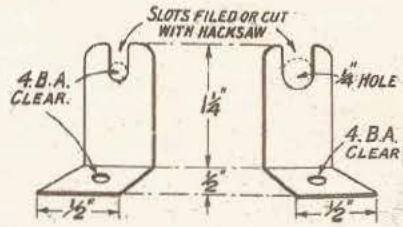


Fig. 14.—Resistance clips.

the variable pattern has one contact consisting of a 4B.A. screw inserted into the cap at its lower end, and the other is usually made with the bush through which the threaded plunger, actuated by the knob, passes. We can, therefore, make one of our clips with a 4B.A. clearance hole for the end contact screw, but in the other it is best to make a ¼-inch hole to be on the safe side. In some of these components the bush is made from 2B.A. material, but in others, it is 0B.A., or even a little larger. A slot should be filed from the top of each clip into the holes made as shown in Fig. 14, so that the resistance may be slipped into

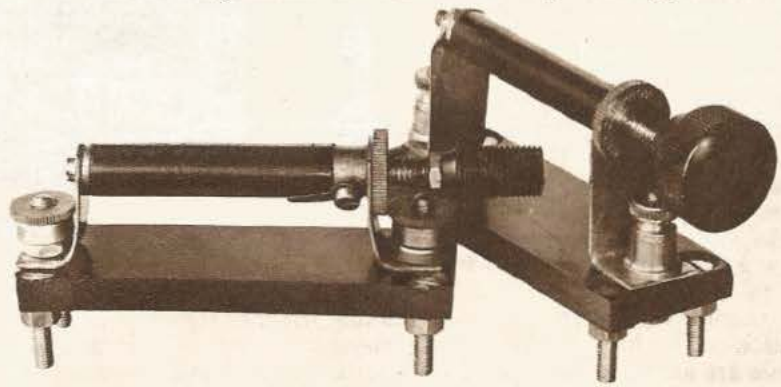


Fig. 12.—Mounted resistance units.

place by merely loosening the 4B.A. screw, and the collar which acts as a "one-hole" fixing. As these components vary a little in length it might be as well also

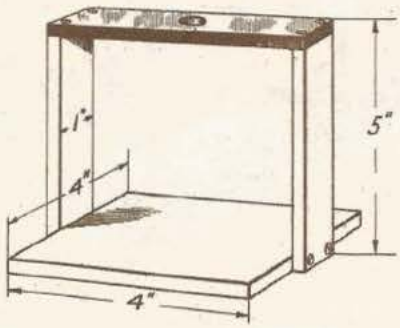


Fig. 15.—Stand for "one-hole" fixing components.

to file slots running into the 4B.A. clearance holes through which the terminals are passed. When this is done the distance between the clips can be adjusted to suit any particular leak or resistance without difficulty.

For fixed gridleaks and anode resistances a simple mounting is that shown in Fig. 5 photograph. Here, again, the holes in the clips through which the terminals pass may have slots cut into them so that the distance between the clips may be adjusted and components of various lengths securely held. The dimensions of the ebonite required for making mountings for fixed leaks and resistances are exactly the same as those given in Fig. 10, but there is no need to make the clips so high; from $\frac{5}{8}$ inch to $\frac{3}{4}$ inch will be found sufficient for them.

Undoubtedly the best kind of fixed condenser to use with the layout board is the type with a mica dielectric made with metal ends which fit into clips.

The great advantage of using them is that once a suitable mounting has been made up condensers of any capacity between ·0001 μF and ·01 μF can be inserted into the clips upon it in a moment. To change the capacity of any condenser in circuit, therefore, no connections or disconnections need be made. To make a stand for condensers

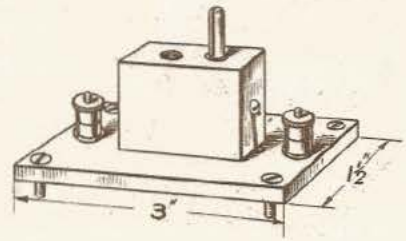


Fig. 16.—Anode or choke coil stand.

of this kind we require a piece of ebonite 3½ inches in length by 1½ inches wide. The drilling layout is shown in Fig. 11. It will not be necessary to make clips since these can be purchased so cheaply from makers of clip-in condensers.

(To be concluded)

A Useful Three-Valve Receiver

(Concluded from page 25)

resistances to the off position. The valves may now be inserted and the resistances just turned on to see if the filaments light correctly. If all is well, the H.T. battery may be joined up.

For an initial test, it may be found simpler to join the terminals H.T.+1 and H.T.+2 together, connecting them by a piece of wire to the high-tension battery. Also, when first using the receiver, the terminals G.B.—1 and G.B.—2 may be shorted to L.T.—G.B.+.

Commence testing on the local broadcasting station, using constant aerial tuning. Connect the aerial lead to A, join C to E and to earth. Insert a No. 50 coil in the socket L1, if the wave-length of the station to be received is below 420 metres, above which a No. 75 may be tried. A No. 75 coil should be inserted in the reaction-coil socket L2. The telephones are joined to the terminals indicated.

Turn on the filaments now, keeping L2 well away from L1, and vary the condenser C1 slowly. When signals are heard, bring L2 closer to L1, and retune on C1, noting whether signals increase in strength. If not, reverse the leads to the reaction coil by changing over the rubber-covered leads to the terminals X and Y.

When a little practice has been obtained in operating the receiver the effect may be tried of varying the voltage applied to the high-tension positive terminals. Take separate leads from each of these positive terminals to different tapping points on the battery. Also, about 3 and 6 volts negative may be applied to the grid bias terminals 1 and 2 respectively, when using fairly high anode voltages. With a little patience, the operator will be able to find the best values of high-tension and grid voltages to apply for the particular types of valve used.

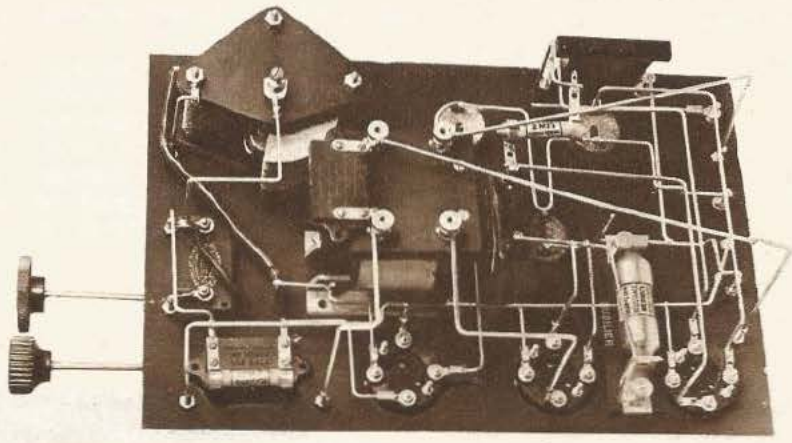
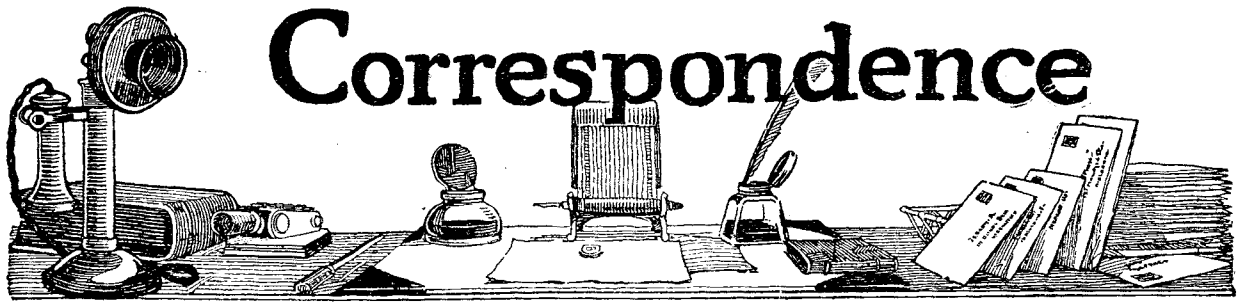


Fig. 8.—A further back-of-panel photograph.



IS THIS A RECORD?

SIR,—As you will remember, I sent you some of my results a short time ago which you published in No. 19, *Wireless Weekly*, but this time I should like to go further by asking you if I can claim a record for long-distance *overland* broadcast reception on a small frame aerial using four valves.

To give a description of apparatus and results I should like to point out first of all that my flat is situated on the bottom floor of a five-storey building and my set and frame are in the centre of the flat.

The set which gave the following results has nothing "super" about it, and was made entirely by hand, including the variable condensers. The receiver, 3H.F. and rectifier:—

Coupling between first and second valves tuned anode.

Coupling between second and third valves resistance capacity.

Reaction coil swings inside anode coil.

The frame, which hangs over the set, is tuned by a 0.0005 μF condenser.

The results:—

On September 27 I received the whole programme from 5XX, which continued till 2300 hours G.M.T. and finished up with Big Ben striking the time signal.

On Sunday, September 28, I was late opening up on 1,600 metres, and at 2145 G.M.T. I tuned in 5XX and heard a vocal chorus which finished after ten minutes.

2200 G.M.T.—A series of piping dots.

2205 G.M.T.—Weather report.

2210 G.M.T.—Latest news items, some of which I remember as being about Lloyd George speaking at Portsmouth. The American world fliers, etc. A fire breaking out in ? Hospital whilst three operations were taking place, etc., etc.

2215-2219 G.M.T.—Silence.

2220 G.M.T.—Hullo! 5XX calling, followed by next week's programme.

2225 G.M.T.—Good-night everybody.

All this came through very distinctly on the 'phones, and after reading all the reports in *Wireless*

Weekly and *Modern Wireless* on reception of 5XX, I have not yet come across a case of better results than my own.

Receiving across Europe, with its many jamming stations, is, I think, more difficult than Transatlantic reception.

I should be exceedingly pleased to know whether I can claim the record for 5XX under the conditions I explained earlier in my letter.

Congratulating Radio Press on its deserving success and prosperity,—Yours faithfully,

D. T. L.

Constantinople.

P.S.—This may be of special interest to "Mr. Brown."

A SOCIETY'S RECEIVER

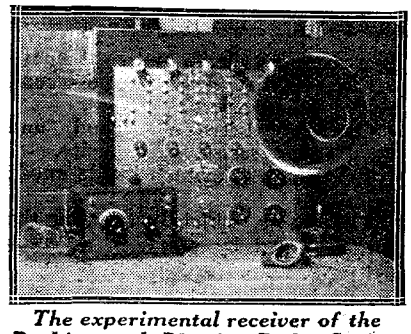
SIR,—Enclosed please find photograph of the under-named Radio Society's experimental receiver, and I trust same is of interest to your readers. My only regret is that photo is rather distorted and a copy of *Modern Wireless* does not appear in same, as I send all my copies to U.S.A.—Yours faithfully,

For the BARKING AND DISTRICT RADIO SOCIETY,
A. M. GIBBS, Hon. Sec.

GRAMOPHONE v. WIRELESS

SIR,—In support of Mr. P. W. Harris I should like to bear testimony to the immeasurably better reproduction of a loud-speaking receiver by wireless over the commercial gramophone, however good.

As one who is conversant with the performances of both, both from private and professional use, I feel that what is wrong is Mr. Brockway's receiver, his loud-speaker, his manipulation, or all three of these factors.



The experimental receiver of the Barking and District Radio Society

It is incontestable that the gramophone is lacking in control when compared with a wireless receiver and L.S. reproducer. Few music lovers would slam on a record, jab in a needle, run the motor in any manner and claim they were operating a gramophone. These three points are the cardinal factors in the gramophone, and when sympathetic attention is paid to the motor (with correct speed adjustment), the sound-box well-chosen, the needle also selected to the type of record, even the first-class machine gives up its control factors. The record (beyond cleanliness) is a thing apart, and is bought as it stands, good or bad, and nothing can be done to alter it (except its volume, which should be controlled by the needle and sound-box and not by a pair of muffling doors). The eternal snags in the records are (1) surface noise owing to friction of needle; (2) *uncontrollable* resonance at certain frequencies, which are recorded in some cases on the actual disc itself. What chance has the operator to get over this? The partial answer to No. 1 is the new scratchless record of to-day. But it is sheer folly to pretend it is noiseless. At the very best and in brand new condition there is an unmistakable hiss. The second problem still remains intact.

In the case of wireless reception, there should not be the least sound in an L.S. other than the transmitted item. The worst one has to contend with is atmospherics as extraneous noises, and England does not appear to be pestered with this trouble. If the L.S. produces sounds other than this on local broadcast reception (which are not X's or temporary interference from other stations), the trouble is in the

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FOR SALE.

1 Omni Receiver made on Mr. Scott-Taggart's instructions by a London firm of standing, complete with 3 coil holder and 50 connecting links.
2 pairs Sterling de Luxe Headphones.
1 Peto Pan Loud Speaker.
1 Ever Ready 108 Volt H.T. Battery.
3 Marconi R Valves.
1 B.H.T. R. Valve.
3 Mullard Valves.
2 Cossor Valves.
3 Wecovalves (Dull emitter).

All in good condition.

The whole lot cost £40. £28 in cash accepted. Free delivery upon receipt of remittance. Apply "Woodfield House," Penryn, Cornwall.

INVENTIONS are required. I can sell your wireless inventions. Payment by results. Box A23. Barclays, Bush House, Strand, London, W.C.2.

FOUR-VALVE A.J.S. Wireless Receiver for Sale. Complete set with all accessories, condition good as new, just overhauled by makers. Cost £27, take £15, or £10 without accessories. Box A24 "Wireless Weekly." Barclays, Bush House, Aldwych, W.C.2.

receiver or etc. as before stated. I have stuck to L.S. reception and have got something I can *enjoy*, and there is no reason why everybody sufficiently enthusiastic cannot do the same. The result is (for all practical purposes) perfect reception, distortionless reproduction, absence of extraneous noises, *and the instrument needs no attention to provide a complete evening's entertainment.*

The artistic value of the last is worth much alone. Compare, then, the adjustability of the wireless receiver and its scope is boundless, the control upon volume and tonal value minute, and to him that will specialise in L.S. reproduction the reward is a " perfect " copy.

The question of the record *v.* programme *matter* is dead mutton. There are many records (and by far the majority, too) whose standard of performance is not so good as its prototype in wireless. The gramophone keeps its " past masters " indefinitely, wireless brings forth the topical authority, and the ever-present artist is with us yet. The value from an artistic sense of the Master record is marred by the " snags " already referred to; and who shall say that the programme of yesterday *has* gone for ever?

The sole remaining asset of the gramophone is that it does not work to a scheduled time, and for this reason, if no other, the gramophone will not pass into disuse.

With best wishes and looking forward to your winter programme,
—Yours faithfully,
S.E.5. H. SHEARMAN DYER.

THE SIMPLICITY RECEIVER

SIR,—I have completed building the Simplicity three-valve set as contained in your Radio Press Envelope No. 3.

In view of the extreme satisfaction it gives, I feel that it is only right to acknowledge my thanks to Mr. Kendall for the good circuit, clear photographs and diagrams, and the complete and concise instructions and to yourself for placing them within the reach of all.

I am using the set on an indoor aerial which is as follows: Three strands of copper wire (bare) 12 ft. long and 2 ft. apart across a second floor landing. These wires are joined and brought down two flights of stairs on insulated hooks at a distance of ½ in. from the wall to the ground floor.

The landing across which the aerial is slung has only one outside wall, and we have high buildings adjacent on two sides and over 50 telephone wires on high steel masts on another side.

My earth is 20 ft. of bell wire to the water tap.

You will therefore agree that the set is not by any means working under good conditions.

The results so far are as follows, although I have not had time to do much searching for stations:—

Leeds.—Can be got too loud to be comfortable.

Hull.—Ditto.

Manchester.—Very loud.

Newcastle.—Loud.

Sheffield.—Ditto.

Bournemouth. — Comfortable phone strength usually.

London.—Ditto, but fades badly.

Chelmsford.—Comfortable phone strength.

Petit Parisien.—Good strength.

Madrid.—Music clear, speech readable.

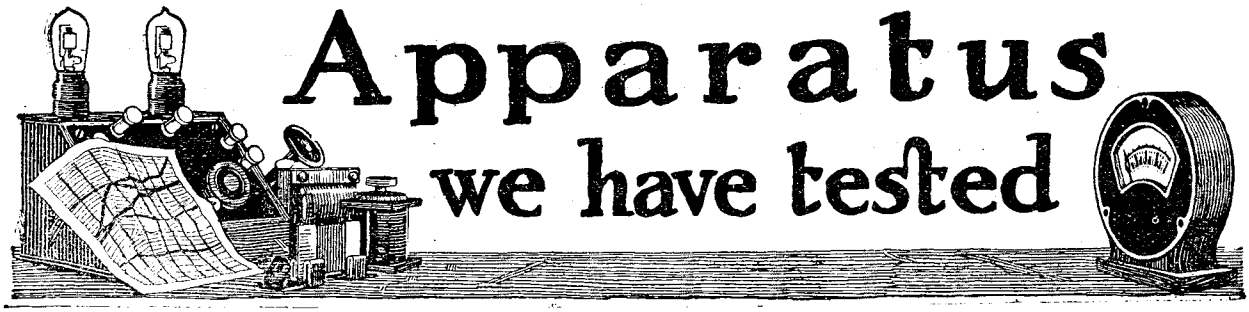
Aberdeen and Edinburgh have been picked up and are quite good at times, speech being clearly readable.

I am sure more stations will be got when I have time to search for them. At present I hardly know where to put the condenser and what coils to use for a given wavelength.

I may say that this set is my first venture in wireless.

My wireless friends, two of whom are in the trade, testify to the excellence of the set, and quite agree that the results are beyond any three-valve set they have tested.

The valves used are Marconi D.E.3 for H.F. and L.F. Ediswan .06 for rectifier.—Yours faithfully,
Selby, Yorks. ERNEST PIERCY.

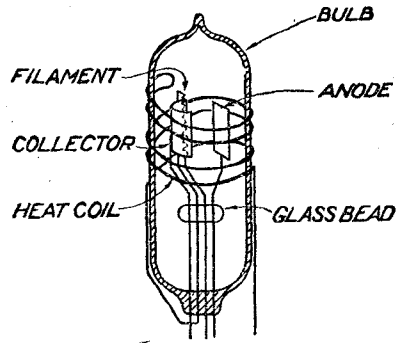


Conducted by A. D. COWPER, M.Sc., Staff Editor.

"Sodion" Valves

Messrs. R. A. Rothermel, Ltd., have recently submitted a sample of the "Sodion" valve and holder, a report on an earlier sample of which (kindly sent us by a correspondent) was published in these columns some time ago.

This is quite a unique type of valve, in which sodium metal plays a part, the usual grid being replaced by a trough-like element placed behind the filament on the side remote from the anode plate, and called a "collector." There is also a small external heating-coil in series with the filament, wound on the tiny bulb, which is enclosed in an obscured-glass outer jacket. The makers state that it sometimes takes half a minute for the "tube" and batteries to settle down when first switching on. As indicated in the earlier report, the valve is for use as a detector only,



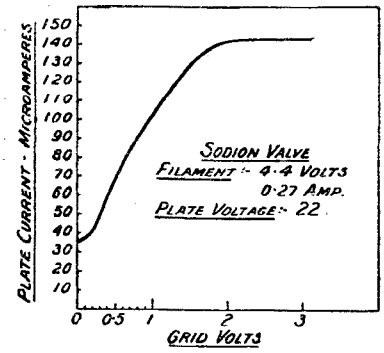
no normal amplification or reaction-phenomena being available with this type. The principal claim for it seems to be that of exceedingly good detection, without risk of interference.

The rating given is 3.8 volts and .24 ampere, four dry cells, or a 6-volt accumulator with a high-value filament-resistance being indicated. The dry cells would evidently require to be of the monster variety, if long continuous operation in daily broadcast reception was in question. With this sample, at the rating given, the results were poor; at 4.2 volts and .25 ampere better results were obtained, the optimum being with 4.4 volts and .27 ampere. The older sample showed on repeating the test the best conditions at 4.2 volts and .31 ampere. The tube gave then a bright yellow light. The makers warn against running the filament so hot that a white light is given. The plate voltage is given as 16.5

to 22.5 volts; tests were made at 22 volts.

Since detection only is indicated, the characteristic was determined only for 4.4 and 22 volts respectively; and as the instructions with the valve require a small positive grid-bias by potentiometer at all times, no grid-leak or condenser being used, there was no point in determining the negative portion of the characteristic.

The plate-current was very small—0.14 milliampere maximum. The characteristic showed an extremely sharp bend upwards just above zero grid volts, and then a gently sloping portion up to a little below 2 volts plus. By adjusting by means of the potentiometer (arranged across the L.T. battery as usual), so that the mean grid potential falls in the neighbourhood of this sharp bend, it is evident that extremely good rectification should result, the modulation of the plate-current in the phones being of considerably greater amplitude upwards for an *increase* of the grid-potential than downwards for a *decrease*, to the same extent, of the grid-potential. Actually the efficiency of rectification is quantitatively greater than with a good galena crystal; in actual test, in reception of 2LO at 35 miles away on quite a moderate aerial, by careful setting of the potentiometer (best just below .6 volt plus) the signals were just comfortably audible in the phones, whereas with the same tuning device—one of low resistance and high efficiency—it was a decided strain to hear the words in ordinary speech and in daylight with a sensitive galena crystal. A series-condenser of .0002 μF and corresponding increase in tuning inductance gave slightly better signals, unlike ordinary crystal



reception; but the tuning was noticeably flat, and of course the reception in no way compared with what was readily obtainable with an ordinary valve with the same order of filament-watts consumption, and making use of the invaluable aid to efficient and selective reception, properly controlled reaction.

As a substitute for the somewhat fickle crystal in certain circuits, where reaction in the detector is not desired, this "Sodion" valve has some possibilities.

It was found an easy matter, by mounting it on a slip of insulating material 2½ in. by 1⅝ in., to transform the American type of valve-socket supplied into a four-pin plug-in adapter for use on ordinary panels.

A Fine-Adjustment "Vernier" Condenser

A tubular type of one-hole-fixing fine-adjustment or so-called "vernier" condenser has been submitted by Eric J. Lever. The outer of the two concentric brass cylinders which make up the condenser is about ⅝-in. diameter, the overall length below the panel when fully extended being 3 ins. A 3-16 in. diameter hole is required for fixing the instrument to the panel. Two small terminals, which will come very close behind the panel, provide electrical connections to the two cylinders, and the position of the inner one is controlled by a sliding spindle and small knob. The clearance between the cylinders is extremely small, but on trial there were no signs of accidental short-circuits due to this feature, and the condenser was silent and reliable in operation. The controlling spindle slid quite

stiffly in its bearing, fine adjustments being best made by a combination of rotational and progressive motions. Extremely fine tuning was obtained when this condenser was placed in parallel to the usual A.T.C. in a sensitive receiver. The specimen submitted showed .00011 μF maximum and .000018 μF minimum. We should like to have seen a somewhat lower minimum, as one of some 20 micro-microfarads is too high for certain capacity-reaction and neutrodyning applications for which such a small variable condenser should be useful.

Audio-Choke and Transformer Coils

We have received from Messrs. Leslie Dixon & Co. samples of a type of audio-choke and L.F. transformer coil made to Government specification, of which they hold, we understand, a large stock, and which are available at an extremely moderate price. These are mounted in a substantial wooden box, with a heavy ebonite panel on one side fitted with four large terminals, marked primary and secondary, I and II.

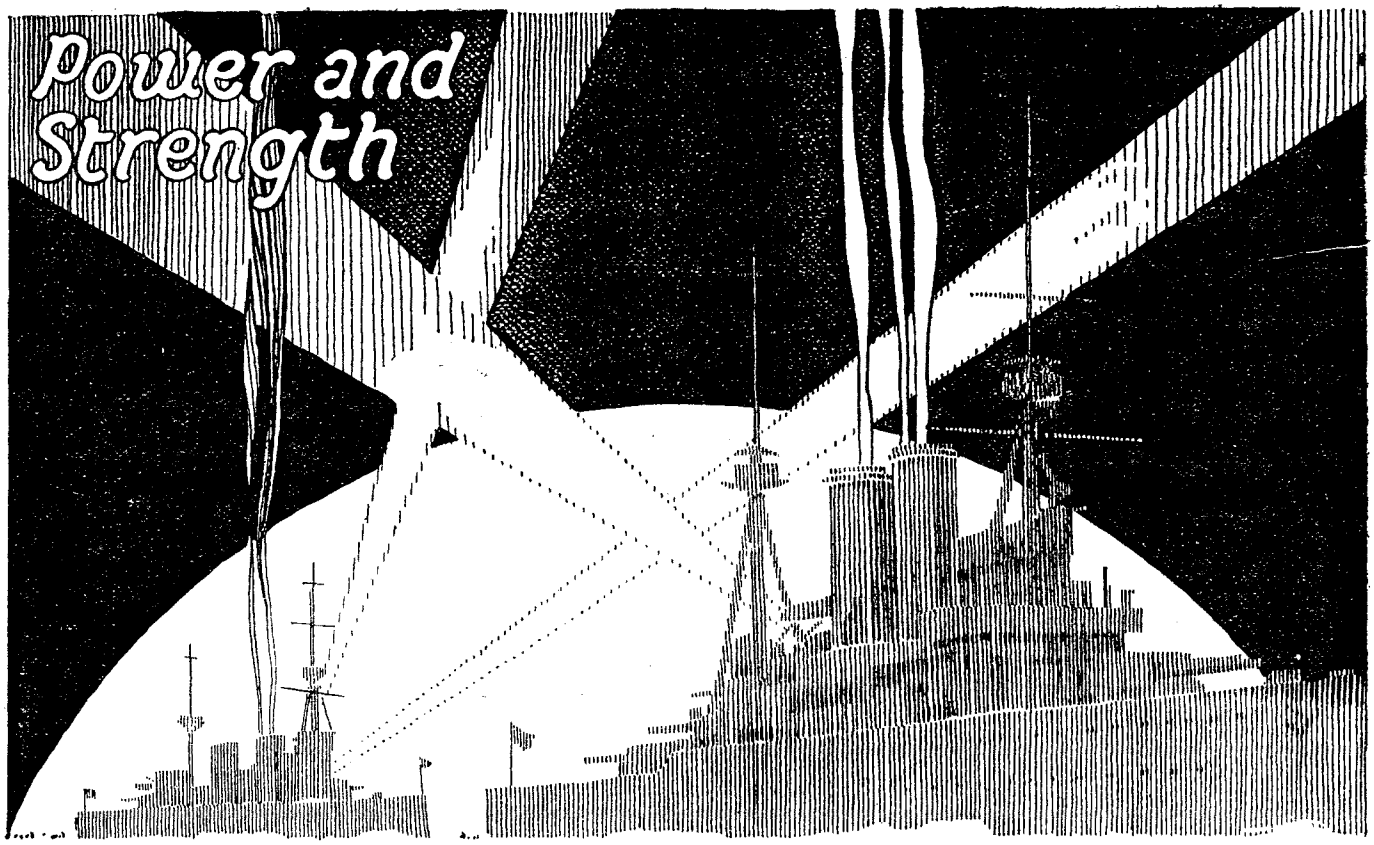
Tested in actual reception as an inter-valve L.F. transformer with the primary and secondary coil connected up in the usual manner, it was observed that the primary impedance was too low for good distortionless amplification following an R valve of high impedance; but that when used as a second-stage transformer with small power valves (in power amplification) the build up of signals in this second stage was quite satisfactory and the tone was good.

With the primary and secondary windings put in series, the whole coil was tried in a choke-capacity coupling for L.F. amplification. In this rôle, with but moderate H.T. but with the gridleak connection arranged so as to give a suitable grid-bias to the following valve, excellent amplification resulted with noticeable freedom from distortion, comparing in this matter favourably with other audio-choke coils of good design. Evidently there will be many uses for an effective audio-choke of this type; and we can safely recommend the experimenter to take advantage of the opportunity of obtaining at a very modest outlay an efficient piece of apparatus which was designed and made for serious service, and which will have manifold applications in radio experimental work; *e.g.*, for choke-capacity filter-circuits to protect the windings of the headphones or loud-speaker from heavy plate-currents, and similar purposes, this unit will be found most convenient.

"Oojah" Graphite Pile Rheostat.

A filament resistance of the carbon-compression type, but which is claimed by the makers, Messrs. Oojah, not to be a powder resistance, and to be free from packing, is the "Oojah" Graphite Pile Rheostat, a sample of which we have put to extended tests. This is an attractively-finished fitting, with a neat one-hole-fixing device of unusually good design, and provided with a large, clearly-engraved controlling-knob. It is about 1⅝ in. long beneath the panel, and 1 in. clear diameter. Small soldering-tags are provided for electrical connections.

The nominal range is from .15 to 35 ohms: the specimen submitted went from a very low value to 50 ohms in a smooth and regular manner, and with about three complete turns of the spindle. Used for controlling both dull- and bright-emitter valves, it gave exceedingly good, smooth, noiseless control, and showed no signs of undue heating; whilst the usual "creep" of the resistance value in actual operation appeared to be minimised in this resistance. There were no signs of packing during these tests.



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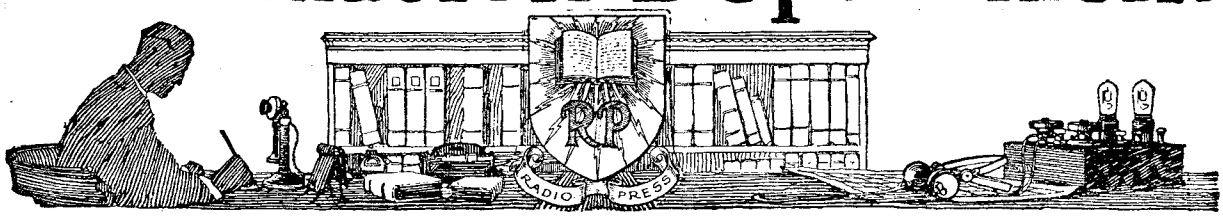


SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

N.G. [WEST HARTLEPOOL] is using Circuit ST45 from "Practical Wireless Valve Circuits," Radio Press, Limited, and submits particulars of a certain condenser in his possession with which he wishes to receive various wavelengths. He asks the necessary sizes of coils to use to cover a range of 1,200—1,800 metres.

Your aerial tuning condenser is of approximately 0.0006 μF, and with this in parallel with your inductance, you will require coils having 100, 250, and 200 turns respectively to cover the range you mention.

E. G. F. [ILFORD] has made a dual amplification circuit which gives very satisfactory results, but experiences trouble when using a number of pairs of telephones in series.

Your circuit diagram is quite correct as shown, and should give good results. The slight hissing sound you mention is quite in order and should be present. We do not see any reason for distortion effects being produced when a large number of telephones are connected in series, but you should shunt the telephone terminals with a condenser having a capacity not less than 0.002 μF. If the trouble is very persistent, you might raise this capacity to 0.005 μF, and try the 'phones in parallel.

J. S. [WIDNES] has a three-valve dual receiver in which he reports that the detector valve is constantly burning out, and asks for help.

Since the valve usually lasts some days, but always burns with abnormal brightness, we think the trouble is almost certainly in the filament resistance, between whose terminals there is a short circuit. This is confirmed by the fact that adjustment of this rheostat makes no difference to the brilliance of the valve.

J. T. (RAYNES PARK) is using a small c.w. transmitter on 200 metres, and finds considerable difficulty in making the set oscillate with reasonable steadiness and stability. It has a tendency to the erratic stopping of oscillation whenever adjustments are made, with a consequent sudden rise in anode current and consequent damage to his dry battery H.T. supply.

From your description, it seems that you are using a direct-coupled circuit—that is to say, one in which the anode coil is connected directly in the aerial circuit; and, further, that your aerial is of large capacity. This is often an undesirable state of affairs on the shorter waves, since it becomes difficult to maintain self-oscillation with the small amount of inductance available for coupling purposes. Try a loose-coupled circuit or a counterpoise earth.

C.N.T. (BIRMINGHAM) has a variable grid leak which he believes to be faulty, and asks how he may test it.

The grid leak is probably one of the most difficult components in the set to test, and it is often done merely by substitution even by professionals.

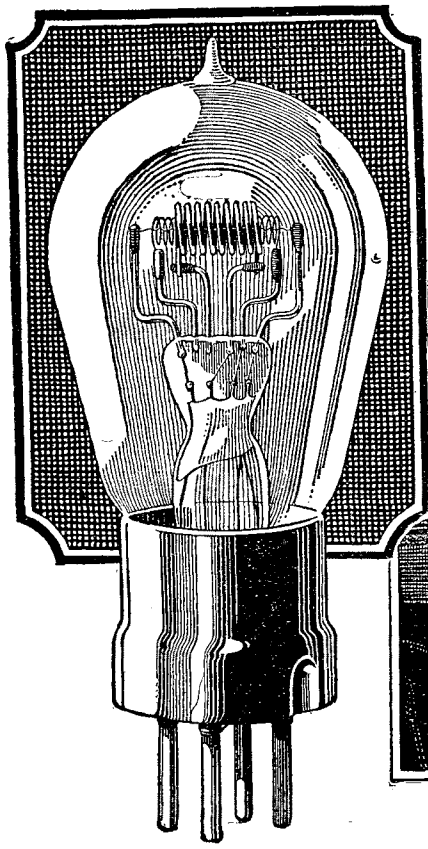
Try removing the leak from circuit altogether, and note whether any crackling sounds are reduced, or whether they persist. Further, note whether any noises are heard when the knob of the leak is rotated.

D.O.R. (SOUTHALL) asks what is a vernier condenser, and what is its use?

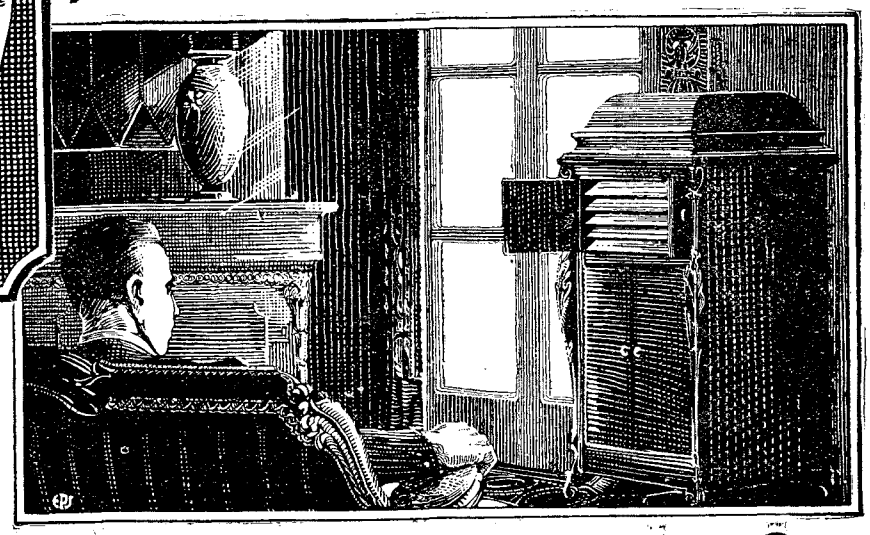
The word Vernier is being very carelessly used nowadays in connection with almost any piece of wireless apparatus which affords a particularly exact adjustment. A better name altogether would be "fine tuning" condenser. Such a condenser is simply a small variable condenser, comprising only three or at the most five plates, so that a considerable movement of the controlling knob and dial gives only a small change in capacity. By connecting a condenser of this description in parallel with a large variable condenser, the preliminary adjustments are made upon the large condenser, and then the fine tuning condenser is called into action to effect the final accurate adjustment.

F. W. P (CLAPHAM) asks what is the cause of sudden distortion in amateur telephony sometimes heard after broadcasting hours. He states that an amateur is being received perfectly well, when suddenly most violent distortion of the speech occurs accompanied by whistling.

The type of distortion to which you refer is caused by the interference with the carrier wave of the telephony by another carrier wave of the same frequency, which occurs when a transmitting amateur switches on his transmitter in the middle of the conversation of some other station, with whom he does not know he is interfering.



Louden



Have you noticed it?

10/-

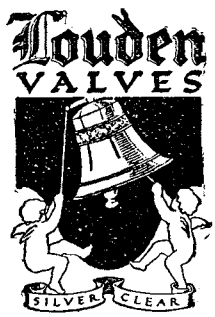
If you listen intently to your gramophone you will become aware of the light scratching of the needle. But although you hardly notice it unless you listen specially it is there all the while.

Once you could hear gramophone music against a background of complete silence you would never be content to return to the obbligato of scratches and hisses which you now cheerfully endure.

It is the same with Wireless Reception; you hardly notice the continuous breathing sound going on in your loud speaker, but—unless your set is fitted with Louden Valves—it is there, and it is preventing you from getting the best possible results from your set.

The Louden Valve has been designed specially with the object of eliminating all those "mush" or breathing sounds so prevalent with valves of the ordinary type. If you would care to know how this is achieved your dealer will supply you with a folder giving full information.

But we feel that you are concerned with *results* rather than with *reasons*, so our advice is that you should not consider your present reception perfect, but fit Silver Clear Louden Valves and see how much better it can be.



The Plain Louden for Detecting and Low Frequency Amplifying.

Filament Volts ... 4.8-5
Filament Amps. ... 0.4
Anode Volts ... 40-80

FELLOWS WIRELESS

The Blue Louden for H.F. Amplification.

All Loudens are silver clear and free from mush. The current consumption is low and the life long.

Louden Valves - Silver Clear

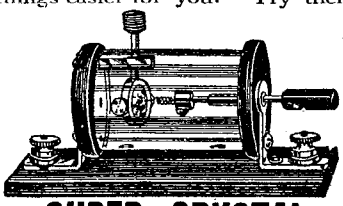
ADVT. OF THE FELLOWS MAGNETO CO., LTD., PARK ROYAL, LONDON, N.W.10.

E.P.S.4.

GAMAGES

NEW ACCESSORIES

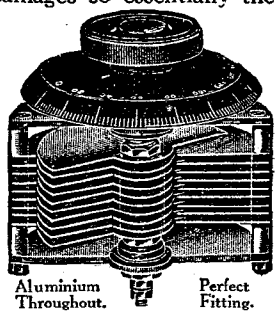
It is offers like these that make Gamages so essentially the Store for the Wireless Enthusiast. New, improved Apparatus—for the most part exclusive to Gamages—all certain to improve results or make things easier for you. Try them.



SUPER CRYSTAL DETECTOR.

The striking points about this new detector (first of its kind) are the *revolving crystal*, the Silver Cat's Whisker, all brass parts lacquered. New Crystal easily fitted. Complete with Gamages Famous "Permanite Crystal." Price for Panel Mounting .. **4/6** Price for Table Panel Mounting **5/6**

Post 4d. on each type.



Aluminium Throughout. Perfect Fitting.

VARIABLE CONDENSERS

Insulated Bushes. One hole *only* required for fitting. Terminals provided for making connection.

·001 Price **9/-** ·0005 Price **6/-** ·0003 Price **5/6**

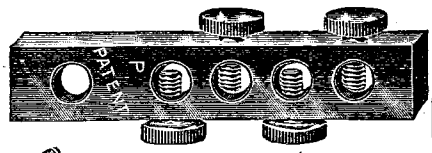
Vernier Price **3/9**

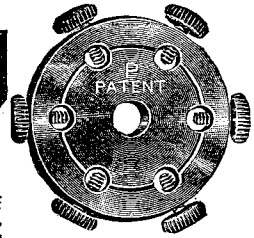
·0005 with Vernier Panel Mounting .. **7/6**

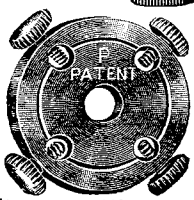
·0003 with Vernier Panel Mounting .. **7/-**

Post 4d. each extra.

"MULTIPHONE" CONNECTORS & TERMINALS





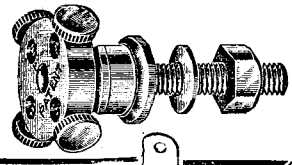


THE "MULTIPHONE" CONNECTORS.

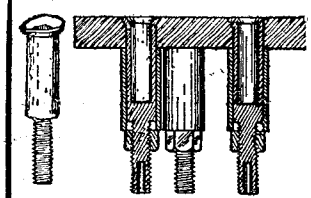
For using several pairs of headphones on your set, 4-way Round Type, as illustrated on left, and 4-way long type as above. Each **9D.** Post 2d.

"MULTIPHONE" CONNECTORS 6-way round type as above **1/-** Post 2d.

"MULTIPHONE" TERMINALS. As illustrated on right. A well-made and splendidly finished part, complete with nut and washer. 4-way only. Price, Post 2d. .. .. each **1/-**

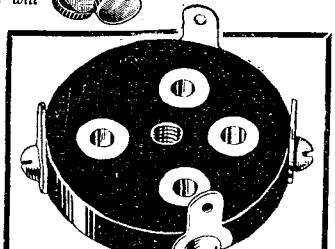


Send for yours right away — the value will amaze you.



VALVE HOLDERS.

Latest type for Flush Mounting. Reduced height makes for compactness, reduced capacity and reduced solid dielectric for efficiency. Soldering Hole for reliable and neat connection. Flush for protection of Valve. Brass Finish. Easy to mount. Price per set of 4. Post Free. .. **1/-**



THE 'GAMAGE' UNDER PANEL VALVE SOCKET

STRIKING POINTS:—Anticapacity; Positive Contact with Valve Leg; Neat appearance; Protection from burning out valves by incorrect fitting; Low Price. In the usual high standard of quality. Price .. .. **10D.** Post 2d.

GAMAGES, Holborn, LONDON, E.C.1

REPAIRS TO HEADPHONES TO LOUD SPEAKERS TO COILS

REWOUND to any RESISTANCE & MADE EQUAL to NEW. PRICE QUOTED ON RECEIPT OF INSTRUMENTS.

PROMPT DELIVERY.

Established 26 Years.

The VARLEY MAGNET COMPANY

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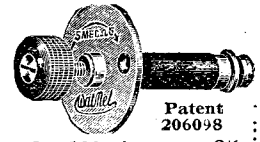
CONTRIBUTORY CAUSES

The consistent tendency of Receiving Sets to reproduce extraneous noises is, more often than otherwise, put down to that endless source of hiss, noise and bubbles—the H.T. Battery. Yet experiments show that condensers of very large capacity apparently fail to smooth out the current. It may be taken that the trouble lies elsewhere. Substitute a *Watmel Variable Grid Leak* and note the difference.

The detector valve working on an incorrect portion of the curve is found to be one contributory cause of mysterious noises, principally due to unsatisfactory choice of resistance material in the grid leak. In the ***Watmel,*** resistance is gained by a material which extended experiments has proved to be noiseless in operation. If your Set is noisy —remember the detector valve and fit a



Patent 206098

5 to .5 Megohms ... 2/6

50,000 to 100,000 Ohms. 3/6

Other Resistances to suit any circuit.

Send P.C. for Descriptive Folder. SEE THE TRADE MARK

ON EVERY GRID LEAK. BEWARE OF IMITATIONS.

Watmel

the only NOISELESS GRID LEAK

IMPORTANT NOTICE

to intending purchasers

The Watmel Wireless Co. wish to notify the trade and public that their Variable Grid Leak Patent Application No. 206098 was contested in the Comptroller's Court, and on Appeal; in both instances the Patent Grant was upheld and costs awarded.

It is the aim of this Company to protect traders', customers', and also its own interests by securing Patent protection for the novelties in its specialities, as it is these novelties, invented by experts and exhaustively tested, which are the Hall Mark of all Watmel Products.

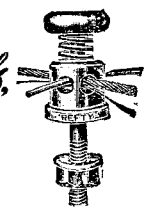
All goods of our manufacture bear this mark. It is your only guarantee. **Watmel**

THE WATMEL WIRELESS CO.

332a, Goswell Road, London, E.C.1.

Telephone - - - - - - - - *CLERKENWELL 7990.*

Terminate Those Terminal Trials, Put in a Reffy And be all Smiles.



Pilot Panel Service

The Pilot Panel Service explained:

WHEN a man decides to build a good Receiving Set he immediately comes up against the difficulty of a suitable cabinet and the drilling and the engraving of the panel. Cabinet-making is a skilled man's job and many a perfectly good piece of ebonite has been spoilt by a hole in the wrong position or because it has been incorrectly cut to size.

To eliminate most of the difficulties in Set-building we have instituted the PILOT Panel Service. In future, ALL Sets described in all the principal Wireless Magazines, will be available in sets of parts for the Home Constructor with panels ready drilled, tapped, and engraved. Two types will be placed on the market—Type A, following the author's literal specification and using his actual components; and Type B, an adaptation using Peto-Scott guaranteed components. Naturally through standardisation of components and our lower manufacturing costs due to large output, Type B will often show a large saving over Type A.

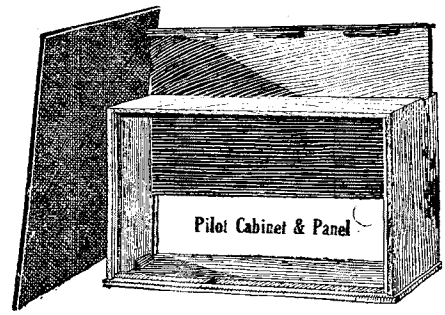
Remember that if our instructions are followed we positively guarantee that all Type B receivers are the equal in every respect to the more Expensive Type A Sets. Our Service Dept. is available for all our customers and will test and rectify errors of construction at a nominal charge. We want all our customers to have the utmost confidence in every Set produced under the PILOT Panel Service.

5 exclusive Pilot advantages:

1. **Absolutely no previous Wireless skill required—the only tools necessary are a screwdriver and a pair of pliers.**
2. **Every Set when completed is quite the equal in efficiency of the original.**
3. **Provides a high-grade instrument at the cost only of the components.**
4. **Success guaranteed—failure quite impossible if instructions are followed.**
5. **Every Instrument designed by a recognised expert.**

Pilot Panels

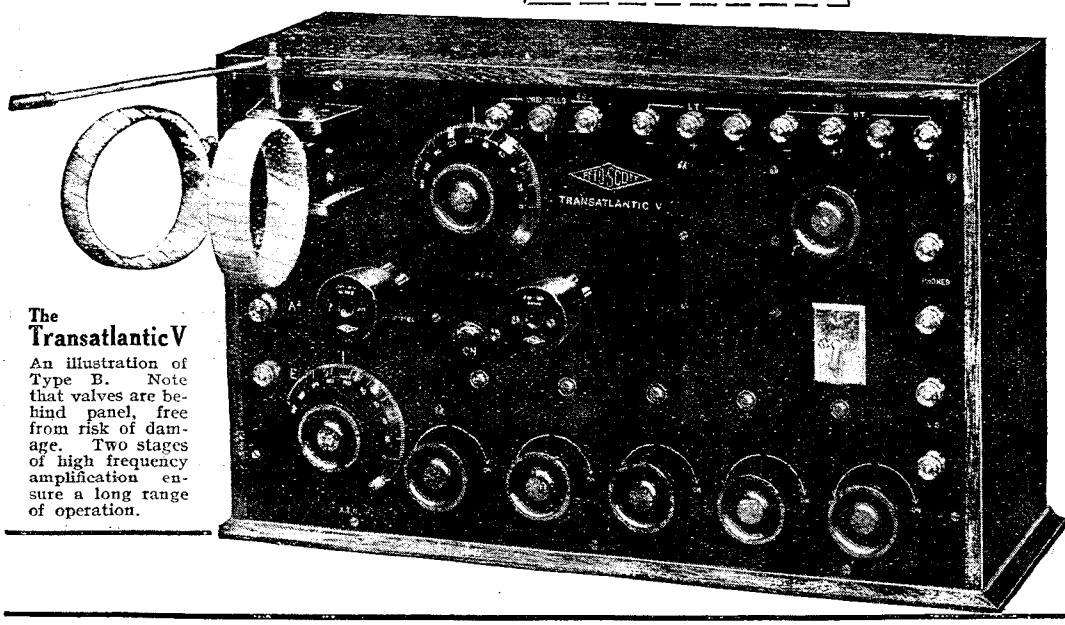
Every Wireless Receiver depends for its efficiency upon the panel. Low grade ebonite will prevent any Set from functioning properly. Every PILOT panel is manufactured from the highest grade Post Office ebonite cast accurately to size, matt finished on both sides, and with edges squarely ground. We guarantee every panel to be leak-proof and non-warping. Each panel engraved with word "PILOT," and supplied carefully packed in sealed wrapper. Standard ¼-in. thickness throughout.



All these splendid Sets now available:

The Transatlantic V (a super 5-valve long distance Receiver).
The S.T. 100 (2-Valve).
The 3-valve Dual Receiver.
The Puriflex (4-valve).
The All-Concert de Luxe (3-valve).
The 4-valve Family Receiver, and others.

All these Receiving Sets have been designed by prominent radio engineers and described in various issues of "Modern Wireless."



The Transatlantic V
An illustration of Type B. Note that valves are behind panel, free from risk of damage. Two stages of high frequency amplification ensure a long range of operation.

Write to-day:

Before building a new Set, be sure you get particulars of the wide range available under the PILOT Scheme. Our literature (free on application) will show you exactly the components you need for any Set and their price. Register your name for a free copy of a large illustrated Folder to be issued immediately.

PETO-SCOTT CO. LTD.
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Branches:
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CARDIFF: 94, Queen Street.
LIVERPOOL: 4, Manchester Street.
PLYMOUTH: Near Derry's Clock.

Gilbert Ad. 1636.

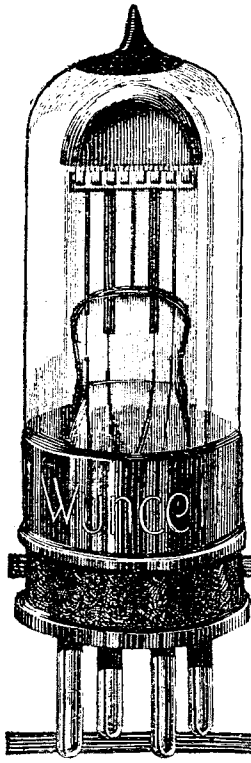
The Spirit of Progress.

THE same spirit of progress which was responsible for the design of the Cossor Valve still dominates the research workers responsible for the new Wuncell—the Cossor Dull Emitter.

The new Wuncell operates at a temperature of only 800 degrees (as against the .06 type of Valve operating at 2,000 degrees) and its filament glow is barely noticeable in daylight. Owing to its extremely low current consumption and robust filament design (in diameter the Wuncell filament is approximately the same as the standard bright Valve) its life should be almost indefinite.

But true progress does not end with Valve design—service counts for something, too. In the new Cossor packing scheme every Valve will be finally packed in its wrapping of cotton wool and *sealed in its carton*. Your dealer will not find it necessary to break the seal to prove to you that the filament is intact.

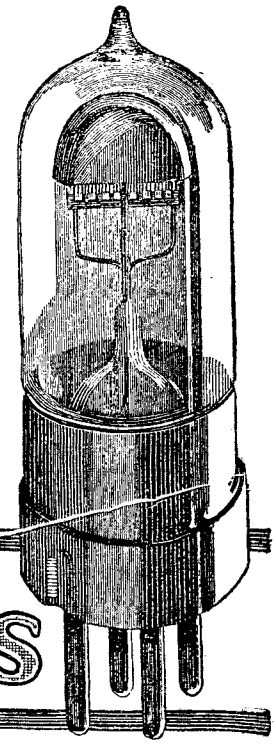
Thus every Cossor user is guaranteed an absolutely new and unused Valve.



Prices of Wuncell Dull Emitters

W.1. (For Detector and L.F. use) **21/-**
W.2. (With red top) for H.F. use **21/-**

Types W.R.1 and W.R.2 as above but with self-contained resistance in base to operate from 2-, 4- or 6-volt accumulator .. **23/6**



Cossor Valves

Advertisement of A. C. Cossor, Ltd., Highbury Grove, N.5.

Gilbert Ad. 1624.

Dampness—the arch-thief of signal strength.

THE wonderful Eureka Concert Grand was not evolved in a day—nor a week—nor a month—nor, for that matter, in a year. It was the direct outcome of much intensive study of the problem of Low Frequency amplification and the possibility of obtaining "power" results without the necessity of using power valves.

From the first, the radio engineers who designed the Eureka worked on original lines. In fact, apart from the fact that the Eureka has a primary winding and a secondary winding it has little in common with ordinary Transformers. Take its superb insulation, for example. In the Faraday House Test Report it is recorded that the tremendous pressure of 2,000 volts was necessary to break down the insulation between windings and between windings and case.

But that is not all. This tremendously high insulation safety factor is permanent. No matter how old your Eureka its insulation will always be perfect *because the Transformer is hermetically sealed up after its last test report.*

Dampness cannot affect it. Many L.F. Transformers absorb moisture and naturally signal strength is considerably reduced. If your Set is not as loud as it was, say, six months ago, it is quite likely that your Transformer is the cause. Discard it and instal a Eureka Concert Grand. You will get greater purity of sound, increased volume, and freedom from trouble. *Remember that the Eureka is the only Transformer that can be suspended in water for fourteen days, and used immediately without any harmful effects.*

PORTABLE UTILITIES CO., LTD.,
Fisher St., London, W.C.1.

Concert Grand ... 30/-
Eureka No. 2 ... 22/6
(For Second Stage.)

EUREKA

Low frequency Transformer

Gilbert Ad. 1639.

READ THESE WELL-KNOWN RADIO PRESS BOOKS

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1	Wireless for All ... ... By *John Scott-Taggart, F.Inst.P., A.M.I.E.E.*	9d.
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3	How to Make Your Own Broadcast Receiver ... ... By *John Scott-Taggart, F.Inst.P., A.M.I.E.E.*	1/6
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5	The Construction of Wireless Receiving Apparatus ... ... By *P. D. Tyers.*	1/6
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18	Tuning Coils and How to Wind Them By *G. P. Kendall, B.Sc.*	1/6

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1	How to Build an S.T.100 Receiver ... By *John Scott-Taggart, F.Inst.P., A.M.I.E.E.*	1/6
2	How to Build a 4-Valve Receiver By *Percy W. Harris.*	2/6
3	How to Build the "Simplicity" 3-Valve Set By *G. P. Kendall, B.Sc.*	2/6
4	How to Build the All-Concert-de-Luxe Receiver By *Percy W. Harris.* ...	2/6

Simplex Wiring Charts.

1	For 2-Valve Set	1/-
2	For 3-Valve Set	1/-
3	For 4-Valve Set	1/-

Radio Press Wireless Panel Transfers ... ... 6d.

The Radio Press Envelopes are the most complete guide to wireless construction ever devised. They contain exact size panel and wiring blue prints, complete working drawings, sheets of instructions regarding construction and working, lists of components, and many photographs on beautiful art paper showing the set and wiring from every possible angle. Every possible detail is explained and you cannot go wrong.

Any of the above publications can be obtained from principal wireless dealers and through any bookseller—or direct (plus 2d. postage) from

RADIO PRESS LTD.

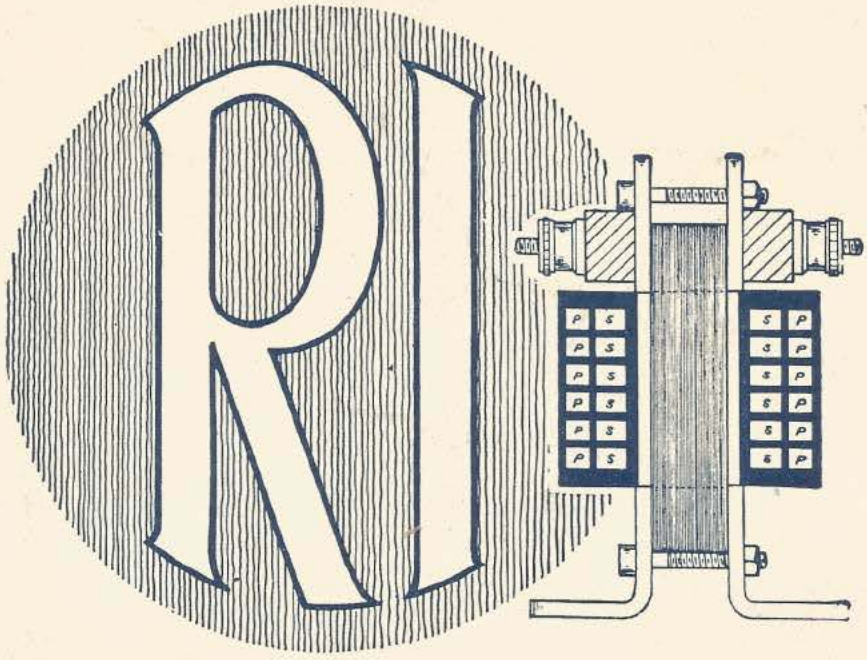
BUSH HOUSE, STRAND, LONDON, W.C.2.

Why take Chances?

SOME have to take chances every hour of their working lives. They require supreme confidence in their own nerve and skill and also in the reliability of the materials they use.

Builders of Radio Press set designs are different. They have supreme confidence, but they take no risks. Sets may be inspected and the Radio Press undertake to report on and put right any set made according to their designs, and to guarantee results.

What more could they do?



The construction that counts

True judgment and appreciation require to be based on more than outward appearance. Time after time the public are persuaded to buy the "just as good" article on the strength of similar outward appearances. The result is disappointment and distrust. Too late we rediscover the knowledge that it's the heart of things that count.

Just look at the internal construction of the New R.I. Transformer. Note the careful symmetry of design and heavy insulation between coils. The primary and secondary are wound in twelve sections, the six sections of the primary being placed on the outside of the secondary sections, giving the lowest self-capacity (18 micro-microfarads) of any transformer in general use.

The further security of one year's guarantee is given with every New R.I. Transformer. Apart from these strong features of real worth the monogram R.I. carries more confidence for you of perfect workmanship in wireless components and sets than any other trade mark.

Price 25/-

Ask your friends, and, then write for the New R.I. Catalogue.

Telephone: Regent 6214-5-6 Telegrams: "Instradio London"

Radio Instruments Ltd.

12 Hyde Street, Oxford Street W.1.

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Wireless Weekly, 6d. Net. Wednesday October 29th, 1924

Wireless Weekly

Vol. 5. No. 2

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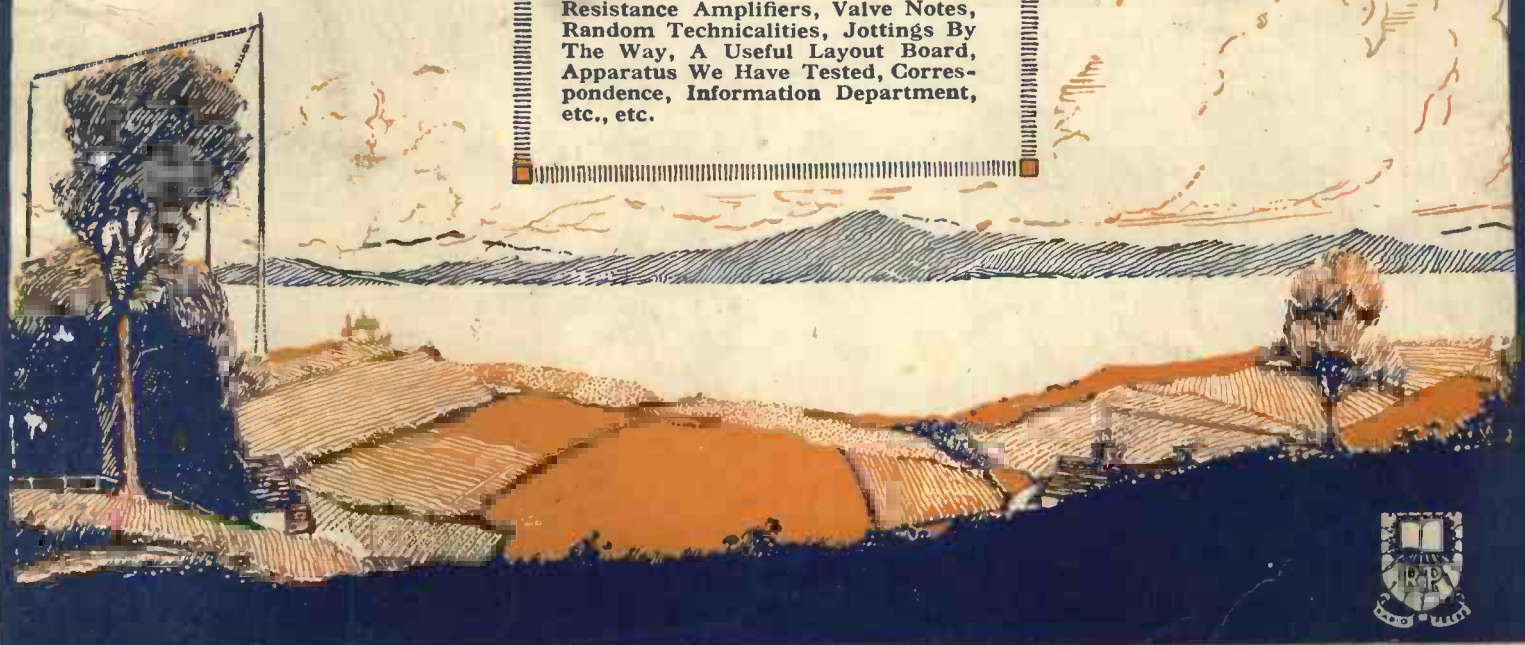


Amateur Works New Zealand—Full Details

Ethophone-Duplex

A two-valve set which will work a loud speaker

FIVE GUINEAS!

THE Ethophone-Duplex is wonderful value. The fact that such an efficient two-valve set sells at such a low price has created enormous interest among the listening public all over the country.

The convenience of listening to broadcast by means of a loud speaker is appreciated by all, but the question of cost makes many hesitate before buying expensive apparatus. They will welcome the Ethophone-Duplex. About 20 miles from a main station and about 100 miles from the high-power station it will receive broadcast on a loud speaker, the range on headphones being four or five times as great. These ranges may be considerably exceeded under favourable conditions.

The Ethophone-Duplex has three controls: a dual rheostat which makes possible the use of bright or dull-emitter valves without alteration to the set; a special type of variable condenser; and a geared coil-holder giving vernier movement of the reaction coil. Tuning is simple and the wave-length range may be extended from 250 to 5,000 metres or more by the use of Burndept Coils. Write now for full particulars of the Ethophone-Duplex—the set that sells at a price that suits your pocket. Demonstrations can be arranged.

No. 1503.—Ethophone-Duplex, without valves, coils, batteries, etc., **£5 5s.**, to which must be added **£1 5s.**, Marconi licence.

Purchase Burndept by its name—substitutes are not the same.

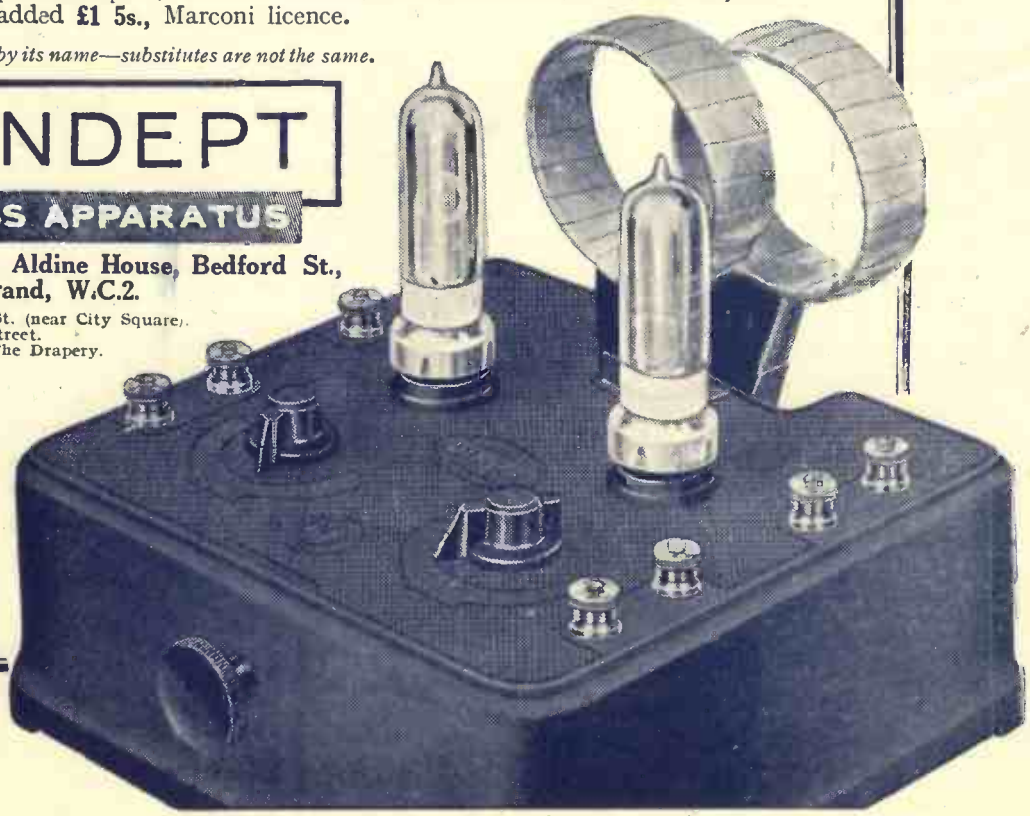
BURNDEPT
WIRELESS APPARATUS

BURNDEPT LTD., Aldine House, Bedford St., Strand, W.C.2.

LEEDS: 12, Basinghall St. (near City Square).
CARDIFF: 67, Queen Street.
NORTHAMPTON: 10, The Drapery.

A SURPRISE!

Burndept are about to put on the market a new loud speaker which for efficiency and price will surprise everybody. Full particulars of this new Burndept accessory will be given shortly. Look out for this coming announcement if you want a really reasonably-priced loud speaker.



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The Experimenter Proves His Worth

HEARTY congratulations are due to Mr. C. W. Goyder, Mr. G. Marcuse, Mr. J. A. Partridge, and Mr. E. J. Simonds for their wonderful work in establishing two-way communication with amateurs in New Zealand. Equal congratulations are due to Mr. Bell, of Dunedin, the first New Zealand amateur to communicate with us, to Mr. R. Slade, also of Dunedin, and to Mr. Shiel, of the same city, who established communication with Mr. Partridge. Full details of these experiments are given in our article on another page.

If any further proof were needed of the absurdity of the official attitude towards the experimenter in this country it is given by the success of the remarkable experiments just referred to. If the Post Office had had their way there would have been no possibility of such communication and only the pressure of public opinion has enabled such experiments to be conducted at all. To realise fully the significance of this amateur work, it should be borne in mind that not only have three amateur experimenters in this country communicated with three amateurs in New Zealand at the tremendous distance of 12,000 miles, but actually this is the first occasion that two-way communication by wireless has been established at all, even by commercial companies with their high-power stations and great technical facilities. It seems only a short time since great publicity was given to the fact that a commercial company with an elaborate valve transmitter using exceedingly high power had succeeded in establishing direct one-way communication with Australia. Mr. Goyder, who until recently was a schoolboy at Mill Hill, and even now is but a student at the City and Guilds Engineering College, carried out his experiments with an input of 200 watts, about a seventh of the power used by commercial companies in their ordinary ship to shore installations! Mr. Marcuse, with a power input of only 250 watts, was equally successful, and we believe the power used by Mr. Partridge and Mr. Simonds was about the same.

CONTENTS

Another matter in regard to the Post Office action to which we have not yet fully referred, but one which we are sure will arouse the indignation of many who do not yet know the facts, is the penalisation of the experimenter who wishes to use higher power. Mr. Frederick L. Hogg, G2SH, of Highgate, who is well known for his remarkably efficient Transatlantic working, has written to us giving a few particulars of the fees he has had to pay. "This," says Mr. Hogg, "is my little list for less than four years:—

	£ s. d.
March, 1921 ...	0 10 0
February, 1922 ...	1 15 0
December, 1922 ...	2 0 0
October, 1923 ...	5 0 0
December, 1923 ...	1 0 0
October, 1924 ...	6 0 0
	£16 5 0

"I think," continues our correspondent, "I shall write them saying, 'enclosed please find £6, etc., for *I* certainly can't find it.' Most of the six pounds' worth expires next April, too!"

We feel very strongly that experimenters such as Mr. Hogg and those whose achievements have been reported above should be the last to be penalised for their work. Their own expenses in regard to apparatus are far higher than those of the receiving experimenter, and we see no reason why they should pay a higher fee than 10s. to the Government. We are, therefore, placing at the disposal of the Radio Society a sum of money sufficient to reimburse such experimenters for fees charged to them over and above the 10s., which fees we regard as absolutely illegal and unjustifiable on any technical or other ground, until such time as the Post Office are made to take a saner attitude. Needless to add, the disposal of this money is left to the discretion of the Radio Society.

Meanwhile we trust that active steps are being taken to stage a suitable test case in the courts to remove these and other hardships in connection with transmitting licences.

"Neutral-Grid" Coupling

By A. D. COWPER, B.Sc. (London), M.Sc., Staff Editor.

A most interesting method of obtaining stability in H.F. amplifiers.

IT should be familiar to all by now that with the ordinary methods of H.F. amplification by means of parallel-tuned anode or tuned transformer, if any reasonably high efficiency or sharpness of tuning be sought then the alternative trouble of persistent self-oscillation invariably appears.

Apart from casual couplings the capacitative coupling via the grid-plate capacity of the first valve, as shown in Fig. 1, gives a sufficient reaction effect. The two tuned oscillating circuits A and B are coupled together by the small capacity C, so that oscillations in B are communicated back to A, and there by the valve action enhance the oscillations in B, and so on.

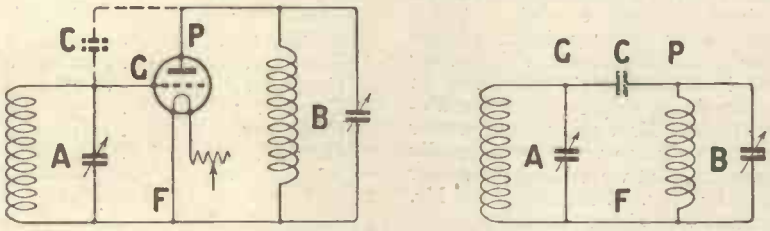


Fig. 1.—The oscillating circuit in a tuned H.F. amplifier.

Now if, as in Fig. 2, the grid G (which has small capacities both to plate P and filament F) be cross-connected to a tapping-point T at or near the centre of the inductance of the anode-circuit B, it will be effectively *neutralized* with respect to any high-frequency oscillations in B, as the circuit is obviously symmetrical about G.

If, as is usually the case, the grid-plate capacity is much less than the grid-filament capacity, the neutral point T will be displaced proportionately down towards the filament end of the inductance. For the oscillating P.D. across the smaller condenser of the two in series here is naturally greater than the oscillating P.D. across the larger, the same H.F. current flowing in each, so that a larger share of the potential drop in the inductance must be taken with it.

Between T and G can then be introduced an independent oscillating circuit A, which will neither affect *directly* nor be affected by the other, B; but when G is the grid of a valve in operation, oscillations in A, by varying the H.F. potential of G with respect to F according to the ordinary valve-action, will set up and maintain amplified oscillations in B.

As there is now no need for special precautions against self-oscillation, low-resistance efficient oscillating circuits can be used, giving sharp tuning and a high build-up in the anode circuit, resulting in relatively good H.F. amplification. The ordinary reaction devices can be safely used in conjunction with this coupling.

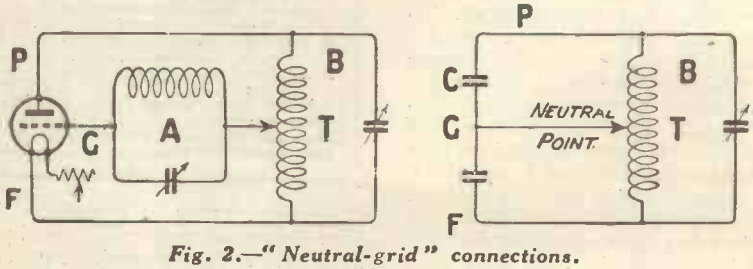


Fig. 2.—"Neutral-grid" connections.

Since the grid oscillating circuit is to be connected to a tapping-point in the anode inductance, as to its lower end, a loose-coupled aerial circuit must be used—this incidentally becomes now possible without troublesome instability resulting. A grid blocking condenser must also be used to keep the H.T. voltage off the grid, and the latter must have the customary 2-megohm leak to the L.T. minus.

Practical trial of the circuit confirmed these theoretical considerations, which had presented themselves during a discussion with Mr. J. F. Johnston on the "Tuned-Anode-Cathode" H.F. circuit developed by the writer (*Modern Wireless*, Vol. III, No. 4, p. 366), from Mr. Johnston's "Tuned Cathode" coupling (*Wireless Weekly*, Vol. IV, No. 9, p. 277), and in particular in connection with an attempt to devise a practical 2-stage amplifier circuit of this type (Fig. 8 in *M.W.*). Subsequent detailed analysis showed that in the circuit suggested there, too intimate coupling existed between the two anode circuits to allow of much build-up in the second one, but in a further attempt to simplify this circuit the principle outlined here presented itself to the present writer. The problem of extending this to two or more successive stages presents (as usual) some complex difficulties.

Practical Details

For the moment Fig. 3 gives practical working details for a simple "*Neutral-Grid*" H.F. coupling, in the form of a 2-valve short-wave broadcast receiver. Note-mags. can be added as desired, of course. The only part which is not standard is the tapped anode inductance, which should be a plain solenoid

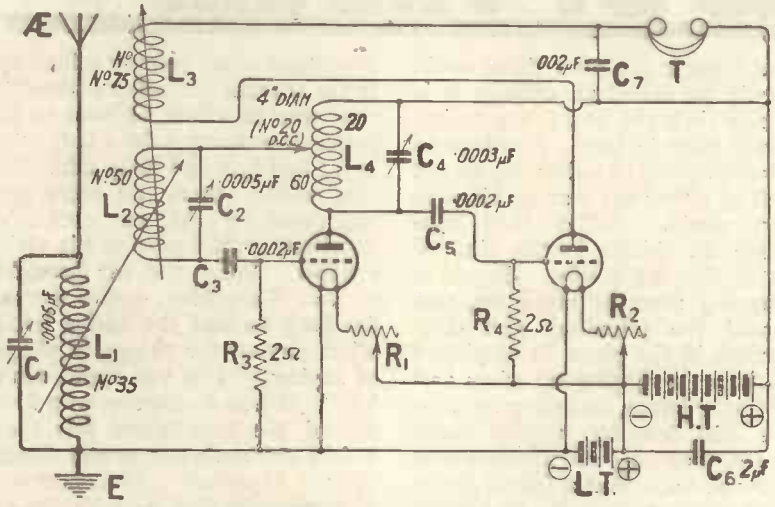


Fig. 3.—A practical "neutral-grid" broadcast receiver.

on a 4-in. diam. former (or corresponding basket-coil) of 60 turns of No. 20 S.W.G. d.c.c. wire, lightly shellaced and well baked after winding. This, if tuned by a .0003 μF variable condenser, will cover the usual range of wavelengths. It should be well isolated from the other inductances.

With Ordinary Valves

Experiment showed that with ordinary valves a tapping at about ⅓ of the way up from the "earth" (*i.e.*, H.T. plus) end of the coil (at the 20th turn here) gave nearly enough the desired "Neutral-Point." This was not at all critical (unlike the critical setting of neutrodyning devices), as there is a certain latitude of natural stability in any case due to resistance-damping, and any excess stabilising effect in reason is wiped out by the usual magnetic reaction from the detector-valve anode back to the grid-inductance.

The three coils—aerial, grid, and reaction—are mounted in an ordinary 3-coil holder, and the reaction-coil (a No. 50 or 75 as usual) should not require to be close up to the grid-coil to cause oscillation, when grid and anode are correctly tuned. There appeared to be no particular advantage in the use of a series condenser in the aerial circuit.

The circuit in Fig. 3 was found quite easy to handle, given some little experience in the use of a 3-coil tuner. Aerial tuning is not critical; anode tuning is extremely so, and the selectivity is accordingly excellent.

An Alternative Method

An alternative method, for those who would avoid a 3-coil holder, is indicated in Fig. 4, where, in place of finding an (approximately) neutral *permanent* tapping-point for the grid connection, a tapping-switch is used—with tapping-points, say, every 5 turns, or closer, from the H.T. plus end for 20 turns—enabling the latter connection to be made either to the end—when violent self oscillation should result on tuning the two circuits as usual—or to a point in the anode inductance which *just* gives stability, after the preliminary tuning has been carried out. Adjustment of the tapping-point makes but a small difference to the tuning adjustments.

The temptation to make this anode inductance of the usual fine-wire, high-resistance type should be resisted, as with such inefficient oscillating circuits only poor results can be expected, but little better than the customary; damping of any kind is quite out of place here.

With the circuit as shown in Fig. 3 something approaching good loud-speaking resulted at 35 miles from 2LO on a poor 70-ft. test-aerial, and many distant stations were tuned in with ease and at excellent strength on the head-phones.

There is an opportunity here for some enterprising coil manufacturers to make a really efficient low-resistance plug-in anode coil with a tapping at about ⅓ of the length, either with a separate terminal for the grid-connection or on the customary 4-pin base. Then H.F. amplification of real stability and fair efficiency would be attainable with no further trouble than that of plugging in the corresponding tapped anode-coil, and placing the proper sizes of ordinary coils in the 3-coil holder.

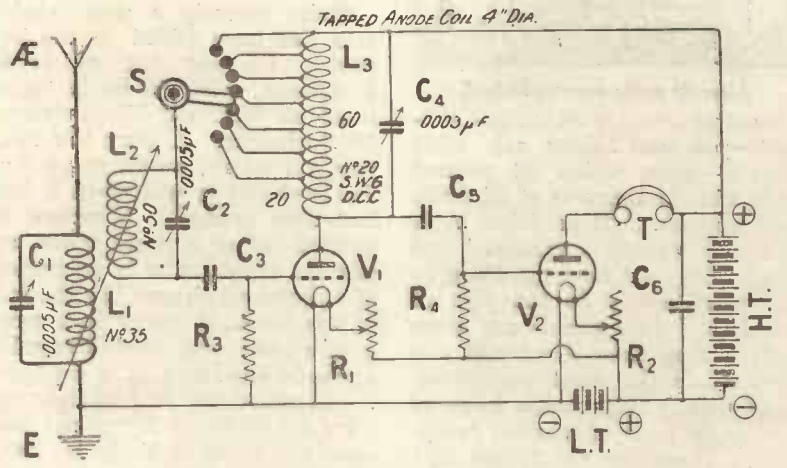


Fig. 4.—An alternative method.

JOTTINGS BY THE WAY

By Wireless Wayfarer

The Sizing Up Process

WHEN a newcomer arrives in your district everyone is of course engaged for the first two or three months of his residence in sizing him up. The men wonder what he does with himself and how he earns a living. Possibly they enter into polite and casual conversation on the way to town in the morning train, or as they return home in the evening. If he is a smoker they approve, but if he frequents non-smoking carriages they are apt to regard him with suspicion. Does he play golf? This is very important, for if he does it is most probable that he will talk shop all the time when he gets a chance, and will never be able to

Already quite accomplished.

discourse sensibly on the one subject—you need hardly ask what that is—upon which all normal men wish to converse at all times and seasons. If he fishes he is probably already a practised and ready liar, and may therefore be converted easily to the joys of wireless. Few people are more entertaining than those who can reel off in the most convincing way utterly improbable tales of wondrous feats of wireless reception. These are the things that the men want to know. The women, of course, never look at the man himself. They examine his wife, or rather the clothes that she wears, and maintain that they can deduce all kinds of things about the pair from what they see here. If she is good looking they soon discover that she has false teeth, that her hair is dyed, and that though the poor thing could hardly be called an eyesore it is a pity that she has not a rather better taste in hats. Members of wireless clubs of either sex do not look at either the man or his wife particularly. What they note above all things is the kind of aerial that he erects. Should a towering mast be stuck up, and should the plumbers and electricians in the place be employed for days in rigging up wires and soldering joints, and digging deep pits and burying mighty earth plates, then all good wireless men know at once that a friend and a brother has come to dwell amongst them. When I say "know" I mean that all the signs are there, and that in nine cases out of ten their judgment will not be at fault.

The Case of Montmorency Marjoribanks

Quite recently a new inhabitant has been added to the imposing burgess roll of Little Puddleton, whereon he is registered as Algernon Montmorency Marjoribanks. A name like this, you will admit, ought to go far, and probably it will when it has had time enough. Somehow it seemed rather a misfit when we saw its owner, who is possessed of a proboscis shaped like the end of a billhook, a rather dark complexion, and hands that wave palm upwards whenever he is engaged in conversation. At first sight we were not drawn to Algernon; nor were our wives to his better half, whose style of dress was a little florid, to say the least of it. Even I, who seldom notice these things, was struck by the rather startling nature of her apparel on the day on which she first walked through the market square of Little Puddleton. Somehow a bright green hat, golden hair, a fair isled jersey, a scarlet skirt, and about seventeen other colours mixed up in the scarves and other oddments that women affect, seemed to be rather overdoing it for a lady who is fat and fair and forty odd. On the whole, then, we were not impressed by what our eyes told us of either Algernon or his vivid consort. What the ear brought us was, if anything, rather worse, for both he and she had a habit when paying for things in shops of saying, "Dot vos right, ain't it?" It was Snaggsby who first spread the scandalous tale that before the outbreak of the Great War Algernon Montmorency Marjoribanks had been known to the world, or to such portions of

Mrs. Algernon Montmorency Marjoribanks.

the world as were acquainted with him, as Moses Veilchenduft, and that his wealth had been gained by his willingness to advance from £5 to £50,000 on note of hand alone, no irritating inquiries made and no sureties asked for.

Flattering

I can well remember receiving on many occasions circulars from a Moses Veilchenduft, and I was duly flattered at doing so, for in other transactions I had seldom been able to find anybody willing to lend me so much as half a crown, and even if they did most of them made quite a lot of unpleasant inquiries. But somehow it seemed like *lèse majesté* to connect Moses with Algernon, and all the members of the wireless club felt that Snaggsby was indulging in mere scandalmongering; a thing which we detest in Little Puddleton. Why, if

General Blood Thunderby has happened to observe Admiral Whiskerton Cuttle arriving by the last train from town (which gets in at 9.30), and should tell you that he has frequently seen the same man coming home with the milk, he will always make you promise not to tell a single soul.

Vulgar Curiosity

The Marjoribanks' *ménage* had taken a very pretentious house situated in the best part of Little Puddleton, between the cemetery and the sewage farm, which had been vacant for some months because no one could afford the enormous rent asked. Though, as I have said, we were not impressed either by the appearance or by the utterances of the pair, we could not help feeling a certain interest when one morning we saw a huge mast at least sixty feet in height being carted up to Chiltern Lodge (4 recp., bill., lounge, hall, 17 bed. and dress., 4 bath, h. and c., garage and stabling for 10). I will not say that a certain slightly ill-bred curiosity was not aroused amongst the members of the wireless club. In fact when, during my afternoon stroll, I happened to pass the house, I met in turn Poddleby, Snaggsby, Bumpleby-Brown, Gubbsworthy, General Blood Thunderby, Admiral Whiskerton Cuttle, Breadsnapp, and Professor Goop, all of whom were taking their constitutional in that direction because, as they informed me, the air was so much better in that part of the town. It is a little sad, I think, that even the best of wireless men cannot keep their inquisitiveness better within bounds, for I have not the slightest doubt that every one of these people, with the exception, of course, of myself, was out simply and solely to see where the mast would be erected. Though I had no such motive when I went for the stroll, I may tell you that as I passed a gang of men were engaged in digging a large hole about forty yards away from the house right in the middle of what had once been a first-rate tennis lawn.

Welcome

As I leaned over a convenient gate watching them at their toil I could not help thinking that after all there must be something in Algernon Montmorency Marjoribanks, for a man who had thus destroyed a perfect tennis lawn in order to erect his aerial mast in the best position must be a wireless man of wondrous keenness. Naturally, I kept this reflection to myself, but on the following day, when I went to the wireless club, I found that most of the members were discussing the question, and that they were disposed to regard the newcomer with much more sympathetic eyes. All of them, it appeared from their remarks, had spent half the time in gazing furtively at the operations in the garden at Chiltern Lodge. It is a little sad, I think, that decent men should do this kind of thing. Still, the consensus of opinion was that as Marjoribanks had obtained the noblest pole that he could lay hands on, and as he was erecting it in such a place, he was obviously marked out as a future member of that select body, the Little Puddleton Wireless Club. A kind of informal debate was held, in the course of which the problematical candidature of Algernon Montmorency Marjoribanks was mooted. It was carried *nem. con.* that as (*a*) we were rather short of funds, and (*b*) A.M.M. was obviously not, and (*c*) he was patently an enthusiast of the first water, he should be duly approached by Poddleby, our secretary, in a diplomatic kind of way about joining the club.

All curious, with the exception of myself.

Disillusionment

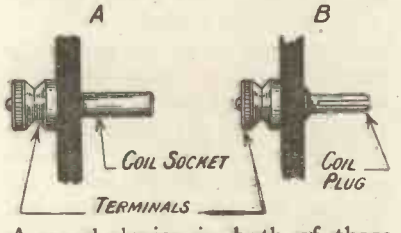
That evening I decided that I would call upon Algernon Montmorency Marjoribanks. After dinner I made my way by easy stages up the hill to Chiltern Lodge. Arrived there, I rang the bell. The door was opened majestically by a butler such as only the Marjoribanks' clan can afford to keep. I was shown into the study where Algernon (a most friendly soul) offered me a vast cigar ("Dese vos good, mein poy. Dey gost me fife shillins abiece wholesale") and greeted me cordially. "I see," I said, "that you are a wireless enthusiast"—his eyebrows went up, but I noticed this no more than the deprecating wave of the hands (palm upwards) which accompanied it. "Your wireless mast alone tells me that; and may I say that in Little Puddleton we are most ready to welcome any real wireless man." "Vireless? *Vireless?*" said my host. "Vot you mean? I gif not a hang for your vireless. Vot I shtudy is der veather. Dat pole is for mein vind gauge. . . ." I left as soon as I decently could. Well, well, *well.*

WIRELESS WAYFARER.

□ □ □

A Useful Connector

A USEFUL connecting device is shown in the accompanying diagram. All that is necessary is to extract a complete terminal head from its screw and insert in its place the screwed shank of a coil plug or socket. When assembled in this manner upon the panel it has the advantage of answering a double purpose. A plug connection may be made from the backs of the panel and a terminal connection from the front. This is particularly useful where it is desired to connect the aerial and earth leads on the underside of the panel, and, say, a condenser across the same two points on the upper side of the panel, or vice versa. Another instance of its use is in the case of battery connections. Plug-in connections may be made from the batteries to the panel inside the cabinet.



A good device in both of these instances is to in the first case employ a socket for the aerial connection, and a plug for the earth connection, and likewise in the latter case, thus obviating the possibility of linking up incorrectly. H. B.

The Design of Resistance-Capacity Coupled Low-Frequency Amplifiers

By H. J. ROUND, M.C.

Continued from page 4 of the last issue.

LET us consider 2 D.E.5 valves in cascade with 150 volts on the plate and 100,000 ohms in series with each valve. In the plate of the last valve we can, without running into danger, get a change of ± 40 volts with an expenditure on the grid of ± 3.

Now, again, this 3 is produced with an expenditure on its grid of $\frac{3}{13}$ = .23 of a volt, so that with two valves we can step up more or less distortionlessly from .23 volts to 40 volts, a magnification of 170. The addition of another valve could not increase this 40 volts, it would only enable one to reduce the input to .018. We can increase this 40-volt swing to 95 by increasing our plate voltage to 300, or we have another alternative which very nearly doubles our possible sweeps. A choke coil can be made such that for the lowest frequency we have to consider its impedance is extremely high, so that its R line can be drawn horizontal, but as its stable resistance is very low we can set it at any value of IA by altering Vg and work round that point.

Effect of Choke Coil Feed

In Fig. 10 I have drawn a nearly horizontal line through an arbitrary point on a D.E.5 curve with the same Vo as before, and you will see that the sweep of VA is now twice, or nearly twice, what it was before. That is, with a choke coil feed we can apply twice the grid volts change and get twice the plate voltage change as in the resistance case for the same application of Vo (see Fig. 9). The use of the choke coil is not very harmful for only one valve, but the fact that, unlike the resistance, it can store energy (and produce reaction effects), and its self-capacity is large, and its impedance not constant for all frequencies, makes it not quite so nice to use in a circuit if you want to know all about what you are doing, but a little consideration will show that it is not really necessary except for the last valve, where we are aiming for a maximum sweep.

The problems of the transformer are still more complicated, and one cannot help feeling that in these days of .06 filament valves—is anything but the resistance amplifier (or in certain cases choke amplifier) worth while?—another valve or so and distortionless calculated circuits against possible distortion and endless argument as to whether it is all right or not.

The manufacturer and seller of made-up gear is unfortunately worried by an awful bugbear—people have got into a habit of judging sets by the number of valves, and expecting equal number of valves to give equal output watts. If we forget the number of valves and only compare performances, price, running cost and trouble, I think the resistance amplifier will win out.

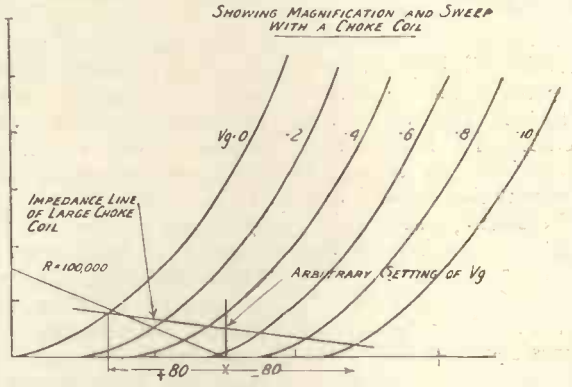


Fig. 10.—Showing magnification and sweep with a choke coil.

Positive Grid Bias

Now, just one more point. Why do we call making a grid positive "running into danger"? In practice it is seldom possible to avoid a little of it—how much depends on the set owner's judgment—but for best results "no grid currents" are the rule. In the resistance amplifier applying a potential to the grid which causes grid current to flow, firstly, tends to drop the A.C. potential across the grid resistance, and, secondly, due to the presence of the condenser K (Fig. 2), and the rectifying action of the grid, the bias of G is momentarily altered in the negative direction, and depending on the shape of the valve curves, the offending applied voltage affects the magnification of any other voltage being applied at the same time, producing harmonics or combination tones in music.

The last, or power, valve is quite a different consideration. As the actions in the plate circuit of the power valve are very complicated when one is using either the bell telephone type of telephone or loud-speaker or the balanced arm type, and only becomes comparatively simple in the case of the moving coil type of instrument, I will have to go into their calculation at a later date.

In general, however, if our high-tension voltage is fixed, the lower the resistance of the plate circuit of the last valve, the more distortionless power can be dragged out of it if the telephone windings are wound at the best value in every case. With any type of tube, lowering the "m" value lowers the resistance; therefore the low "m" value tube is the best if we can supply enough undisturbed volts to it. This I have indicated how to do.

The Ideal Wireless Table

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

THOSE who are fortunate to have rooms which can be used purely and simply as wireless dens need not bother very much about the bench or table used for wireless work, for almost anything of convenient size will meet their requirements. But the majority of wireless enthusiasts are bound to have their sets in one of the living rooms of the house where broom, duster and other destructive and (from the masculine point of view) quite unnecessary tidying implements are plied at regular intervals by housemaid or charwoman. In such cases the wireless set's only hope of safety

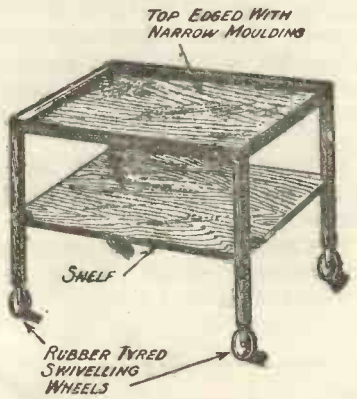


Fig. 1.—The type of wireless table referred to in the article.

whilst the onslaught against dust is in progress lies in retreat. The ideal table, therefore, is one which, whilst it is fit to be a piece of furniture in a drawing-room or dining-room, is at the same time easily movable. It must have sufficient top surface for the set itself, and for various small parts that may be in temporary use, and it is desirable that there should be a shelf below to support the high-tension battery in addition to a box which acts as a container for spare coils, condensers and the like.

Receivers in the Drawing-room

Though I am lucky enough to have a wireless room in which most of my gear reposes, I have also a cabinet set which lives in the drawing-room, and is used almost entirely for broadcast reception. For some time I made use of a cane-topped bamboo table which was not a very handsome piece of furniture, besides which, like most of its kind, it soon grew rather rickety. To remove this from the drawing-room to some place of safety when cleaning was in progress was always rather a business, for it had to be carried, and it weighed a good deal with the set upon it. I had long been intending to replace it with something better looking and more stable, and I had, in fact, made several designs for the perfect wireless table; but somehow nothing was done, and the designs remained, with other miscellaneous papers, in a drawer of the desk. Then one day I saw in a furniture shop exactly what I had always wanted, and wondered why I had never thought of it before. This is simply a small dinner wagon or plate tray such as is shown in the drawing, and wireless enthusiasts who are good at carpentering can easily make the thing for themselves, whilst those who do not care about woodwork can purchase it in oak or some other good-looking wood for about thirty-five shillings.

Battery Shelves

This table has a top surrounded by a narrow moulding, which is most handy, since it prevents small things such as grid leaks and valves from rolling off on to the floor. The inside dimensions of the top are 23¼ inches x 16 inches, which allows ample space even for a large set. Below is a shelf which serves splendidly for the high-tension battery, and an ex-army high-voltage battery box purchased for 3s. 6d. This last will hold a couple of dozen plug-in inductance coils, as well as spare valves and other small parts. The accumulator stands in the corner of the room, and is provided with a wall plug. The table is fitted with swivelling, rubber-tyred wheels 4 inches in diameter which enable it to be wheeled without the least trouble from place to place. When the invasion of mops and brushes begins one simply disconnects aerial and earth, pulls out the low-tension battery plug, and wheels the set with no trouble at all to a place of refuge.

Protection from Dust

To protect the set from dust and damp, a cover of American cloth has been made whose dimensions are shown in Fig. 2. To make it, cut out a rectangular piece 25 in. long by 17 in. wide, and another piece 8 in. wide by 7 ft. in length. Then stitch the narrow strip on to the top so as to form a flounce. As American cloth is both dust proof and damp proof, the set is well protected when the cover is placed over it.

Fig. 2.—The cover which will protect the set when not in use.

□ □ □

RADIO NOTES

Standard Radio Time Check Sought

In order to eliminate the necessity of changing from the universal 600-metre wavelength on which S.O.S. calls are sent for the reception of time signals, the United States Bureau of Standards is conducting a series of experiments at the Arlington radio naval station with the object of permitting the automatic control of clocks within the country and on the ships at sea.

The system studied will permit all clocks to be set without the operator being distracted from any of his other duties.

French Crystal Set Picks up Chelmsford

An amateur of Charenton, near Paris, reports that he has heard Chelmsford, 5XX, on 1,600 metres, with an ordinary crystal set without an outdoor aerial.

A Wavemeter for Amateur Transmitters

By PERCY W. HARRIS,
Assistant Editor.

The telephones are used for calibration. Indications of resonance are visual.

TO the transmitting amateur the wavemeter is much more important than to his confrère who devotes himself entirely to reception. The latter, without a wavemeter, is frequently working in the dark, but when doing so is inconveniencing none others than himself; the transmitting amateur who is uncertain of his own wavelength is not only inconvenienced in not being able to fix up schedules to work with others, but is more than likely to cause unwanted interference, and, indeed, to break the conditions of his licence which limit him to certain specific wavelengths. That a large number of experimenters are very much in the dark regarding their own wavelength is proved by the fact that they can be frequently heard asking other stations to give them a wavelength reading. With proper apparatus they should be able to measure their own waves without having to disturb the ether in vainly endeavouring to find some distant listener to do the work for them.

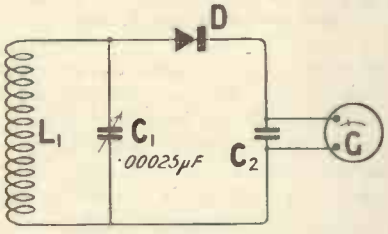


Fig. 1.—The first circuit tried.

To those who are acquainted with the practical conditions of amateur transmission it might appear that the measurement of one's own wavelength is a comparatively simple affair, especially if an accurately calibrated heterodyne wavemeter is available. It would seem a simple matter to connect a pair of telephones in the heterodyne wavemeter and to adjust this until a beat note is heard, and then by settling down on the zero point to ascertain the wavelength from the calibration chart. In practice, however, it is most difficult to measure one's own wave with a heterodyne wavemeter, as the strength of the oscillations from the transmitter is so great that it overpowers the heterodyne oscillations, preventing the formation of a beat-note. Again, it is most inconvenient to have to wear a pair of telephones while adjusting the apparatus, for one is thus forced to keep the heterodyne much too near the transmitting apparatus. If we go into a different part of the house with the wavemeter then it may be necessary to ask a companion to make the adjustments, and this, of course, is a long and tedious business for both.

The wavemeter about to be described is not novel so far as the circuit is concerned, and I make no claim to originality for it. It is, however, a method which deserves to be much better known, and in practice is extremely simple. The accuracy obtainable is quite high enough for most purposes, and the apparatus presents the following important advantages:—

1. Readings are visual, there being no need to wear headphones.

2. Calibration from existing wavemeters, either buzzer or heterodyne, is very simple.

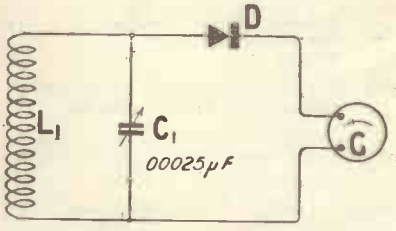


Fig. 2.—An alternative arrangement which also failed.

3. No batteries or valves are needed.

4. The apparatus is used within reach of the transmitter, and can rest on the same table.

5. Only one plug-in coil is required for each range of wavelengths.

6. The calibration curve approximates to a straight line.

7. Cost of construction is not more than £4 10s.

The circuit used is quite a simple one. It consists of an inductance and capacity, the values of these being chosen to suit the wavelength it is required to test, a crystal detector, a pair

This instrument, which is easy to construct and manipulate, makes accurate tuning of the transmitting apparatus a simple matter.

Plan photograph showing galvanometer.

of high-resistance telephones, and a sensitive galvanometer. The galvanometer used is the standard Weston instrument, and is extremely sensitive to minute direct currents. There are set up in the circuit L1 C1 oscillatory currents of the frequency of the transmitting apparatus, when this circuit is tuned to the particular wave used. If now we rectify these currents through the crystal detector we can make them affect the galvanometer. It might at first be thought a circuit similar to that shown in

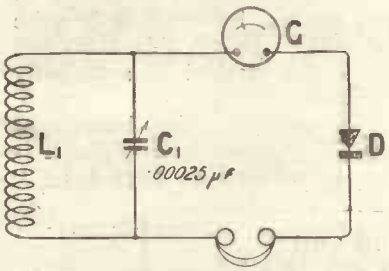


Fig. 3.—The circuit finally chosen.

Fig. 1 could be used. Here the rectifying currents charge the condenser C2, which cannot discharge back through the crystal detector, and therefore discharges through the galvanometer. This circuit, however, will not do, as the large condenser C2 is connected in parallel with the condenser C1 through the crystal detector D, and every time we adjust the detector we upset the calibration of the instrument. I have experimented with this circuit and with a .00025 mfd. variable condenser across L1; adjustment of the crystal detector may change the reading for resonance 20 or 30 deg. of the condenser. It is, therefore, hopeless to attempt to use such a circuit as this.

The next circuit to suggest itself to us is that in Fig. 2, in which we can dispense with the condenser C2 and run the rectified current straight through the winding of the galvanometer. This, too, in practice, is unsatisfactory, and the calibration is altered every time the condenser is adjusted.

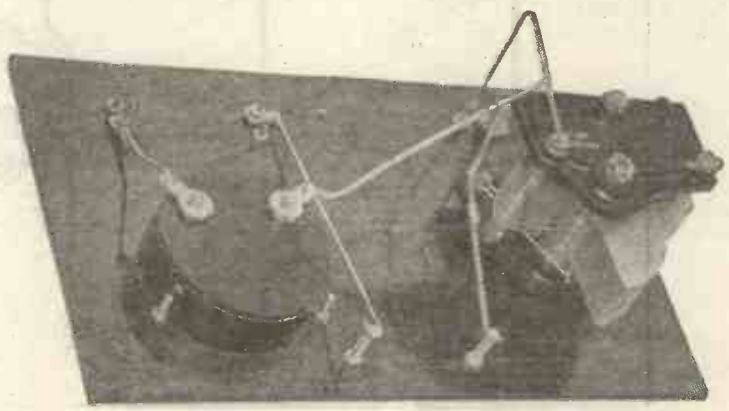
The Circuit Chosen

The circuit I have found quite satisfactory is that given in Fig. 3. Here it will be seen that one side of the variable condenser is connected to the winding of the galvanometer and the other to the telephones, which act as a choke to the high-frequency currents. In practice this circuit works exceedingly well, and considerable alterations of the adjustment of the crystal detector do not materially affect the calibration. The arrangement of the telephones, as shown, is a great advantage, as we can use the 'phones for the calibration of our instrument from another wavemeter. When using it for measuring a transmitting wave the 'phones are always left in circuit, being an essential part in the arrangement.

The reader may now wonder whether this device is sufficiently sensitive. In practice it is fully sensitive enough and gives a clear reading on the galvanometer several feet away from a transmitter using only 4 or 5 watts. For calibration purposes it is surprisingly sensitive, the *Wireless Weekly* short-wave heterodyne causing a deflection of the galvanometer needle when nearly a foot away from it. Even a buzzer wavemeter will cause a deflection when held close to the instrument.

Constructional Details

Very few components are required, and the wiring, as will be seen, is of the simplest. We need, first of all, a panel of guaranteed ebonite, a good quality square law condenser of .00025 or .0003 mfd. (I have



Wiring is of the simplest character.

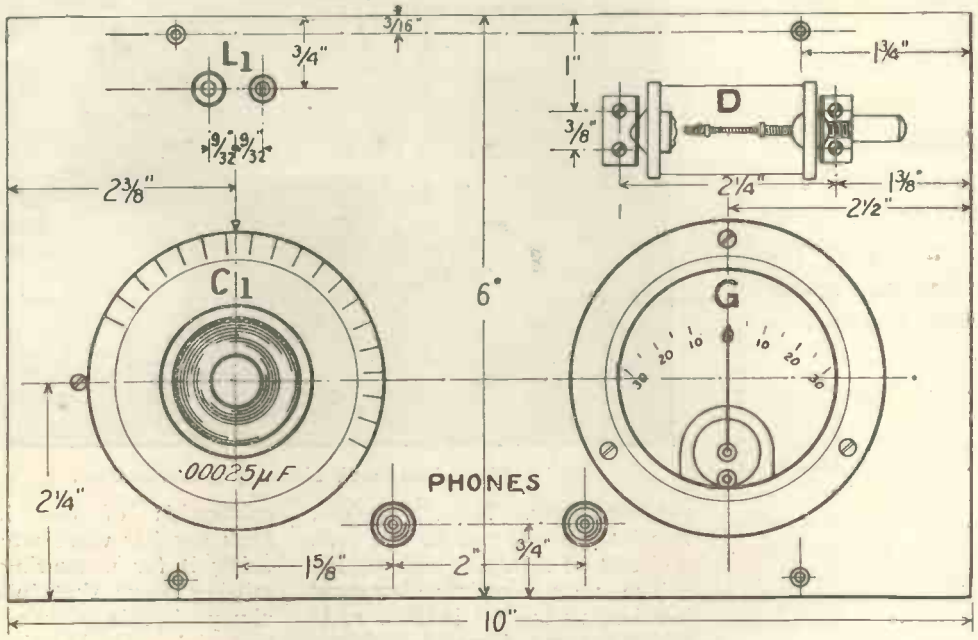


Fig. 4.—Half scale drawing of top of panel.

used a Sterling in this instrument; there are others equally suitable), one enclosed crystal detector, one Weston galvanometer, one socket for the plug-in coil, two terminals, one pair of 4,000-ohm telephones (the same pair of telephones should be always used on the instrument), plug-in coils for the wavelength range required, square wire for wiring up, and a suitable box.

Calibration

When the set is finished it can be calibrated either from a buzzer wavemeter, or, better still, from a heterodyne wavemeter. In any case, it is well to practise with a buzzer wavemeter first of all. The coil is plugged into its socket, and, with the wavemeter buzzing at some suitable wavelength, the crystal is adjusted in the usual way, with the telephones on the head. Readings should then be taken at each, say, 20 deg. of the variable condenser, and a curve plotted showing the wavelengths for the different readings. The curve so taken will approximate to a straight line, although it will not be quite straight on the lowest readings. An actual calibration curve of the instrument shown is given in Fig. 6, from which it will be seen that above 40 deg. it is quite straight. The instrument will work on a wavelength as low as 75 metres, but below this the calibration might not remain constant.

For wavelengths from 150 to 200 metres, however, it is quite reliable. Below this I do not think the method is sufficiently accurate.

To calibrate the instrument with a separate heterodyne it is

(*Continued on page* 63)

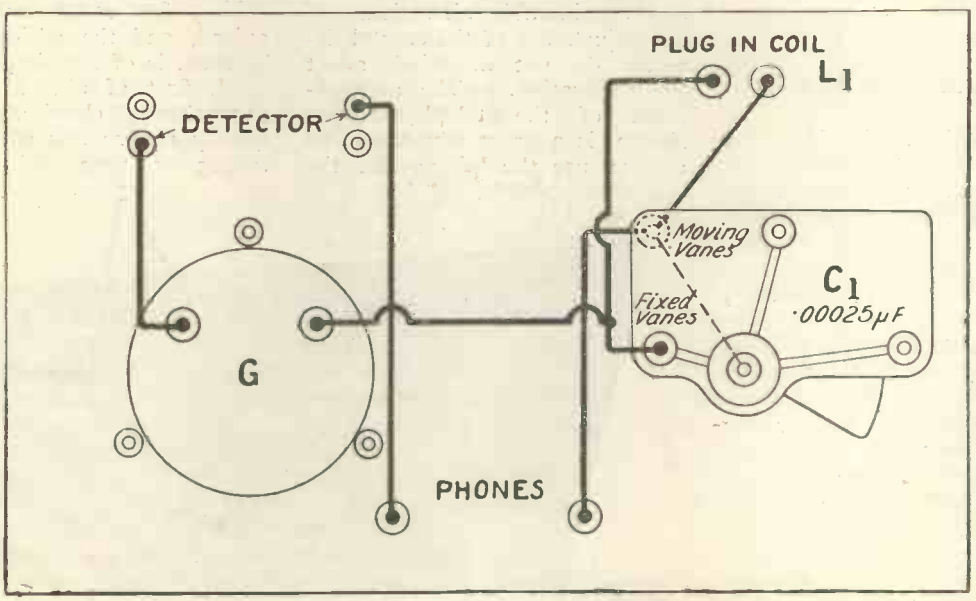


Fig. 5.—Half scale wiring diagram.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

AN interesting demonstration at Cambridge the other day showed the merits of the three-valve dual receiver as a distance getter. There is, of course, only a single stage of high-frequency amplification, but the results are certainly very good, and the selectivity is better than many sets. Reaction, of course, is introduced from the second valve to the grid circuit of the first, reaction being thus introduced into the aerial circuit as well as the grid circuit of the second valve, *i.e.*, the secondary circuit of the high-frequency transformer.

Standardization

The fixed plug-in transformer is a useful article, and I would very much like to see it standardised as regards the connections to the pins. The different types of commercial transformer vary considerably, and it would be a good plan if the manufacturers adopted a standardised arrangement.

The small size of these plug-in transformers is, no doubt, a great advantage in high-frequency amplification, because stray magnetic fields are reduced to a minimum, whereas if large inductances of the plug-in coil type are employed, magnetic fields are very liable to cause self-oscillation.

It would surely be possible to make a very much smaller inductance coil suitable for tuned anode working. Possibly some sacrifices would have to be made in other directions, but such coils would have advantages for special work.

Some Components that are Required

The publication of Mr. Harris's neutrodyne receiver in the *Wireless Constructor* has caused a stampede in the trade for neutrodyne condensers having a very low minimum capacity. Here, of course, is a typical instance of the absence of a suitable article on the market. I believe that only one firm had a design for this condenser, and that they are consequently flooded with orders.

I am amazed at some of the components that everybody wants and which no manufacturer supplies, or, if he does so, it is done in so unostentatious a manner that the wireless public, generally, knows very little about it.

High-tension Batteries

How many, for example, have read about a very neat high-tension battery box which I saw the other day? This box enabled ordinary flash-lamp batteries to be used, and there was also provision for taking tappings from each battery. The different batteries in the box were automatically connected in series on closing the lid, and the whole arrangement struck me as being a very attractive proposition.

Personally, I always use a proper high-tension battery, but I know perfectly well that there are many wireless experimenters who use batteries of the flash-lamp variety.

Who, in this country, has ever heard of a neutrodyne transformer being placed on the market? I do not expect that anyone will venture to do any work in this direction until the technical press gives a lead in the matter.

Coil Holders

As regards coil holders, I believe there is only one manufacturer who has appreciated the importance of turning out, at a reasonably cheap price, a coil holder in which the coils, as they separate, turn at right angles to each other. In the particular pattern that I recently saw, the rotary motion did not take place quickly enough, so that when a coil was moved away from the other it was not possible to get the coils completely at right angles. The idea, however, is very sound, and it is a very decided advantage to obtain a minimum coupling of this kind.

A resistance coupling unit is another excellent idea. This is a component which has never before been really considered seriously as a component at all. The anode resistance of the particular component I am speaking about seems to me to be on the low side, an important consideration, no doubt, being the cost of a wire-wound resistance of higher value.

One Hole Fixing

The one hole fixing idea is also an excellent move in the right direction, although some manufacturers still prefer to have a number of screws going through the panel. Others, on the other hand, have, in certain cases, tried to support, by one hole fixing, a very weighty component which is obviously unsuitable for such mounting.

Take another case of a component which is very badly needed. A neat valve-holder which may be mounted vertically behind a panel is badly wanted, and there is no reason why such an article should not be marketed; any mechanic could design half-a-dozen different types which would fill the bill admirably.

A Valve Need

We, as technical writers, not infrequently have the valves behind the panel in our sets, but

the methods used are much more crude than they would be if some enterprising manufacturer produced a suitable valve-holder for the purpose which would need no special bracket or platform.

Cabinet making is another field which has never been properly exploited. Tens of thousands of cabinets are required, but almost without exception the cabinet making industry is asleep. Ebonite manufacturers, in many cases, are missing the great opportunities open to them, although we are happy to say that one or two firms have recently realised the great market for ready cut panels of guaranteed quality. This will obviate the necessity for wireless constructors buying doubtful material by the pound, and have to go through the ridiculous ritual of rubbing this doubtful material down with emery paper to remove a probable conducting surface.

Rheostats

Rheostats suitable for dull-emitter and bright-emitter valves are few and far between. The first enterprising firm to produce a good dual rheostat has done an enormous business in them. Nevertheless, the need for this rheostat was there long before such an article was placed on the market. So, in the same way, there are numerous other components which are badly wanted but which are not on the market.

Take the case of earth pins and special earths. Everyone needs some kind of an earth, or nearly everybody, but no attempt is made to popularise what should be a very popular component. I believe that some earth pins have been marketed, but few people know anything about them, and the industry generally is only slowly awakening to the possibilities of many components and accessories.

A Comparison

The wireless industry in America is on an entirely different footing. You can buy practically anything you need, but in this country, whether it is due to over-caution or lack of enterprise, new ideas only come slowly, and when they come they are often throttled at birth, and the wide public knows nothing about them.

Take the case of voltmeters and ammeters. There is a huge market for these in wireless work; they can be incorporated in handsome sets, and even a beginner should be persuaded to have at least a high-tension voltmeter for his own good. The instrument makers themselves are asleep, and do not appreciate the potentialities of the wireless public. Can anyone imagine a motor journal without descriptions of different kinds of speedometer? A measuring instrument is more vital to a wireless experimenter than a speedometer to a motorist.

Why cannot some manufacturer produce a switch for

switching on filament current without the necessity of pulling the set about to effect a connection? Again, why cannot such a switch be devised so that a resistance is first put in circuit and then cut out so as to minimise the strain on the valve filaments?

Faulty Potentiometers

Why are so many potentiometers on the market to-day so faultily manufactured? Why does our Test Department get in dozens of sets in which the fault is purely traceable to a dud potentiometer? Surely the industry can produce a variety of potentiometers which will stand up to their very simple work.

Simple component that it is, a terminal can be well or badly made. Who makes these neat ebonite cap terminals which would be universally employed if the wireless public knew about them? No one wishes to handle bare high-tension terminals if they can get a cheap substitute. I suppose someone in this country makes these things, but we designers of sets cannot employ them because even if we did readers would be unable to buy them, or would not know where to buy them.

Square Law Condensers

Take the case of square law condensers. The large sale of these in this country has been due solely and entirely to the recommendations of Radio Press writers. I think I am right in saying that there was only one square law condenser on the market when we first recommended their use. Now every variable condenser manufacturer has been compelled to produce a model, and many have done it grudgingly.

Perhaps it is because we are so closely in contact with hundreds of thousands of experimenters that we appreciate so clearly what is required, and I could write pages on what constructors and designers are needing. Often an entirely new component comes on to the market and its value is appreciated at once. I am making these remarks, not merely to assist the trade, generally, to appreciate opportunities which lie before them, but to give vent to some of the feelings of constructors who are crying out for apparatus which they need and cannot obtain.

Reflections

THE lilt of a song or the re-introduction of an old-time melody conjures up long forgotten memories of happy moments in the fugitive past. The enjoyment of listening to the best entertainments the world produces can be yours, and your arm chair is as comfortable as a theatre stall. The Western Electric Loud Speaking Equipment, by reason of its wonderful reproduction and purity of tone, will prove a source of continual pleasure.

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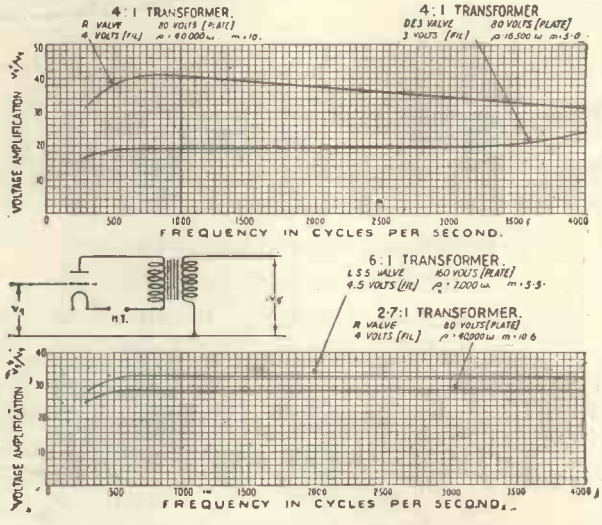

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which goes with each Marconiphone "Ideal" Transformer guarantees that the amplification curve at all points comes within 5 per cent. of the example shown above, when used with a valve with the same constants as quoted. The guarantee also provides for free replacement where a break in the winding occurs within six months.

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Random Technicalities

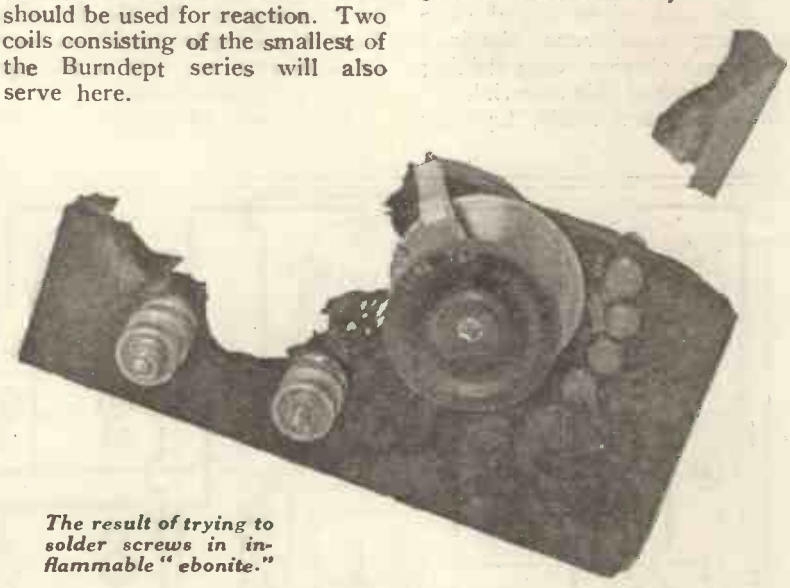
By PERCY W. HARRIS, Assistant Editor.

Some Notes of interest to the Home Constructor and Experimenter.

FORTUNATELY the man who is keen on developing short-wave reception from, say, New Zealand, has now an opportunity of practising every night with the new transmission from KDKA, the broadcasting station of the Westinghouse Company at Pittsburg, U.S.A. KDKA originally transmitted on the ordinary American broadcast wavelengths, and then began simultaneous transmissions on a wavelength of just over 100 metres. It will be remembered how well this came in last year. Recently, however, they have dropped their wavelength still further, and will now be found working on 65 metres with a still further increase of efficiency. On these very short waves there is very little fading, although a peculiar form of distortion is noted which has not yet been properly explained.

Hand-capacity effects

On these very short waves hand-capacity effects are very pronounced, and long insulated extension handles are suggested for the condensers. To give the reader who has not yet picked up KDKA some idea of how to do so, it may be stated that on the unit recently described ("100 metres and below," *W.W.*, October 8 issue) with a three-coil tuner and on the average outdoor aerial, KDKA can be received at midnight and onwards at excellent strength in the telephones, and quite frequently it is obvious that one valve would bring it in quite well. Until you have made up a special short-wave tuner, the simplest way to receive the 65-metre transmission for KDKA is to use a two-coil holder with one coil as secondary and the other as reaction. The aerial circuit, consisting of two turns of wire wound into a ring of about 3 in. diameter, should be laid close to the secondary coil. In series with this wire should be placed a .0005 or other variable condenser set to a very low value. Actually I use about 20 degrees of a .0006 condenser in series. The secondary coil must, of course, be a special short-wave coil, and the Gambrel a/2 serves excellently, the tuning position for KDKA being about 10 to 15 degrees on the .00025 condenser. Tuning is exceedingly sharp, and as the set will oscillate very readily, another coil of the same size should be used for reaction. Two coils consisting of the smallest of the Burndept series will also serve here.



The result of trying to solder screws in inflammable "ebonite."

With regard to the grid leak values, I find that the clearest reception is with ½ megohm, but the loudest is with about 3½ to 4. There seems to be considerably less distortion with the smaller value grid leak, and as generally there is no difficulty in hearing KDKA providing you are able to tune him (at Wimbledon he comes in much better than Manchester), I recommend the smaller value.

Down to 50 metres the ordinary four-pin general purposes valves seem to serve quite well.

Do not despair if at first you fail to pick up KDKA or other very short-wave stations. It requires patience and a certain knack, and, of course, reaction adjustment is rather critical. Although generally it is not to be recommended, you may find at the beginning that adjustment of tuning on the filament resistance will help you. The bottom end of the secondary coil should also be earthed. If you are using a separate heterodyne, be sure to place it on the other side of the room, although if you place it too far away it will be difficult to adjust both your tuner and the heterodyne itself. My own practice is to use a pair of telephones with long leads, and to place the heterodyne just near enough to be able to reach the tuning handle. If your heterodyne is calibrated you can, of course, set it to the wavelength you want, and then make your own receiver oscillate slightly, and pick up the heterodyne wave as if it were the carrier wave of a different station. Do not do this, however, when other experimenters are likely to be working, as it is up to everyone

to avoid unnecessary radiation on these short waves.

My own experience is that KDKA comes in well after 11.30 p.m. these days and at midnight is very strong. Whereas on 100 metres it was almost impossible to distinguish the words owing to distortion, on 60 metres the speech is quite clear.

An "Ebonite" Story

On the previous page you will see a photograph of what appears to be the remainder of a wireless set after a serious fire. In point of fact, this is a piece of alleged "Ebonite" which turned out to be not ebonite but celluloid.

This is the story. A reader of these columns decided to make the crystal set I described in *Modern Wireless* for September. He bought in the Farringdon Road, London, a sheet of what appeared to be excellent ebonite. It looked like ebonite, cut like ebonite, and when drilled gave the long continuous shavings which one obtains when drilling a good piece of this material.

A switch and studs, together with a few terminals, were mounted in the conventional way, the panel turned face downwards, and a start made on soldering. In a minute or two smoke was seen to be emerging from the point where the screw made contact with the panel. The smoke spread, and it immediately became apparent that the alleged ebonite was on fire. As a valuable variable condenser was already attached to the panel, the whole was immersed in a bucket of water to try and extinguish it, but even this did not stop the smouldering, and in the end the portion containing the variable condenser was hacked away with a chopper. A piece of the panel material was brought to me, and I cut off a fine shaving, stood it in a tin lid, and applied a match. The shaving burnt with almost explosive violence.

The effects of selling panels of this kind are almost too terrible to contemplate, for the hot ash from a cigarette might convert an elaborate set into a blazing fire in a few moments.

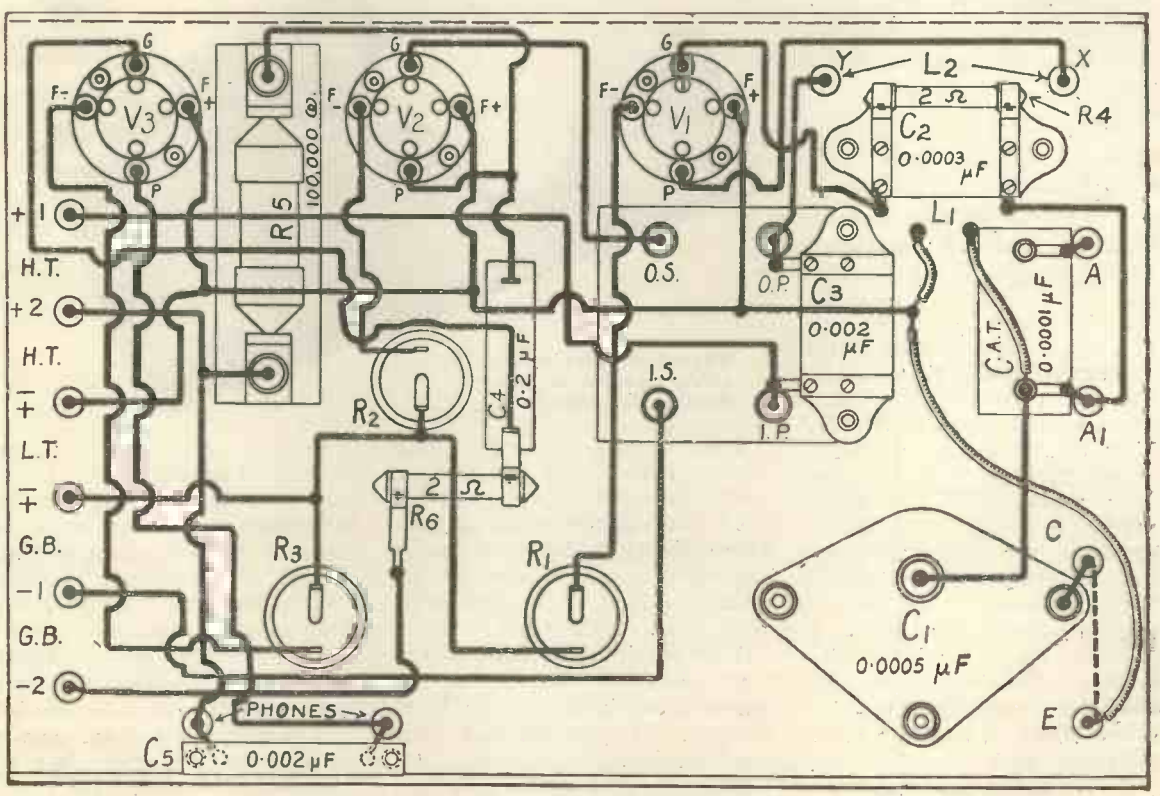
The moral, of course, is only to buy ebonite from thoroughly reliable sources, and, best of all, to buy one of the branded makes, which are now so easily obtainable. The substance referred to above appears to be celluloid with a mixture of some filling material and black dye.

The Type W4 Receiver

SIR,—I am taking the liberty of addressing this short note to you to let you know some of the results I am getting with Mr. Herbert K. Simpson's W4 three-valve set which appeared in *Wireless Weekly* on April 9. I am getting all the main stations, four of the nearest at good loud-speaker strength, and most of the relay stations. I get Berlin every hour in the day, and Radio-Paris about as good as Chelmsford. But last night (or, rather, this morning) I got America, and I am pleased to say that I heard Captain Eckersley from WGY at 12.50 a.m. explaining to the American people how the British system is worked. I heard the rest of the programme, and they were still playing when I turned in at 3 a.m.—Yours faithfully,

G. B. GARRY.

Lochore, Fifeshire.



Owing to an error in the photogravure process the wiring diagram which appeared on page 25 of our photogravure supplement was shown incorrectly, the grid and anode of the second valve being joined together. The corrected diagram appears above.

AN IMPROVEMENT ON THE SQUARE LAW CONDENSER?—

A SQUARE law condenser is a condenser which for a given movement along its scale always gives the same alteration of wavelength with a given inductance. That is to say, if one movement of the pointer or dial of a square-law condenser through, say, 10 degrees gives an alteration in wavelength of, say, 100 metres, every other movement along the scale will give a *pro rata* alteration.

Although for laboratory work a square law condenser is necessary, for ordinary tuning work it has its disadvantages. For instance, it would be impossible satisfactorily to use a .001 square law condenser in a short wave receiver for broadcasting, as such a receiver would be most difficult to tune—it would be far too critical. On the higher wavelengths the .001 square law condenser could be used without difficulty, because tuning on the higher wavelengths is much less critical than on the lower band, and much easier.

If a square law condenser is used for short wave work it should not exceed .0002 capacity. It would be found critical enough even with this capacity. But .0002 capacity is not nearly high enough for an ordinary receiver, as it does not provide sufficient capacity for working on the higher wavelengths.

It can be said, therefore, that a .0002 square law condenser cannot be used at all on the higher wavelength range, and that a .0005 or .001 square law condenser cannot properly be used on short wave work—certainly not .001.

If, therefore, a condenser can be obtained which has almost the accurate characteristics of a square law condenser but is easier to tune with, provides a negligible minimum capacity at one extreme of the scale while at the other end it provides a high maximum capacity, a condenser has been found which for ordinary tuning work (outside a laboratory) is a great improvement on any square law condenser.

There is now such a condenser available. On short wavelengths its characteristics make tuning much nicer and easier than even a .0002 square law condenser—it has a more open scale. The effect of this is to make tuning, especially long distance tuning, much easier on short wave work than any square law condenser possibly can be, and incomparably better than a square law condenser of higher than .0002 capacity. This condenser also possesses the advantage that despite its negligible minimum capacity it also possesses a high maximum capacity, which is always necessary for tuning on the higher wavelengths. With this condenser a receiver is equipped for much nicer tuning, better long distance tuning, much more flexible tuning than is possible with any square law condenser. Its pointer makes two revolutions—when small changes of capacity are required, you work on the first revolution, and on the second revolution when more critical changes of capacity are necessary—WITH ONE KNOB CONTROL.

This condenser is the new LISSEN MARK 2 MICA VARIABLE CONDENSER—and it is worth its price of 17s. 6d.

Negligible min. capacity.

Maximum rated at .001 (actually much higher). Lissen One-hole Fixing, of course.

With this condenser and Lissenagon coils a receiver is fitted with the best tuning combination it is possible to have. Ask for them if you are out for ease and distance.

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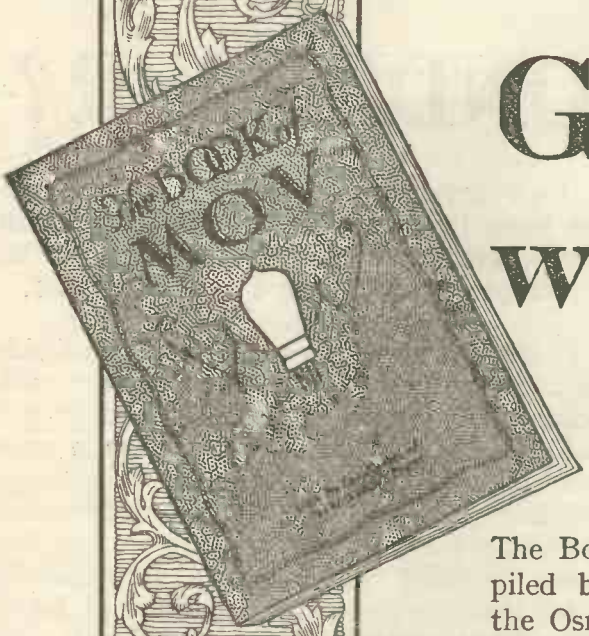

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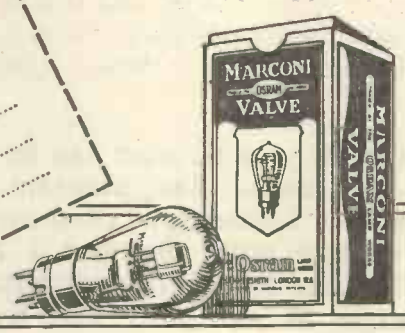

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Announcement of The M.O. Valve Company, Ltd.

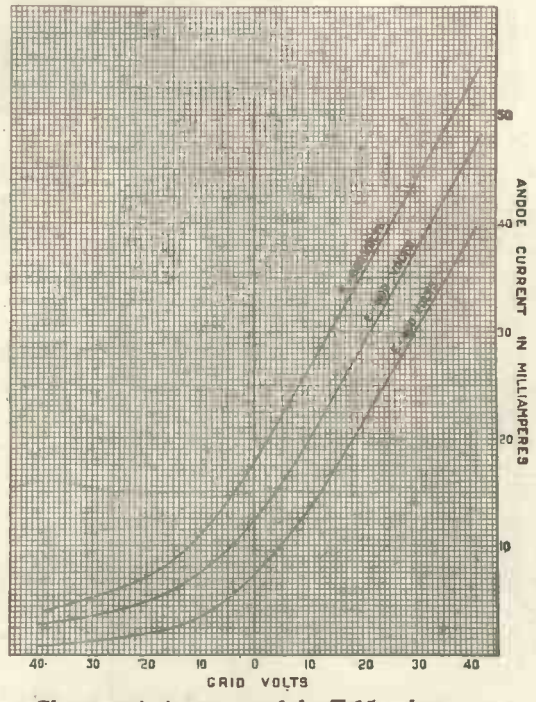
Some Notes on Low-Power Transmitting Valves

With the multiplicity of valves now available, the serious experimenter is often puzzled as to the correct valve for his particular needs. In this article the M.O. Valve Company are given the opportunity of explaining their own products.

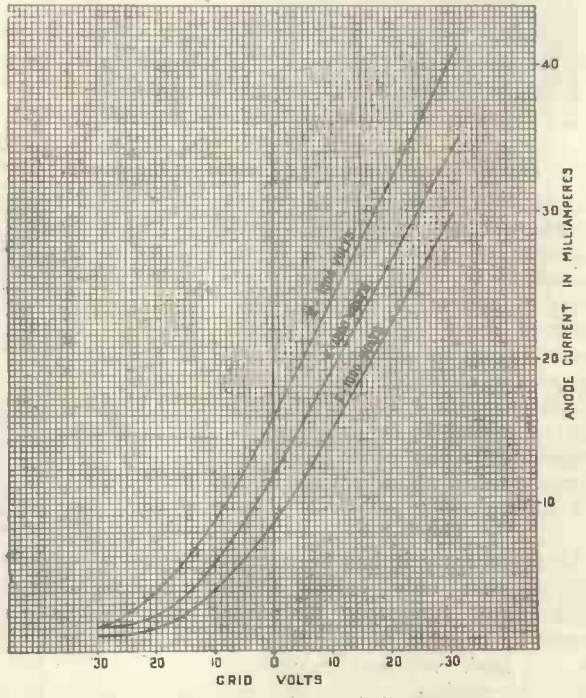
ALTHOUGH a great deal has been written about valves and valve types for receiving purposes, very little has hitherto been said about valves of interest to the experimenter with a small-power transmitting station. Transmitting valves are usually based on a rating of watts dissipation in the anode in the form of heat. This is, of course, very different from the input watts applied to the valve, which will exceed the I^2R watts, and it is therefore necessary to bear this fact in mind when selecting a transmitting valve of definite required power.

It is remarkable what results have been achieved with ordinary receiving valves, such as the "R" as transmitters—apart from that undesirable and sometimes unknowing transmission on the part of enthusiasts with a receiving set and plenty of aerial reaction!—but, of course, such a valve is not designed to stand up to a voltage of more than 200 at most. To meet this need a valve which has received special care in manufacture to obtain as high and as lasting a vacuum as possible must be used. The electrodes must also be of a more generous area, and insulation between anode and the other electrodes improved. A small valve of this type is the T.15, which is capable of dissipating 15 watts in the anode. This is designed to take up to 800 volts on the anode, and the filament consumes 1 amp. at about 5 volts. A slightly larger valve of the same design is available for those who desire to be able to deal with a greater amount of power, and thus increase their possible transmitting range. This is the T.30 which, as its name implies, dissipates 30 watts of energy at the anode and consumes 1.8 filament amps. at about 7 volts. In this case the anode will stand a potential of 1,000 volts, the insulation at the pinch being sufficient to withstand this pressure.

For the more ambitious experimenter a still larger valve rated at a watts dissipation of 50 can be obtained. This, the T.50, is the largest which can be claimed to lie within the range of low-power oscillating valves for transmitters, and is a double-ended tube, the anode lead being brought to one end, and the grid and filament leads to the other. This, of course, increases the insulation efficiency, so that the anode voltage may be increased to 1,500. The filament of the T.50 consumes 2.5 amps. at 7 volts.



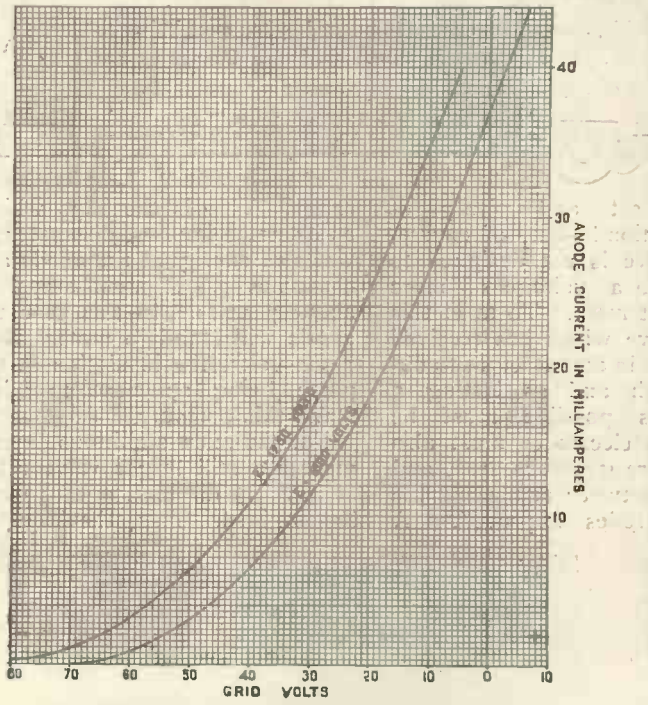
Characteristic curves of the T.15 valve.



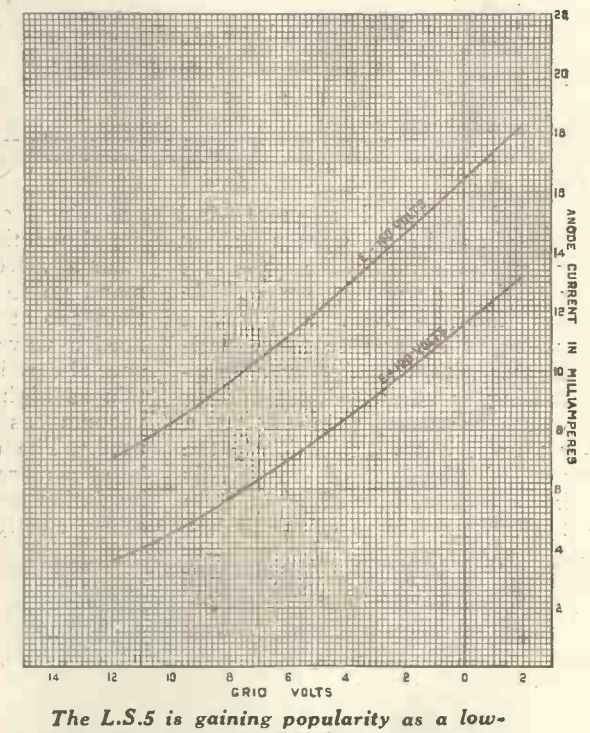
Curves of the T.30 for various voltages.

Mention may here be made of the U.3 type of valve, which is a two-electrode rectifier suitable for supplying H.T. direct current for the three types of transmitters mentioned above. The then, can confidently be recommended to take the place of the T.15 and show at the same time a most marked increase in filament efficiency, consuming as it does only 0.8 amps. at 4.5 volts.

may be of some assistance to existing and prospective wireless transmitting enthusiasts, and throw some light on types of valves which are almost unknown to the general public.

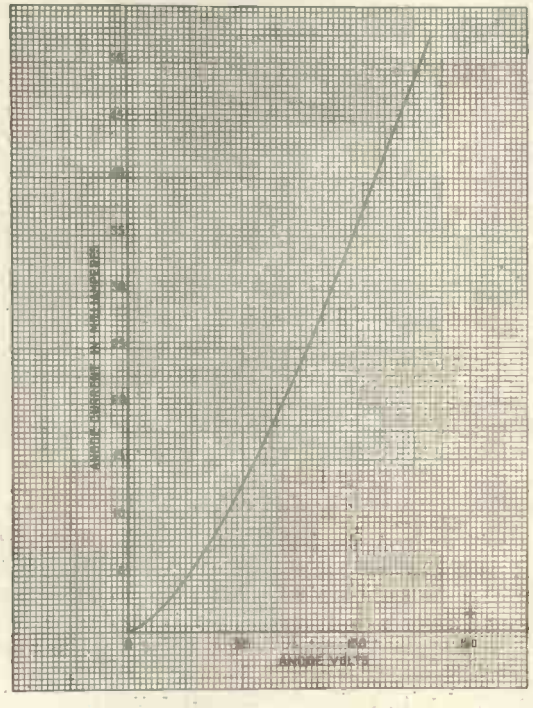


The T.50 will dissipate 50 watts on the anode.



The L.S.5 is gaining popularity as a low-power transmitter.

U.3 is capable of dissipating 15 watts, and will withstand a back pressure of 3,000 volts. If required to be used at this pressure, of course, a protective resistance must be placed in the anode circuit to prevent overheating of the electrode by excessive anode currents. The total emission obtained is 80 milliamps., impedance 2,000 ohms, and the filament takes about 1.5 amps. at 5.5 volts.

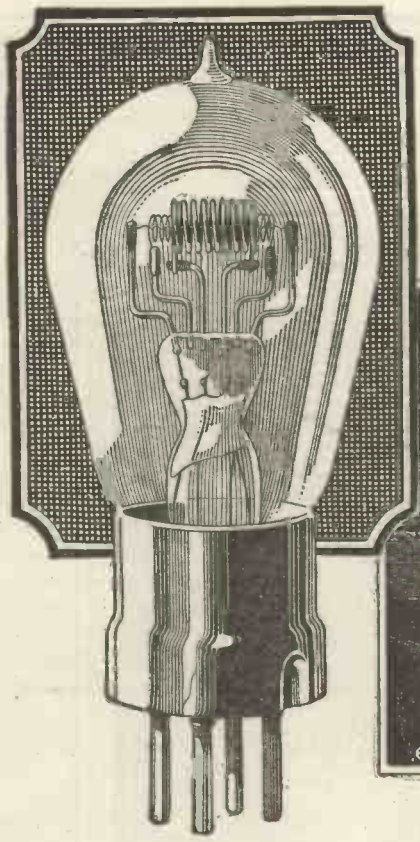


The U.3 rectifying valve.

The L.S.5

Until recently it has been considered that only valves fitted with pure tungsten filaments would be capable of standing up to the high voltages necessary for transmitting work; but experiments carried out on one of the most reliable dull emitters obtainable, the L.S. 5-power valve, show that this valve can be operated with no detriment to its dull-emitting properties, at voltages up to 400. The L.S.5 has indeed actually been tested and has run for a very considerable period at an anode pressure of 600 volts, and steady anode current of 40 milliamps. without showing any falling off in emission. This type of valve, The L.S.5 can, of course, be used also with excellent results as the modulator valve.

It is hoped that these remarks We would also add that all valves mentioned above are made by the M.O. Valve Company, Hammersmith.



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Have you noticed it?

10/-

If you listen intently to your gramophone you will become aware of the light scratching of the needle. But although you hardly notice it unless you listen specially it is there all the while.

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Filament Amps. ... 0.4
Anode Volts ... 40-80

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E.P.S.4.

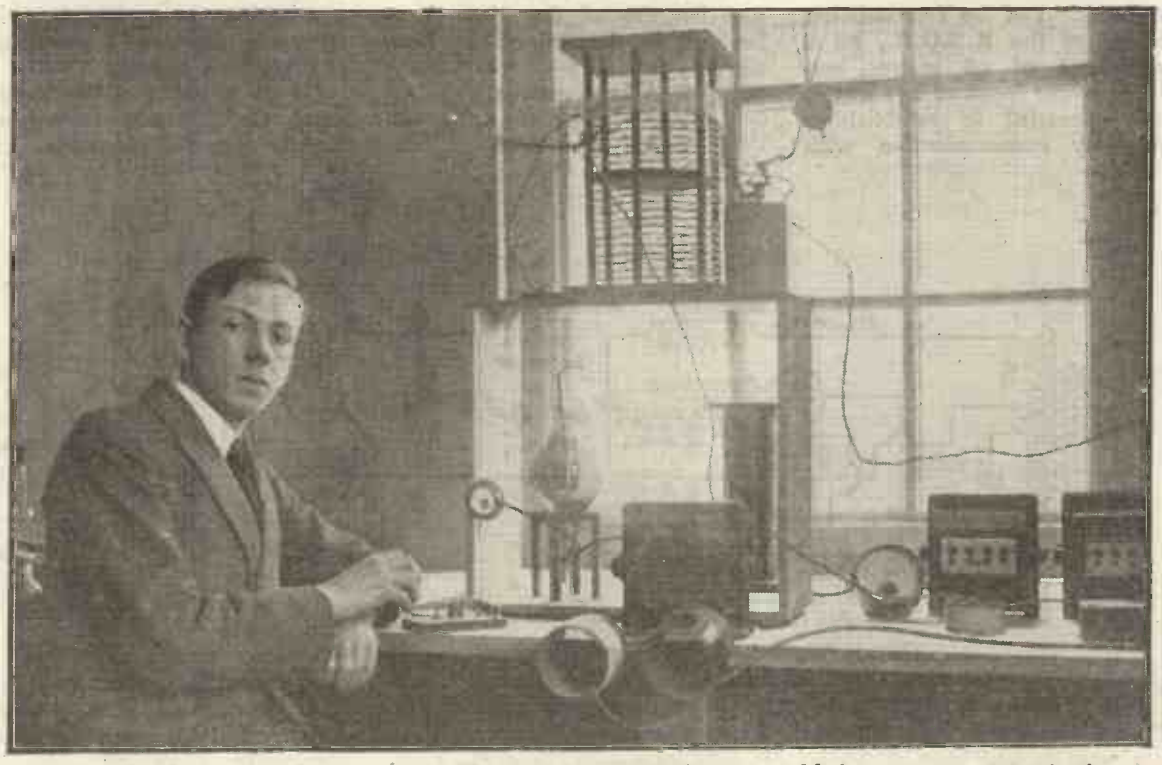
Some Record-Breaking Achievements

An account of the recent amateur two-way communication between Great Britain and New Zealand, and a description of the apparatus in use at Mill Hill School, where Mr. Goyder conducted his experiments.

IT will be remembered that during the official amateur tests last winter the record for being received the greatest number of times in U.S.A. by a British experimenter was held by Mr. C. W. Goyder, a schoolboy at Mill Hill School. It is to this young experimenter that the honour of accomplishing a feat hitherto unaccomplished by a British amateur again falls. This time Mr. Goyder is the first British amateur to establish two-way communication with New Zealand, a distance of 12,000 miles. It is significant that these records have all been made on wave-lengths around and about 100 metres. Mr. Goyder, who is now a first year engineering student at the City and Guilds Engineering College, went up on the morning of Saturday, October 18, to the Mill Hill School set and at 6.15 a.m., while listening for American amateurs, happened to hear the call sign Z4AA on a wave-length of approximately 95 metres. Mr. Goyder (G2SZ) immediately replied on a wave-length of 98 metres, and established communication. He received a congratulatory message to the Radio Society of Great Britain, and was told to inform 2OD (Mr. E. J. Symonds, of Gerrards Cross) that Z4AA had received him strongly the previous night. Z4AA informed him that he was using 150 watts input. The last audible signals were at 7.40 a.m. The morning was clear, cold and moonlight, the barometer being high, and atmospherics which were bad at first had ceased by 6 a.m. On Sunday morning at 6 a.m. G2SZ again called Z4AA and sent the following message: "Congratulations to the Radio Society of New Zealand on achievement, and greetings.—Radio Society of Great Britain." At 6.15 a.m. he heard Z4AA acknowledge the receipt and reply that the Prime Minister of New Zealand sent his congratulations. Signals were audible only until 7.15 a.m., and atmospherics were bad. It should be noted that it was raining at the time.

On Monday morning the atmospherics were again bad, but in spite of this G2SZ again established communication, and after finishing with Z4AA, heard Z4AG calling on a wave-length of 92 metres. G2SZ replied and established communication, but, owing to fading, communication was only maintained for about 5 minutes.

A third New Zealand amateur, Z4AK was also heard on 89



Mr. C. W. Goyder, the young experimenter who was the first to establish two-way communication with New Zealand.

metres, but two-way communication was not established. During the three mornings over half-a-dozen messages were handled and no repetitions were necessary.

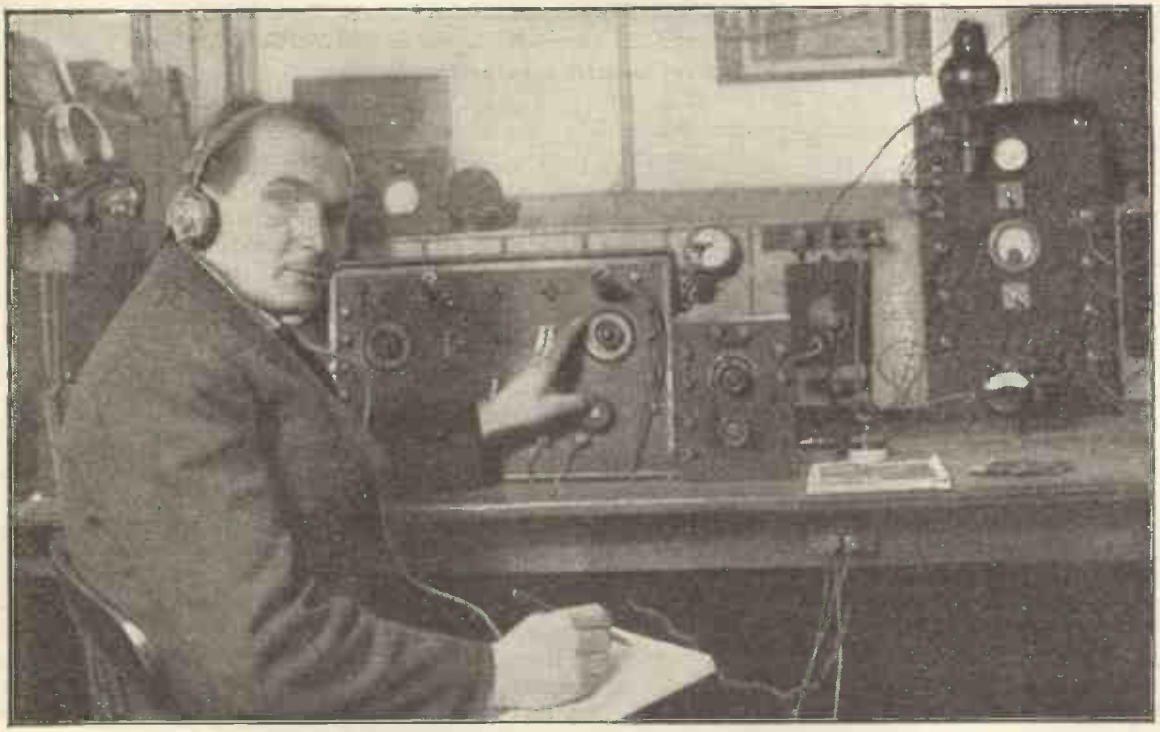
to his credit, also succeeded in working with Z4AK.

On the morning of the 19th (Sunday), G2WJ, Mr. R. L. Royle, carried out the reception

G2SZ. Z4AA was readable on one valve.

Both G2KF and G2NM used two-valve receivers.

As mentioned above, G2OD,



Mr. J. A. Partridge, who has also established two-way communication with New Zealand.

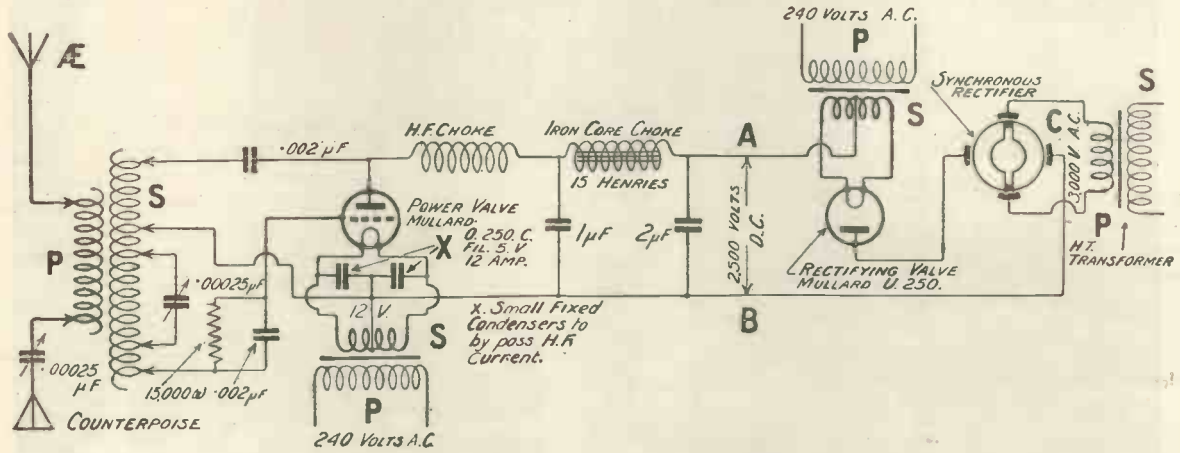
In addition to G2SZ, G2NM, Mr. G. Marcuse, of Caterham, the President of the Transmitting Section of the R.S.G.B., on a wavelength of 96 metres, and with a power input of 250 watts, was successful in establishing two-way communication with

only of Z4AG, Z4AA and Z4AK between 7 and 7.30 a.m. The wavelengths of the New Zealanders, as determined by him, were as follows:—

Z4AG, 96 metres.
Z4AA, 93 metres
Z4AK, 89 metres.

Mr. E. J. Symonds, was also successful in establishing communication with Z4AA. Mr. Symonds also used a wavelength of under 100 metres.

On the morning of Wednesday, 22nd, G2SZ again worked with Z4AA. On this occasion, how-



Circuit diagram of the transmitting circuit used by Mr. Goyder.

Z4AA and Z4AG. G2KF, Mr. J. A. Partridge, of Merton, S.W.19, the well-known British experimenter, who has a large number of long-distance records

Mr. Royle's wavemeter had been accurately calibrated by the Radio Society of Great Britain. It will be noticed that his readings differ slightly from those of

ever, conditions were very bad. The weather at Mill Hill was stormy, and the wavelength was constantly changing, probably due to the aerial swinging. The

addresses of the New Zealand amateurs are :—

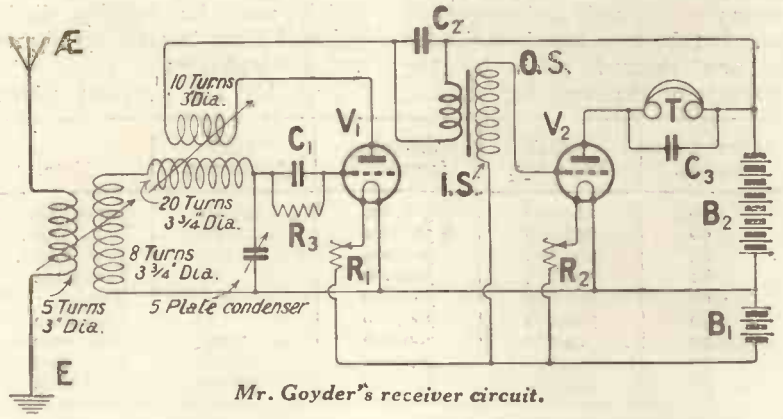
Z4AA, Mr. Bell, " Waiheno," Dunedin, N.Z.

Z4AG, Mr. R. Slade, 15, Harbour Terrace, Dunedin, N.Z.

Z4AK, Mr. Shiel, Dunedin, N.Z.

Dunedin is on the South Island and on the East Coast.

A description of the apparatus used by Mr. Goyder is of interest. The transmitter used was the standard Mill Hill School set consisting of a loose-coupled Hartley circuit, the input being 200 watts. A Mullard O 250 C. 60-watt transmitting valve was fed by means of a step-down transformer giving an output of 12 volts 5 amps with an input of 240 volts A.C. Two fixed condensers are connected across the split secondary to by-pass the H.F. current. Another transformer steps up the mains to 3,000 volts A.C., and feeds through both a synchronous rectifier and a Mullard U.250 rectifying valve to the plate of the transmitting valve. The reason for using a rectifying valve is that it is not possible to put smoothing chokes or condensers across a synchronous rectifier, as the voltage and current must be kept in phase to avoid sparking at the contacts of the commutator (C). A rectifying valve is therefore placed in series with the positive lead, and this prevents the current from getting back to the synchronous rectifier. Therefore full wave rectification is obtained which may be smoothed out in the usual way. The full 3,000 volts is not, however, applied to the plate of the transmitting valve owing to the volts drop due to the impedance of the rectifying valve. The P.D. between A and B is therefore about 2,500 volts D.C. The secondary of the aerial tuner consists of 18 turns of ¼-in. copper tubing wound in a spiral of 6 in. in diameter, and the primary consists of 5 turns of similar tubing. The transmitting aerial is 45 ft. long with a 40-ft. cage lead-in, and consists of five wires spaced horizontally (flat top). A counterpoise is used instead of the usual earth, and consists of 8 wires 15 ft. below the aerial with a cage lead-in (which Mr. Goyder considers gives better results than bunched wires).



Mr. Goyder's receiver circuit.

The receiver consists of a detector followed by one stage of low-frequency amplification, a special low-loss tuner of cylindrical basket coils wound with No. 22 D.C.C. wire being used. It will be noticed that the secondary of the tuner is split and that reaction is applied to a grid coil of 20 turns. With this tuner and a 5-plate condenser Mr. Goyder is able to cover a wavelength range of 75-150 metres. The primary is aperiodic loosely-coupled to the secondary. A separate heterodyne, although used part of the time, was not found to be essential. The detector valve was a standard hard valve *not* of the low-capacity type.

British experimenters are now making a daily effort to establish communication with New Zealand at 5 p.m. G.M.T., and with Australia at 6 p.m. G.M.T. So far, little success has been obtained, which points to the fact that conditions are more favourable during the period of New Zealand dusk and British dawn. Mr. Marcuse, however, has heard signals about 6.30 p.m. G.M.T.

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RADIO PRESS, LTD.

October 22, 1924.

Supersonic Heterodyne Reception in Theory and Practice

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

The second instalment of the series of articles on this important development.

Fig. 6 is a table showing the effect of varying the condenser which regulates the frequency of the local oscillations.

Advantages of Beat Reception.—Beat reception has several advantages apart from the fact that continuous waves are by its means readily split up into groups and that the note may be adjusted to any desired pitch by the operator at the receiving station.

Condenser reading.	Local frequency.	Incoming frequency.	Beat frequency.	Note.
100	265,000	300,000	35,000	Inaudible.
90	290,000	300,000	10,000	Very high.
85	299,000	300,000	1,000	Best value.
81	299,975	300,000	25	Inaudible.
80	300,000	300,000	—	None.
79	300,025	300,000	25	Inaudible.
75	301,000	300,000	1,000	Best value.
70	310,000	300,000	10,000	Very high.
60	335,000	300,000	35,000	Inaudible.

Fig. 6. Table showing what is happening at different adjustments of the condenser which governs the frequency of the local oscillations.

These additional advantages include—

(1) Amplification of signals is obtained.

(2) The effect of spark signals and atmospherics may be lessened.

(3) Very high selectivity is obtained.

Heterodyne advantages

If we split up the continuous oscillations into groups by means of an interrupter the maximum amplitude would be simply that of the continuous oscillations. If we employ the heterodyne method of reception we will vary the amplitude of the groups between zero and twice the amplitude of the incoming signals; we thereby gain an amplification effect. These are the conditions when the local oscillations have the same amplitude as the incoming oscillations, but the same kind of amplification effect is obtained when the incoming signals are weaker than the local oscillations.

The second advantage is due to the fact that spark signals and atmospherics when heterodyned produce low notes which are of even lower frequency than the original signals. Incoming continuous wave signals, however, when heterodyned, may be made to give clearly musical notes which may be readily distinguished from interfering signals and atmospherics.

Probably the greatest advantage of heterodyne reception is that greater selectivity may be obtained as between different continuous wave stations. The use of continuous waves of itself results in a greater selectivity, but heterodyne reception enables us to differentiate between two or more continuous wave stations all working on wavelengths very close to one another. The following example will make this clear.

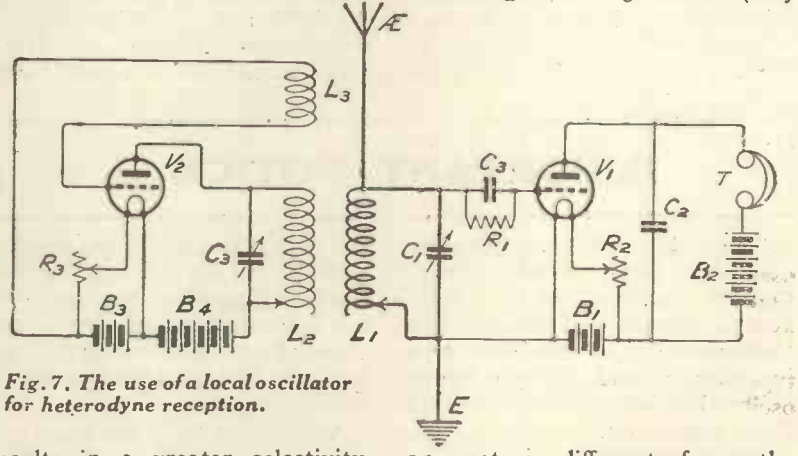


Fig. 7. The use of a local oscillator for heterodyne reception.

Let us suppose that two continuous wave stations are transmitting, one on a wavelength of 700 metres and the other on 702 metres. The frequency of the waves from the 700 metre station is 428,571; a suitable local frequency to give beats of 1,000 would be 427,571. The 702 metre station will produce waves having a frequency of 427,407. The oscillations due to these will produce beats with the local frequency (427,571) and these beats will have a frequency of 164.

High Selectivity

Thus it will be possible to receive the 700 metre station without material interference from the 702 metre station, which will only produce in the receivers a very low note above which the high note of the other station may be clearly read. If the interfering station had a wavelength of 690 metres, the beats produced would have a frequency of 7,000—an extremely high note which will not cause interference. If the interfering station had a wavelength of 685 metres (only 15 metres different from the desired wavelength) no signals at all would be heard as the beat frequency would be above the audible limit. Such high selectivity is, of course, not obtainable with ordinary spark reception

methods where sometimes 100 metres difference would not enable the operator to separate the stations. If examples be worked out for different frequencies it will be found that the selectivity of beat reception greatly decreases as the wavelength increases. The full advantages of beat reception are therefore only enjoyed when working on the shorter wavelengths.

Adjusting the Oscillator

While considering the effect of interference, we should note that as we can adjust our local frequency to two different values to give the same beat note, we should employ the frequency which causes least interference from other stations. It will usually be found that less interference is experienced on one adjustment than on the other.

External Heterodyne Vacuum Tube Receivers

Fig. 7 shows a complete wireless receiver using a valve $V1$ as a detector of the oscillations. Across the grid and filament is the usual oscillatory circuit $L1$ $C1$ shown directly connected to aerial and earth. Such a circuit may be used for the reception of continuous waves by the use of a local oscillator placed in its vicinity. This oscillator is of a type already discussed; the anode oscillatory circuit $L2$ $C3$ has coupled to it the regenerative coil $L3$ so arranged that the valve $V2$ generates continuous oscillations at a frequency which may be varied by altering the capacity of the condenser $C3$. Any kind of oscillator may be used, and it is proposed to show, in subsequent figures, various practical types.

The circuit of Fig. 7 may be made more practical by heating the oscillator filament off the accumulator $B1$ and utilising the high-tension battery $B2$ to supply the anode circuit of the valve $V2$.

Fig. 8 shows a two-stage receiver employing a loose-coupled oscillation transformer, a valve $V1$ as a detector and a second valve $V2$ as an audio-frequency amplifier. The oscillator, shown on the left, derives its filament current and anode voltage from the batteries $B1$ and $B2$ respectively. It is not necessary, in circuits of this kind, to couple a portion of the oscillator circuit deliberately to the receiver, although this may be done. It is best, if possible, to place the oscillator close to the closed receiving circuit, $L2$ $C2$, rather than to the aerial circuit, $L1$ $C1$; by doing this, we lessen the feeble radiation of continuous waves from the aerial, always existing when these kinds of circuits are employed. A reaction coil may be used with the valve $V1$ if desired.

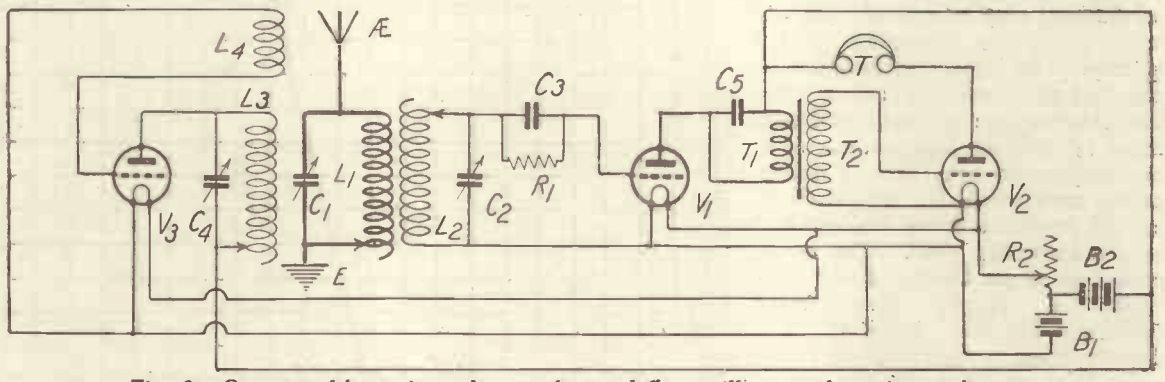


Fig. 8.—One set of batteries only may be used for oscillator and receiver valves.

Self-heterodyne Receivers

Generally speaking, it is preferable to employ external heterodyne methods for the reception of continuous waves, particularly when a multi-stage receiver is used. The disadvantage of such circuits is that it is rather difficult to change rapidly from one wavelength to another as both oscillator and receiver require to be tuned. To avoid these difficulties, the self-heterodyne receiver is often used. In this type of receiver the receiving circuits oscillate of their own accord.

The valve itself may be used to detect the beats. Fig. 9 shows a very practical and useful self-heterodyne circuit in which the valve not only provides the local continuous oscillations, but also acts as a detector of the beats produced. The local oscillations are produced in the circuit $L1$ $C1$ and are given a frequency slightly different to that of the incoming signals; beats are produced in the circuit $L1$ $C1$ and are rectified by means of the leaky grid condenser, $C2$, in the usual manner; the rectified beats are detected by the telephones T.

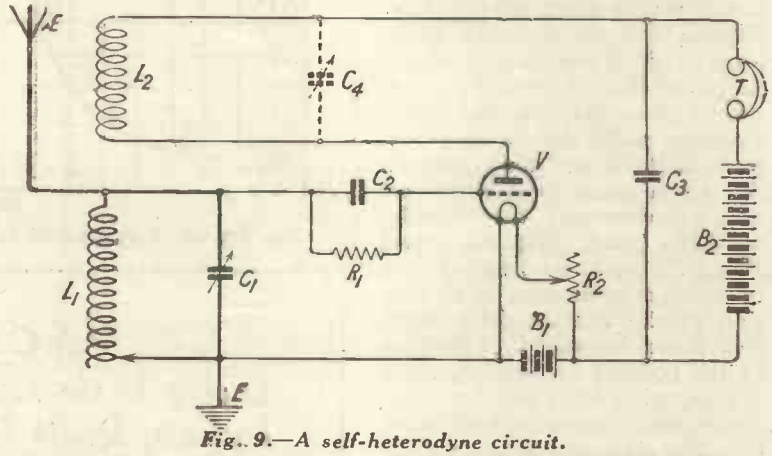


Fig. 9.—A self-heterodyne circuit.

Polarising Effects

Another reason for the great sensitiveness of heterodyne reception is that the efficiency of the detector is greatly improved by the *polarising* effect of the local source of oscillations. We always gain by having a local source of oscillations, even though the frequency of these oscillations may be entirely different from the incoming frequency. The important improvement of the rectifying action of the detector due to local oscillations is entirely independent of heterodyne or beat action, and exists even when the local oscillations have the same frequency as the incoming ones. The explanation of the improved rectification is usually given as follows:—If we imagine a detector tube is operating at the point C of the curve in Fig. 10, we will readily see that very weak signals will cause the representative point to move along what is almost a straight portion of the characteristic curve. Although the "curve" near the point C is really a curve in the usual sense, yet, if we take a very small portion of the "curve" near C, it will be practically a very short straight line. Signals are consequently weak, because of the poor degree of rectification. If, now, we apply a local source of oscillations, the representative point will be swept up towards the E and down towards A. Upon these local variations are superimposed the signals, with the result that the signal E.M.F.'s produce a large change of anode current on a small portion of the characteristic curve well above the point C in the case of the positive half-cycles, while the negative half-cycles produce a very small variation well below C. The difference between these two variations is considerable, and will produce a substantial signal in the telephones. In other words, we have enabled the incoming signals to utilise the big difference in slope between the portions CE and AB instead of using the slight curvature at the point C. The same kind of explanation applies to any kind of rectifier, whether of the crystal or vacuum tube type.

(To be continued)

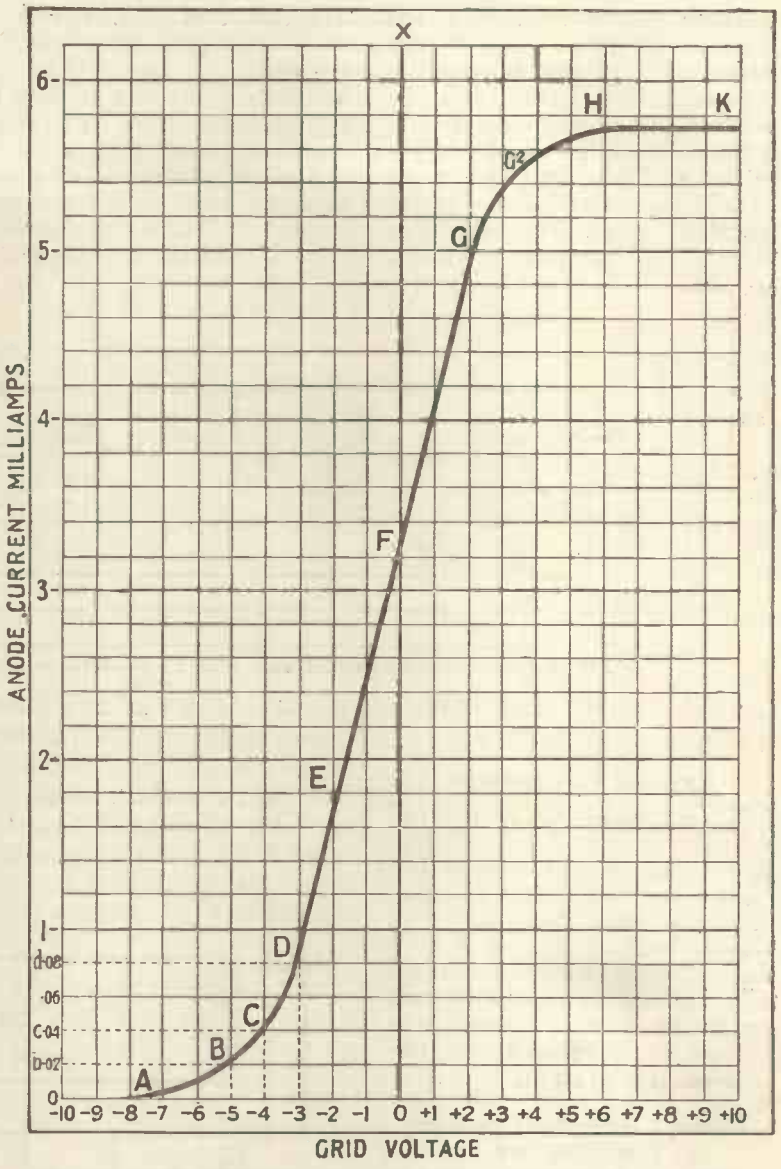


Fig. 10.—A characteristic curve of a three-electrode vacuum tube.

A Transmitter's Wavemeter

(Concluded from page 50.)

only necessary to place the heterodyne about 6 inches away, and to take a series of readings as before. The sole effect of adjusting the crystal will be to vary sensitivity, and thus alter the amplitude of the swings of the galvanometer needle. For any given setting of the crystal detector a maximum deflection will be given when the two wavemeters are in tune, and in practice the crystal can be left set for a considerable time without alteration, particularly when a micrometer-adjusting crystal detector (such as the Burndept) is used.

Once the set has been calibrated a few trials will show which is the best position on the operating bench to place it when adjusting the transmitter. The rule should be followed to place the wavemeter as far away as possible from the transmitter while still getting sufficient deflection to make an accurate reading. To give some idea of the readings it may be said that using an Igranic 50 coil, 200 metres on my instrument comes at 44 deg. on the 180 deg. scale. Using a Pye No. 34 coil, 200 metres comes at 102 deg. on the scale, while with a Burndept S3 200 metres comes at 90 deg. A Gambrell "A" coil brings 200 metres at 110 deg., and an Igranic C1 at 170 deg. 150 metres on this last coil comes at 112 deg. and 100 metres at 50 deg. The lettering on the instrument shown is done with Radio Press panel transfers.

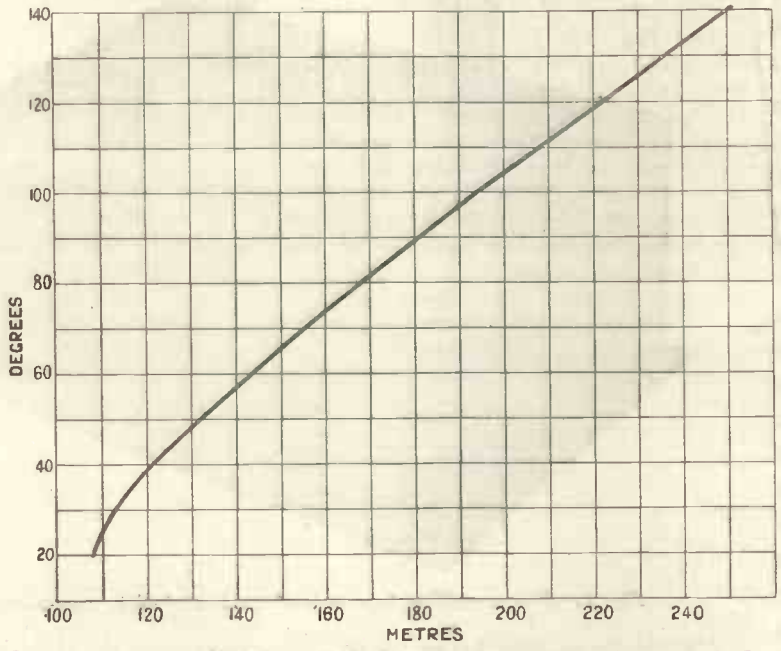


Fig. 6.—A typical calibration curve.

□ □ □

An Aid to Workshop Tidiness

MOST people will agree that neatness is a point which should be considered, and there is no reason why this factor should not be applied to a wireless receiver. On most experimental benches one can see tuning coils, either of the plug-in or basket type, or both, lying about in confusion, taking up space and getting in the experimenter's way, and just because some neat rack, such as is described in this article, is needed. This rack will be found of great use in such cases. The diagrams given show, in Fig. 1, a rack for plug-in coils, and in Fig. 2 a rack for basket coils. It is intended, whichever type may be used, that they should be a part of the receiver itself, being fixed to the panel and thereby enabling the operator to always have the coils he may desire to use at hand. The construction of the first rack is obvious from the diagram. Four valve or coil pins are spaced 1 in. apart on a piece of ebonite, and four holes are drilled in a corresponding position on a line parallel with the pins, at a distance of 9/16 in. The number of pins may be altered according to the number of coils in constant use. The construction of the second rack is even simpler. A base is made, as before, having a centre hole drilled to clear 2 B.A. rod. Next a cotton reel is obtained and secured to the base as shown by means of a short length of 2 B.A. rod, and two nuts, a piece of ebonite being cut to the shape of the top of the reel and placed as shown. The basket coils, when not in use, are then dropped over the cotton reel.

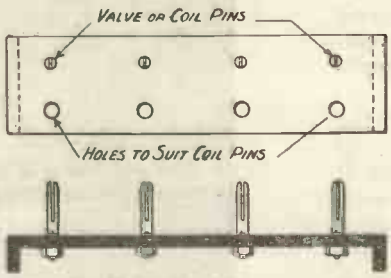


Fig. 1.—How the rack for plug-in coils is made.

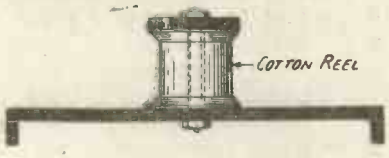


Fig 2.—The simple form of rack for holding basket coils.

H. B.

A Two-Valve Resistance

By HERBERT

A constructional article of s... purity of

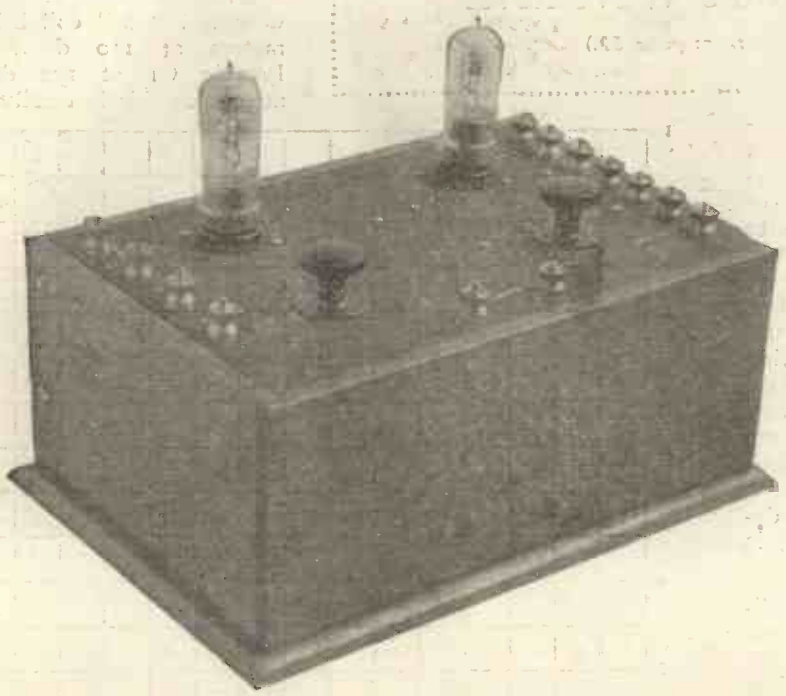


Fig. 1.—The amplifier is neat and symmetrical in appearance.

TO those who prefer purity of tone to volume of sound in broadcast reception, the amplifier to be described will make special appeal. Most readers will know that resistance-coupling in low-frequency amplifiers gives purer reproduction than some of the cheaper makes of transformer, and would be universally used but for one drawback; using a given number of valves, transformer-coupling gives louder signals than resistance-coupling. The difference is not very great, however, three resistance-coupled valves being roughly equal to two using transformer-coupling, and to those who place quality first, the purity of reproduction always associated with resistance-coupling, which is used in the present amplifier, will be adequate compensation for loss in volume.

A photograph of the finished instrument is seen in Fig. 1. The terminals on the left of the panel are marked H.T.+, A, B and C, and are provided to enable the amplifier to be connected to any existing receiver, whether crystal or valve. On the right-hand side of the panel are the battery terminals. Reading from the back these are:—H.T.+1, H.T.+2, H.T.−, L.T.+, L.T.−, Grid Bias 1 and Grid Bias 2. In the front of the panel are seen the telephone terminals.

Two valves are employed, and are seen at the back of the panel with their respective rheostats immediately in front of them. The type of rheostat used permits the use of either bright or dull-emitter valves.

The Circuit

A diagram of the circuit is seen in Fig. 4. The terminals H.T.+, A, B and C are employed for connecting the amplifier to the receiver.

If we desire to amplify the signals obtained from a crystal receiver, we connect terminals B and C of the amplifier to the telephone terminals of the crystal set. The varying potentials thus applied to the grid of V1 appear in magnified form in the plate circuit of this valve in which is included the anode resistance R4. The potentials across this resistance are communicated to the grid of V2 via the fixed condenser C2. These result in amplified currents in the anode circuit of the second valve in which is included the telephones T, shunted by C3 of 0.004 μF. The customary grid leaks R5 and R6 are included to prevent excessive negative charges accumulating on the grids of the valves. The lower ends of these leaks are taken to two separate terminals marked G.B.−1 and G.B.−2, the purpose of these being to enable a suitable biassing potential to be applied to the grids by means of a few dry cells.

Anode Voltage Terminals

Provision is made for applying separate anode potentials to the two valves by means of the two terminals H.T.+1 and

Fig. 3.—Wiring is stra...

Amplifier with e Coupling

' K. SIMPSON.

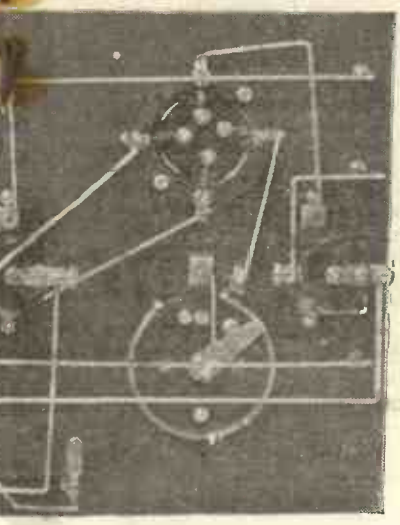
cial appeal to those who value oduction.

H.T. + 2. The need for this is occasioned by the resistance R4, which prevents the full voltage applied to its upper end from reaching the anode of the valve. It is true, of course, that the telephones in the anode circuit of the second valve also cause a drop in potential, but this is very small when compared with that caused by R4.

The two blocking condensers C4 and C5 each have a capacity of 2 μF.

Components Required

In the following component list the names of the manufacturers are included so that the constructor may exactly duplicate the instrument should he so wish. In any case components of doubtful quality should be avoided.



ightforward and simple.

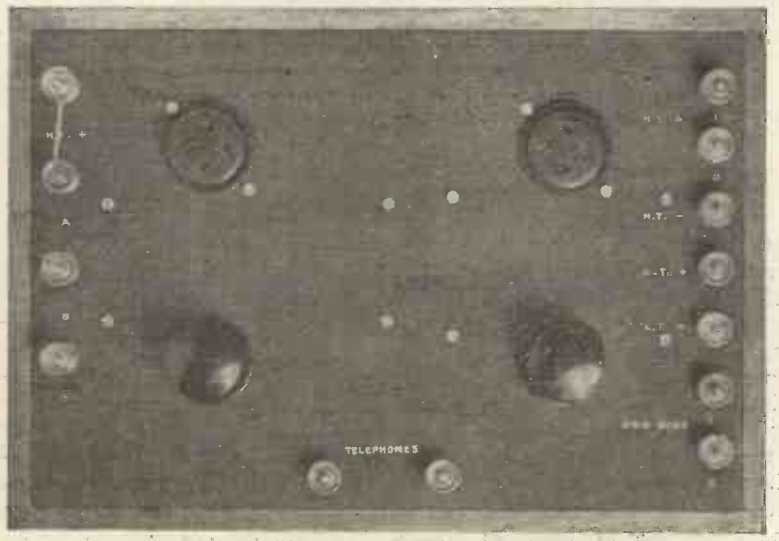


Fig. 2.—Anti-vibratory valve sockets are used.

Ebonite panel 12 ins. × 8 × ¼ in. (Paragon, Peter Curtis, Ltd.).

Cabinet of suitable size.

13—4 B.A. terminals.

12—6 B.A. 1-inch screws and nuts.

2 filament resistances (Burndept, Ltd., Dual Type).

2 valve holders (Burndept, Ltd., "Antiphonic").

2 Polar resistance-capacity coupling units (Radio Communication Co., Ltd.).

2—2 μF fixed condensers, T.C.C.

1 0.004 μF fixed condenser (Dubilier).

A quantity of square section tinned copper wire.

1 set of Radio Press panel transfers.

In place of the two Polar resistance-coupling units mentioned, the following components may be used if desired:—

2—0.25 μF fixed condensers.

2—2 megohm grid-leaks with clips.

2—80,000 ohm anode resistances with clips.

Notes on Components

The Polar resistance-coupling units are compact and efficient, and it is certainly easier to wire up a resistance-coupled receiver employing these than in cases where the separate components must all be mounted and numerous connections made.

The valve holders are of unique design in that they are constructed to prevent shocks reaching the valves, and thus eliminate microphonic effects.

Radio Press panel transfers have been used for making the various markings on the panel, and are equal in appearance to the best (and incidentally expensive) engraving.

Panel Drilling

The panel is drilled in accordance with Fig. 5, from which it is seen that relatively few holes are required. The positions for the screws which are to hold various components underneath the panel are best found when all components are to hand. The approximate positions for the resistance-coupling units may be found by referring to Figs. 3 and 8.

If it is decided to dispense with the resistance-coupling units it will be necessary for the constructor to use his own judgment both as regards the mounting of the components and their subsequent wiring. The latter phrase, of course, refers only to the *method* of wiring; the circuit should still remain as in Fig. 4.

Mounting the Components

With the panel drilled, assembling is commenced, the usual rule

being observed of mounting the smaller parts first.

No difficulty should be experienced in fitting any of the components. The valve-holders fit snugly into holes cut for them, and are secured by means of two or four screws.

Wiring

As may be gathered from the photographs of the back of the panel, this presents little difficulty. Fig. 6 is the wiring diagram, with the aid of which the whole of the wiring may be carried out. Any point of difficulty may be cleared by reference to the photographs showing the wiring.

It will be observed that the telephone condenser is held in position by the stiff wire used for connecting it to the telephone terminals.

The two resistance-coupling units are each fitted with four milled nut terminals, so that soldering is rendered unnecessary here. Care should be taken, however, to see that these nuts are screwed down securely to ensure a good connection to the wire.

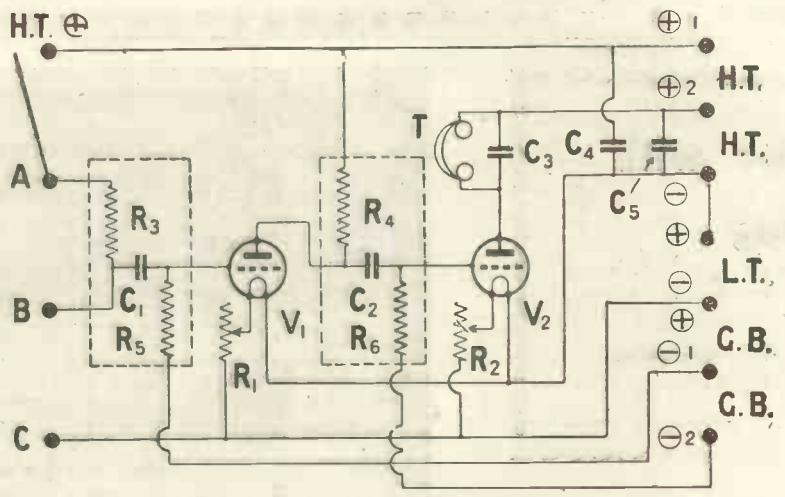


Fig. 4.—Theoretical circuit diagram.

The Cabinet

This may be bought ready made or constructed by the reader as desired. In the present instance the panel fits flush with top of the cabinet. The actual outside measurements of the latter are 12¾ ins. long by 8¾ ins. wide by 5⅝ ins. deep. Ledges are fitted inside the cabinet to support the ebonite panel.

Using the Amplifier

In Fig. 7 is shown the method of connecting the amplifier to a crystal receiver. The telephone terminals of the latter are joined to terminals B and C of the amplifier. The phone terminal nearest the aerial should be connected to terminal B and the other to terminal C.

If the circuit of the crystal receiver is not as depicted in Fig. 7, the same rule should be followed to obtain correct results. In order to make the statement " nearest the aerial " quite clear it should be stated that the tuner is mentally excluded while find-

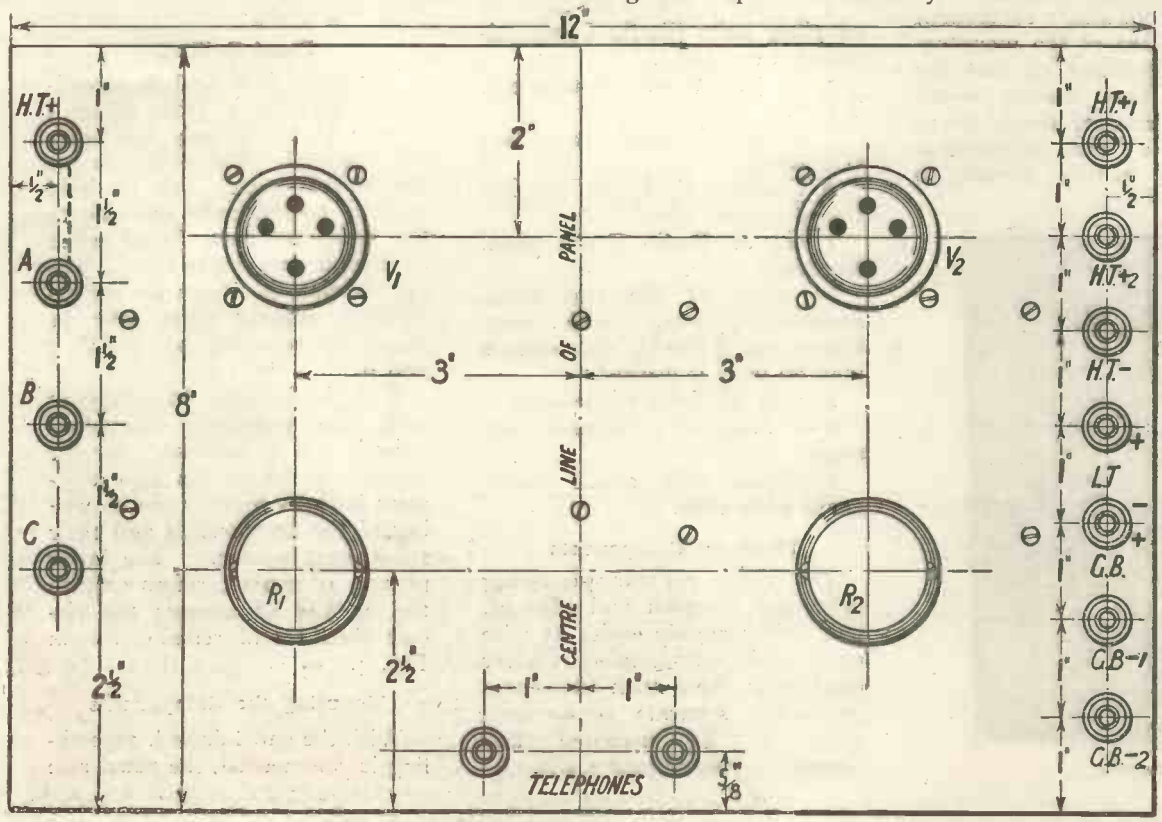


Fig. 5.—Drilling plan to half scale.

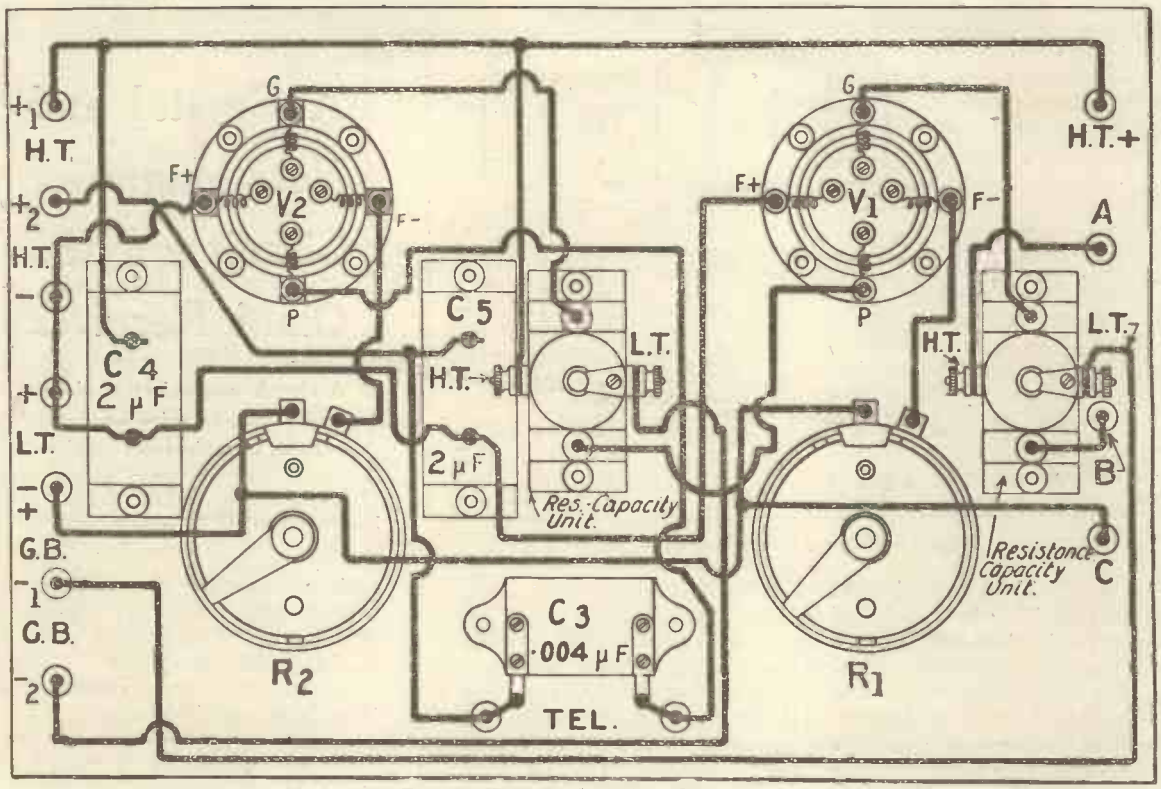


Fig. 6.—Practical wiring diagram.

ing the correct terminals. Thus in Fig. 7, although no actual terminals are shown in the crystal circuit, the line joining one side of the crystal detector to terminal B is correct.

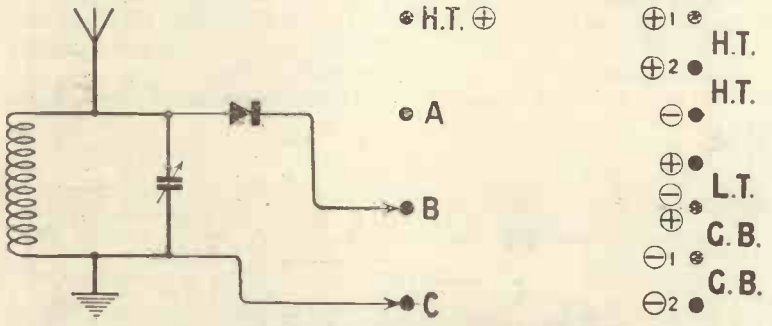


Fig. 7.—Connections for crystal receiver.

The batteries are joined to the various terminals on the right of the panel. For the sake of simplicity, a common voltage may be applied to the anodes of the valves to commence with, and also for the time being grid bias may be dispensed with. The positive terminal of the H.T. battery is now connected to the terminal H.T.+1 and the negative terminal to H.T.−. Now join H.T.+1 and H.T.+2 with a piece of wire.

The low-tension battery is connected to its correct terminals, after which the following three terminals must be connected with a piece of wire L.T.−G.B.+, G.B.−1 and G.B.−2.

It remains now to insert the valves (the rheostats being in the "off" position) and to connect the telephones. Adjust to suitable values the L.T. and H.T. voltages (about 90 to 100 volts in the latter case); upon adjustment of the tuning controls and cat-whisker, signals should be obtained with considerable strength and great purity. Needless to say the crystal receiver should be capable of giving signals without additional amplification, as otherwise nothing can be expected from the amplifier.

(Further details of the operation of this instrument with various types of sets will appear in our next issue.)

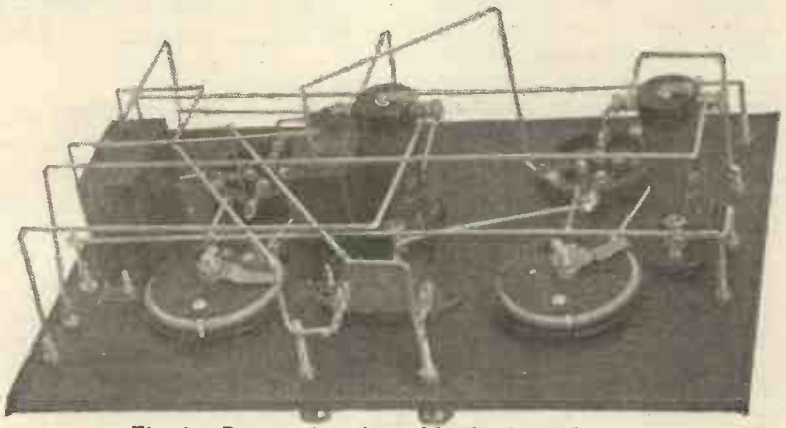


Fig. 8.—Perspective view of back-of-panel wiring.

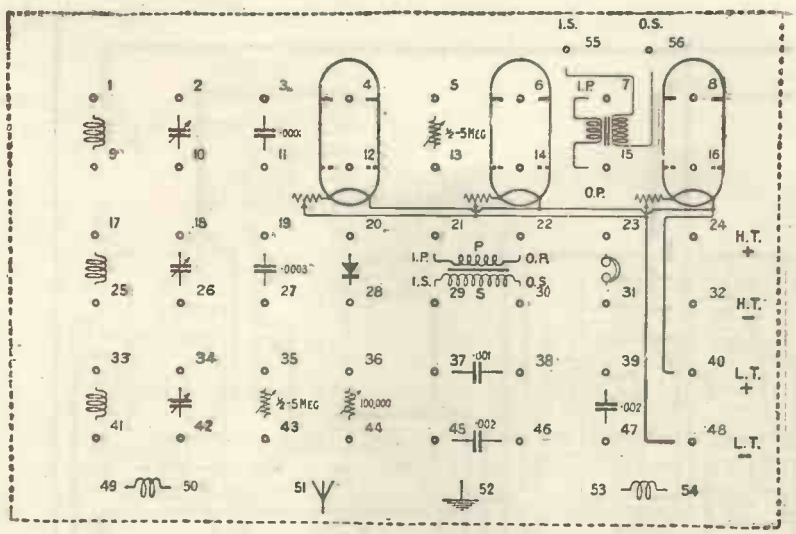


Fig. 1.—The terminal board.

A Crystal and Note Magnifier Circuit on the Omni Receiver

A simple and selective circuit which may be tried upon this popular experimental receiver.

IT is generally accepted that one of the chief drawbacks of the crystal detector is its heavy damping effect and consequent lack of selectivity in any circuit in which it is employed.

Where it is necessary to obtain loud signals and pure speech from the local broadcasting station, a crystal receiver with the addition of one note-magnifying valve is generally sufficient. There is, however, the disadvantage of Morse interference, and the possibility of an evening's programme being spoiled by "jamming" from another station is, with a crystal set, certainly not remote.

The use of loose-coupled aerial tuning renders the set more selective and, in certain cases, more sensitive. The simultaneous tuning of the aerial and closed circuits in the receiver should not present any appreciable difficulty; there is a nicety of adjustment for maximum selectivity that will probably not be obtained immediately the set is wired; but a little practice will enable the amateur accurately to tune in the required station and to exclude the unwanted interference.

The aerial is tuned by means of the coil L1 and the condenser C1 (in series with the inductance).

51—18
26—17
25—52

These connections complete the loose-coupled aerial circuit shown in thick line on the extreme left of the theoretical wiring diagram.

The crystal detector circuit is loosely coupled to this by the plug-in coil L2, and consists of the tuning circuit L2, C2, the crystal detector D, and also the primary T1 of the low-frequency transformer T1 T2 shunted by the condenser C3 of .001 μF capacity.

This last condenser is not essential for the working of the set, but will enable the best results to be obtained, since it by-passes the H.F. currents in the detector circuit that would otherwise be choked owing to the high impedance of the primary T1.

The connections for the crystal detector circuit are as follows:—

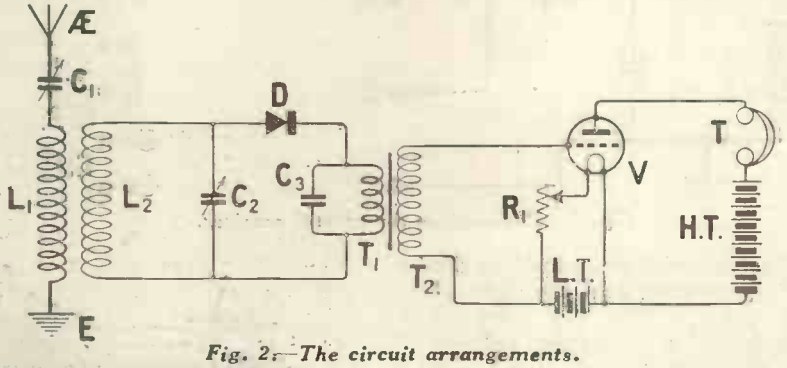


Fig. 2.—The circuit arrangements.

33—34
41—42
34—20
28—21
21—37
38—22
22—42

With some transformers the internal self-capacity of the windings may be sufficient to by-pass the oscillating currents to earth, and in this case the addition of the condenser C3 may make no difference to the results. A slight decrease in signal strength may even result, and if so the connections

21—37
38—22

should be omitted.

The rectified pulsations, after passing through the crystal detector, traverse the primary winding T1 of the intervalve transformer. The note-magnifying circuit is coupled to this, and amplified pulsations are present in the grid circuit of the valve V, having been stepped up by the transformer.

The telephones T and high-tension battery complete the plate circuit of the amplifying valve.

The following is a complete list of connections for the aerial, crystal detector, and amplifier circuits, and it would be advisable to check the wiring carefully before proceeding any further.

51—18
26—17
42—22
21—37

25—52
33—34
41—42
34—20
28—21
38—22
30—12
29—48
4—23
31—24
32—40

These connections complete the set, and when aerial, earth, 'phones and batteries are connected to their respective terminals, a preliminary trial may be made.

Coils

For the aerial coil, Nos. 35 and 50 should be tried in the centre socket, and for the secondary circuit No. 50 or 75 should be placed in the front moving socket of the three-coil holder, on the usual broadcast wavelengths.

For Chelmsford, in the order of aerial and secondary circuits, the following coils will be suitable : Nos. 150 and 200. On the 1,600 metre wavelength there is no advantage in having a series aerial tuning condenser, and if the coils mentioned are to be employed, it will be necessary to alter the connections of the aerial circuit as follows :—

51—17
17—18
26—25
25—52

when the aerial condenser will be in the parallel position.

Operating the Set

Any general-purpose valve may be employed in the amplifier circuit, and the best values of H.T. and L.T. will be found from the manufacturer's instructions.

The high-tension voltage will not be critical for most valves and may be safely varied between 50 and 100 volts.

The operation of tuning should present no great difficulty. The coils L1 and L2 should be coupled closely, and the condensers C1 and C2 simultaneously tuned until the maximum results are obtained. Selectivity may now be increased by removing L2 from L1 by 30 deg. to 60 deg. and readjusting the tuning until signal strength is as great as before.

Experimenting with the Circuit

Experiments worth trying, such as the reversal of the connections to the secondary winding of the transformer, will doubtless occur to the reader, and are always worth carrying out when a little extra efficiency is sought.

The experiment mentioned necessitates the following alterations :—

Disconnect

30—12
29—48

and join

30—48
29—12

Constant Aerial Tuning

Constant aerial tuning will be appreciated where the experimenting in different sizes of coils for the aerial circuit is undesirable. This form of tuning requires the inclusion of a 0.0001 μF fixed condenser.

The complete aerial circuit will then be as follows :—

51—3
11—17
25—52
17—18
25—26

A No. 50 coil will be suitable for all wavelengths up to 420 metres, while for those above a No. 75 should be used.

□ □ □

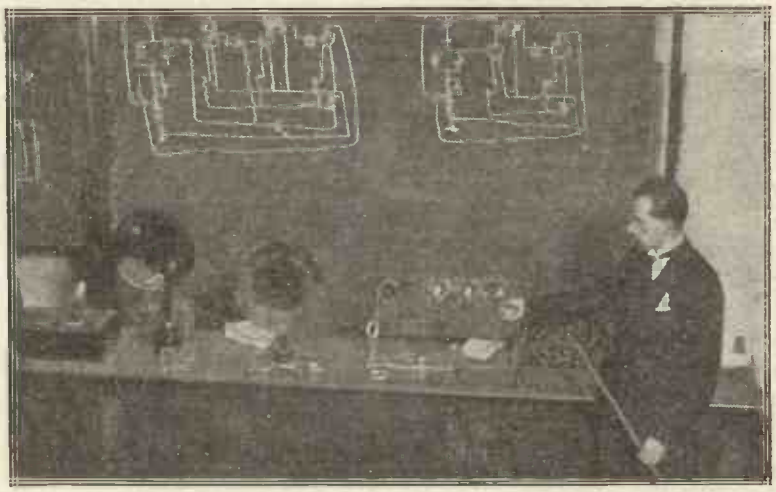
Public Demonstration of the Three-Valve Dual Receiver

On Monday, October 20, Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., gave a lecture to the Cambridge University Radio Society at Cambridge, on the design and operation of reflex wireless receivers. The lecturer gave a brief account of the history of dual amplification circuits and went into great detail regarding the causes for buzzing noises, classifying the different factors in design which enabled instability to be eliminated or at any rate, reduced. The fundamental trouble, due to the modulation of oscillations produced by an unstable valve were emphasised, and reasons given for the tendency of all reflex circuits to buzz when reaction is tightened too far.

At the close of the lecture, numerous questions were replied to, and a demonstration was given of the 3-Valve Dual Set described by Mr. Scott-Taggart in the April issue of *Modern Wireless*.

Using the original set described, six B.B.C. stations were obtained with ease on a loud-speaker which filled the lecture hall, and two or three other stations, including some relay stations, were heard on the loud-speaker, but not so loudly.

Signals from 2LO (60 miles away) did not come in very much more strongly than some of the other broadcasting stations.



This photograph shows Mr. John Scott-Taggart with the Three-Valve Dual receiver which was used in the demonstration referred to above.

A Useful Layout Board

(Concluded from page 32.)

Variable Condensers

WITH the layout board I generally make use of variable condensers of the cabinet mounted type, but there are occasions when one requires additional condensers in order to try different values. On these occasions the little stand, illustrated in Fig. 12, is brought into service.

Rheostats

A very convenient type of rheostat is the surface mounting pattern made by the Metropolitan Vickers Company. This can be obtained in various types suitable for controlling one or more bright or dull emitter valves. There is also a very useful dual rheostat made by the same firm.

If, however, the constructor desires to mount up rheostats already in his possession for use on the layout board he can do so very easily by making small holders on the same lines as those described for variable condensers and shown in Fig. 12. For rheostats the base need be only 2½ inches square, and the uprights an inch in height. Besides the central hole for the spindle there will be two 4B.A. clearance holes for the screws which fix the former of the rheostat.

Anode Inductances

A handy holder for anode inductances or radio-frequency chokes is shown in Fig. 13. Here an ordinary plug and socket mounting such as is obtainable from advertisers for a few pence is fixed by means of a single 4B.A. screw driven upwards from below through a piece of ¼-inch ebonite measuring 3 inches by 1½ inches. Two terminals are provided, connections between them and the plug and socket being made with bare wire.

The Crystal Detector

Any kind of crystal detector may, of course, be used on the layout board though personally I have strong preference for the kind shown in the photograph, which allows the whole surface of the crystal to be searched for sensitive spots and also permits a very delicate contact between catwhisker and crystal to be obtained. Whatever pattern is chosen it can be adapted for use on the board by mounting it upon a base provided with two terminals and driving in countersunk screws at the corners to act as legs.

This pretty well completes the list of components for which mountings must be made. Low-frequency transformers will, of course, stand by themselves and require no mounting, and the same is the case with double coil holders.

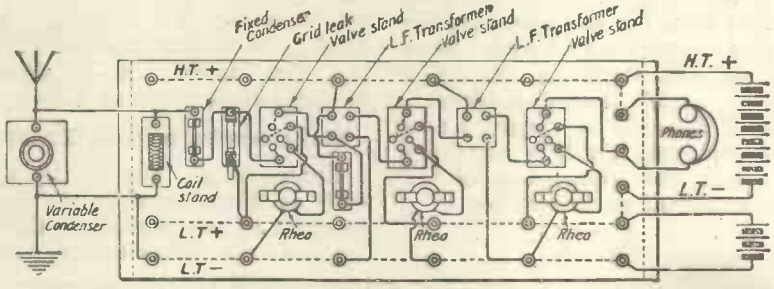


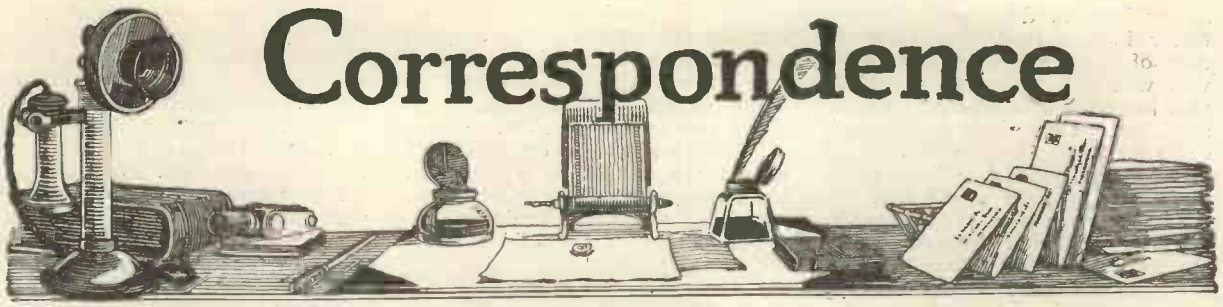
Fig. 17. A detector and two note magnifiers wired up on the layout board.

One of the most important uses of the board is as an aid in designing wireless sets. Let us suppose, for example, that we are proposing to make up a three valve set, consisting of a high-frequency valve, a crystal rectifier, and two note-magnifiers, and that we wish, if possible, to be able to use a panel measuring 14 inches by 8 inches. The first thing to do is to cut out a piece of cardboard or stiff paper of this size and to place it upon the layout board. The whole of the components are then arranged upon it, and the set is tried out to see whether bad interaction between components is taking place. Inductances and high-frequency transformers may be tried out in various positions until the best places for them are found; similarly the low-frequency transformers may be treated in the same way. By using the board we can very soon discover whether the space already planned is too small or whether it is possible slightly to reduce it without interfering with the efficiency of the set. This, though it is a very important one, is only one use for the layout board.

Other Suggestions

Thousands of others will suggest themselves to the reader and those who make up this board, and the mountings which are used with it, will find that it enables them to get through the greatest amount of experimental work in the shortest possible time.

I find it convenient to keep the various mountings in a wooden box of their own which protects them from the effects of dust and damp when they are out of use. There is also a second box containing numerous lengths of insulated wire with bared ends. These range from pieces two to three inches in length to leads of 10 to 12 inches. It saves time and makes better connections if the ends of each connecting wire are tagged. This can be done very quickly, and at small expense. Pieces of brass about ½ inch wide and ¾ inch in length are cut out, a slot about ⅛ inch wide and ⅜ inch deep being made in each. The lower corners are turned up, the wire being placed between them before they are pinched down with pliers.



POST OFFICE HYPOCRISY

SIR,—May I congratulate you upon your article on the "Post Office Hypocrisy" appearing in October 8 issue of *Wireless Weekly*, and I am sure all amateurs will agree with me in stating that the Post Office, by their strictness in granting licences, are rapidly making amateur wireless not worth the trouble in this country, as it is a noted fact that foreign amateurs are far ahead of us in transmitting efficiency.

I may state that I have applied for a transmitting licence, but it is 10 to 1 if I get it; in all probability they will palm me off with an artificial aerial licence, perhaps not that.

I note you have offered £500 for fighting the Post Office in a test case, and it is up to the R.S.G.B. to act at once, and not delay, otherwise the Post Office will take supreme control, and all we experimenters will have to take to keeping white mice or something of that kind.

You have my full support in assuming this attitude, also that of most experimenters I know, and I hope that within the next week or so the Post Office will be beaten at their own game.—Yours faithfully,

IRVING L. HOLMES.

Kettering.

RADIO PRESS ENVELOPE NO. 1

SIR,—I was tuning my ST100 set, constructed from your Radio Press Envelope No. 1, at 2 a.m. one morning, when I was successful in receiving WGY, General Electric Co., Schenectady, New York, on approximately 385 metres. The reception was quite good considering the atmospheric conditions. 2LO comes in with great volume and purity of tone. Bournemouth, Cardiff, Newcastle and Aberdeen at loud-speaker strength. My aerial is 30 ft. high and 90 ft. in length, R.I. transformers, Permanite crystal, Marconi D.E.R. valves, vernier condenser across aerial condenser.

Please accept my thanks for this excellent circuit and weekly journal. —Yours faithfully,

A. C. WILKINSON.

Maidstone.

SOLDERING

SIR,—I notice there have been several articles in your paper these last few weeks about soldering, but good as they were, they all omit,

in my opinion, the most important factor in soldering, viz., temperature of the copper bit. It is all very well to say the iron should be well heated, but how is the amateur to know when it is hot enough or too hot? In the articles in question no guide has been given him, and I have found that the majority of cases of failure in soldering has been through getting the wrong heat in the iron. It is a very simple matter to judge the heat of copper by the colour of the flame that rises above the bit, which goes from yellow when cold to bright green when the correct temperature for soldering has been reached.

A small iron should always be heated over a gas or spirit stove and never in the fire, as it is almost impossible to judge when the iron is ready, and is most successful in lodging little bits of ash on the exact spot you wish to solder.—Yours faithfully,

ENGINEER.

Battersea, S.W.

RADIO PRESS ENVELOPE No. 2

SIR,—I have pleasure in enclosing photographs of my "Four-Valve Family Set." As you will see, I have taken certain liberties with the design, mainly by cutting out the high-frequency switching, using different components and wiring with square wire.

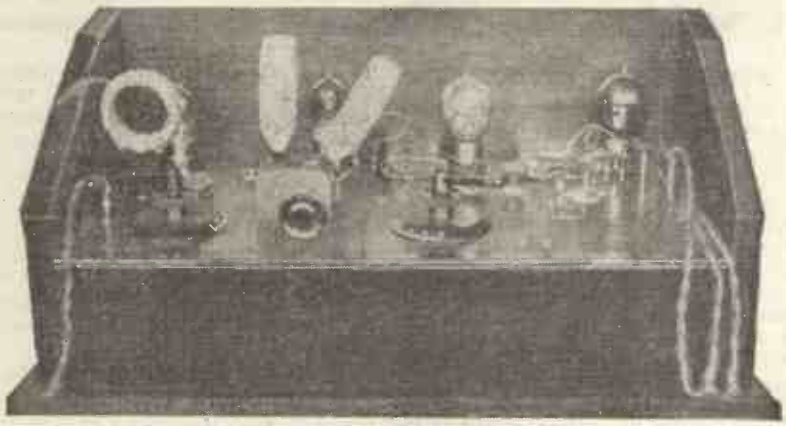
This set consistently gives very satisfactory results. On a good aerial I have no difficulty in tuning-in all the British stations and the better known Continental ones direct on the loud-speaker.

With four valves on the local station the volume is tremendous, but even under these conditions the tone is all that could be desired.

The design of the cabinet is, I think, interesting, as it permits of the valves being enclosed and the set being completely shut up when not in use without departing from the conventional flat panel with its simple wiring.

The main components are: Sterling variable condensers with verniers, Polar coil-holder, Lissenstats, Igranic potentiometer, Lissen T.1 and Sterling power transformers. The valves are Cossor Red-tops, Mullard Ora and two B.T.H. B.4 valves.

May I express my appreciation of your two interesting periodicals, and also of the valuable advice I have had from time to time from Mr. Kendall, of your Information Department?—Yours faithfully,



The Four-Valve Family receiver as made by Mr. Murchie.

ARCHIBALD MURCHIE.

Cotham, Bristol.

PILOT

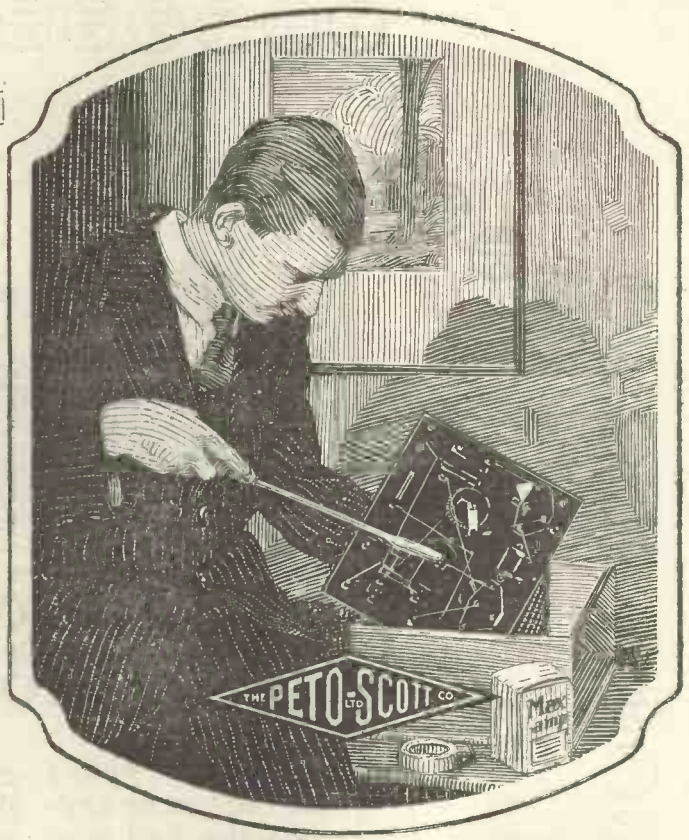
Before you build—or buy—a Set, learn about the new Pilot System.

WHEN a man decides to build a good Receiving Set he immediately comes up against the difficulty of a suitable cabinet and the drilling and the engraving of the Panel. Cabinet-making is a skilled man's job and many a perfectly good piece of ebonite has been spoilt by a hole in the wrong position or because it has been incorrectly cut to size.

To eliminate most of the difficulties in Set-building we have instituted the PILOT Panel Service. In future Sets described in all the principal Wireless Magazines will be available in sets of parts for the Home Constructor with panels ready drilled, tapped and engraved. Two types will be engraved. Two types will be placed on the market—Type A, following the author's literal specification and using his actual components, and Type B, an adaptation using Peto-Scott guaranteed components. Naturally through standardisation of components and our lower manufacturing costs due to large output, Type B will often show a large saving over Type A.

Remember that if our instructions are followed we positively guarantee that all Type B Receivers are the equal in every respect to the more expensive Type A Sets. Our Service Dept. is available for all our customers and will test and rectify errors of construction at a nominal charge. We want all our customers to have the utmost confidence in every Set produced under the PILOT Panel Service.

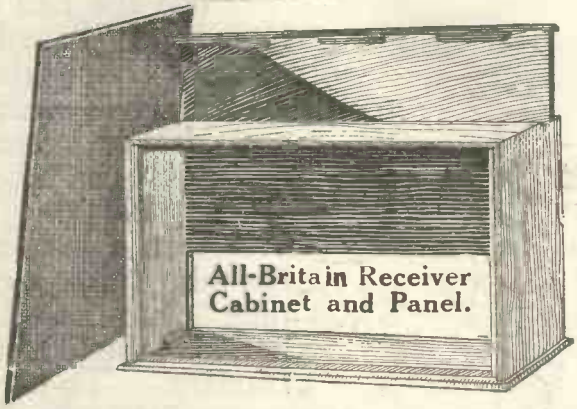
¶ *Every Wireless Receiver depends for its efficiency upon the panel. Low grade ebonite will prevent any Set from functioning properly. Every PILOT panel is manufactured from the highest grade Post Office ebonite cast accurately to size, matt finished on both sides, and with edges squarely ground. We guarantee every panel to be leak-proof and non-warping. Each panel engraved with the word "PILOT" and supplied carefully packed in sealed wrapper. Standard ¼-in. thickness throughout.*



The only trouble-proof method for the Home Constructor—

USE the Pilot System and enjoy the following *exclusive* advantages :—

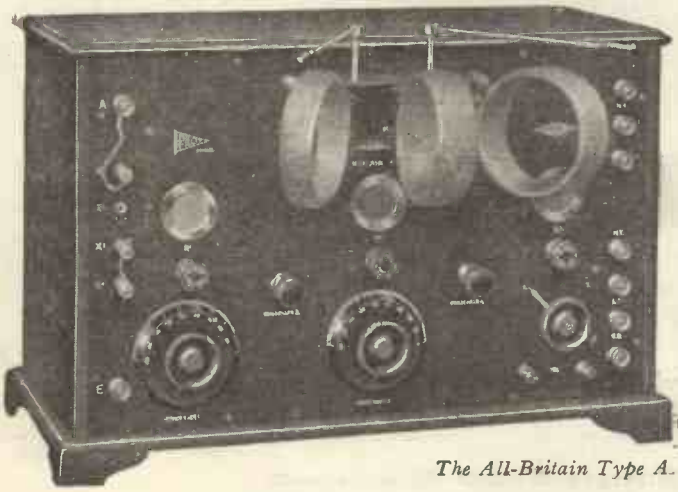
1. **Absolutely no previous Wireless skill required—the only tools necessary are a screwdriver, soldering iron (optional), and a pair of pliers.**
2. **Every Set when completed is quite the equal in efficiency of the original.**
3. **Provides a high-grade Instrument at the cost only of the components.**
4. **Success guaranteed—failure quite impossible if instructions are followed.**
5. **Every Instrument designed by a recognised expert.**
6. **The only System for the Home Constructor backed by a Service Department.**



Choose any one of these splendid Receivers designed by experts—

The Transatlantic V (a super 5-valve long distance Receiver).
The ST100 (2-valve).
The 3-valve Dual Receiver.
The Puriflex (4-valve).
The All Concert-de-luxe (3-valve).
The 4-valve Family Receiver.
The Resistoflex (a wonderful 2-valve Reflex).
The "Popular Wireless" Constructional Reflex.
The All-British Receiver, and others.

The cost of the All-British Receiver—a splendid 3-Valve Set—for example, is as follows :—Panel drilled, tapped and engraved 13/- Polished Cabinet 17/- Complete kit of all components necessary £4 : 2 : 6 Thus for less than £6 you can own the handsome Set shown here, capable of receiving all the B.B.C. Stations and most of the Continental ones. *Write to-day for a copy of our new illustrated Folder on the Pilot Panel Service—you'll never want to waste your time and money on building a Set in the old methods.*



The All-Britain Type A.

PETO-SCOTT Co., Ltd.,

Registered Office & Mail Orders : 77, CITY ROAD, E.C.
Branches : LONDON—62, High Holborn, W.C.1. PLYMOUTH—4, Bank of England Place. LIVERPOOL—4, Manchester Street. CARDIF 94, Queen Street. WALTHAMSTOW—230, Wood Street.

Gilbert Ad. 1664.

AN INTERESTING PHENOMENON

SIR,—While carrying out some alterations to my earth connection I made an interesting discovery.

Part of the connection was made by a brass rod, buried at a depth of five feet. When digging this out I discovered it had the appearance of being partly fused and was discoloured as though having been heated. It was quite clean and bright when first buried.

Could it be possible for an electrical discharge to have passed to earth via aerial and earth wires, thereby partly fusing the brass rod?

Of course it may have been caused by a corrosive action of the soil upon the metal, but I am inclined to think that the first theory is feasible.

It would be interesting to know if any of your readers have had a similar experience.

Wishing *Wireless Weekly* continued success,—Yours faithfully,

W. G. PULLEN (2ASR).

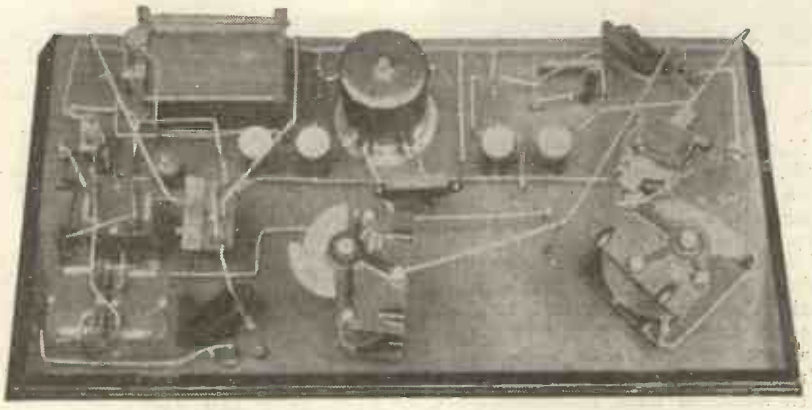
Leyton.

SOME INTERESTING AMERICAN RECEPTION RESULTS

SIR,—It may interest you to know that I received WGY, New York, very plainly on Saturday night, October 11, from 2.50 to 3.30 G.M.T. at Epsom on four valves, 2 H.F. crystal rectifier, two low at weak L.S. strength. The items were clearly announced, being: WGY, 2.50 a.m., banjo solo; 3.0, baritone songs; 3.5, song, "It is Then My Heart Will Forget"; 3.10, jazz band to 3.30, equal in clearness to crystal at eight miles.—Yours faithfully,

E. HARWOOD.

Ewell.



The neat wiring of Mr. Murchie's receiving set.

ST151

SIR,—Being attracted by the circuit diagram of ST151, I decided to build it, and the results were more than satisfactory. If anything, the volume was too much for ordinary domestic purposes, so I short-circuited the grid condenser by means of two "Clix" plugs and sockets and added a good crystal detector. Judge my surprise at the result of the alteration. The volume of sound was tremendous and the quality superb. I have to detune quite a lot to make it comfortably loud. Everybody who hears it remarks on the purity of tone. I use an "Amplion" attachment to my gramophone for loud-speaker work, for which the ST151 in its present form is ideally suitable.—Yours faithfully,

REGINALD POOLE.

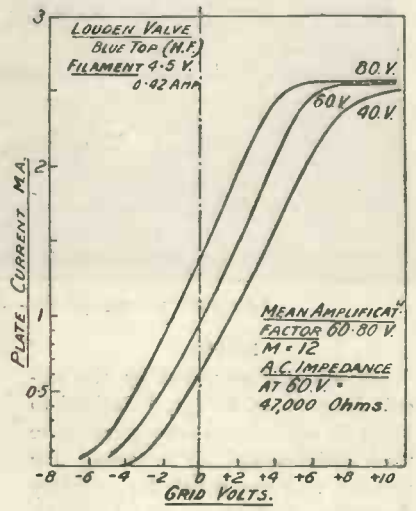
Wandsworth Common.

Apparatus we have tested

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

Louden Valves

Messrs. Fellows Magneto Co., Ltd., have submitted a sample each of their "Louden" valves, Blue Top (H.F.) and Plain Top (L.F.) types. These are of the bright emitter pattern, being rated, according to the makers' announcements, at .4 ampere and 4.8 to 5 volts for the filament, and 40 to 80 volts H.T. The anode takes the form of an open spiral of wire, reminiscent of two fairly recently issued valves of similar moderate price and consumption, but in this case both grid (which is also in the form of a spiral) and plate are of smaller dimensions, and closer; the grid-control and amplification factor accordingly are higher. We do not see much point in this open spiral "plate," unless, indeed, it is inspired by other than theoretical considerations.



With a filament voltage of 4, the current in each case was nearly exactly .4 ampere; but the saturation current only reached 1 milliampere under these circumstances. Evidently the valves are not suitable, therefore, for operation from a 4-volt accumulator. At 5 volts the filaments were very bright, and the consumption was about .45 ampere; at 4.5 volts the filament took, in each case, around .42 ampere, and a satisfactory emission of 2-2.5 milliamperes resulted. The characteristics were accordingly taken at this rating. We were glad to note that it corresponded fairly closely to the nominal rate, which is not always the case.

The curves for the Blue Top, or H.F., amplifying valve showed ex-

A Split Vote

The wonderful popularity of Mullard H.F. and L.F. Master Valves shows the sincere appreciation of the radio public for Master productions. Modern Radio Engineering has produced no finer valves for those who value perfect wireless reception than Mullard Red and Green Ring Valves. Amplify the pleasure of your winter wireless evenings by obtaining these Master Valves. Ask for MULLARD H.F. Red Ring Valves for H.F. AMPLIFICATION AND DETECTION, 12/6 each. Ask for MULLARD L.F. Green Ring Valves for L.F. AMPLIFICATION, 12/6 each. (These Green Ring Valves give wonderful results in reflex or dual circuits). These H.F. and M.F. valves only require a 4-volt battery.

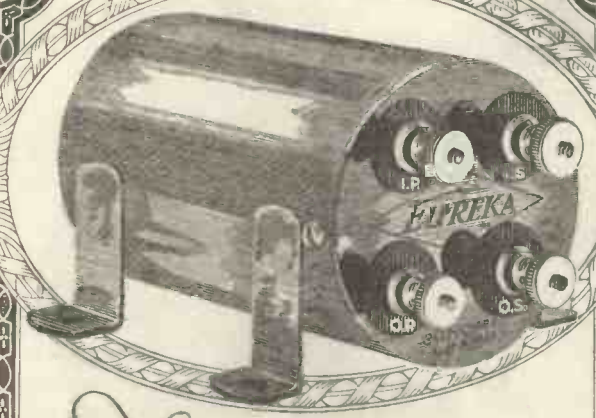
Leaflet M.8 can be obtained from your dealer, and you should avoid accidents to your valves by asking him for the Mullard Safety-Disc free on request. Send us his name and address if you cannot get what you want, and we will supply him.

Mullard

THE · MASTER · VALVE

Advt.—The Mullard Radio Valve Co., Ltd. (W.W.), Nightingale Works, Nightingale Lane, Balham, S.W.12.

It will pay you always to watch WIRELESS WEEKLY ***Advertisements.***



The economy of good Quality

AT last—probably as the result of much editorial space being devoted to the subject—the L.F. Transformer is being selected on quality and performance. Not as so much iron and copper wire, but as a definite part of a Receiving Set which can make or mar a reputation for clear and truthful reception.

The design of the Eureka is such that its production costs must necessarily be higher. For instance, its coils contain more than 2¼ miles of fine drawn copper wire of the highest grade. Its steel casing—the principal factor in eliminating interaction—is covered with a deposit of copper. Its expensive core—the process of hermetically sealing the contents against atmospherical influences—the ruggedness of its construction, all these processes could be simplified and reduced in cost, *but only at the cost of efficiency*. This we cannot do. Every Eureka owner knows that he owns the finest possible L.F. Transformer money can buy and appreciates that the exceptional results he obtains have more than justified the extra expense.

Concert Grand, 30/- *Eureka No. 2*, 22/6
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Gilbert Ad.1607

WIRELESS WEEKLY SMALL ADVERTISEMENTS.

12/6. Crystal Set 1 Valve Amplifier increases signals four times. Pledge Bros., 26, Woodstock Rd., Oxford.

AGENTS Wanted. Wireless valve repair business. Deal with the actual repairers. Lowest trade terms. All types repaired. A hard vacuum guaranteed. Also old valves bought for cash, 6d. each. Cossors 1/- each. M. & G., 60, Churchfield Road, Acton, W.3. Telephone Chiswick 2681

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BATY Condenser, High Max., Low Min., High insulation, Min. weight, 5/3 postfree. Coil to match, 230/4,000 metres, 6/9 post free. Combined space 4"x1", weight 2 oz. Suitable for all circuits. Technical reprints giving circuits, 1/3 post free. Ernest L. Baty, Luton.

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

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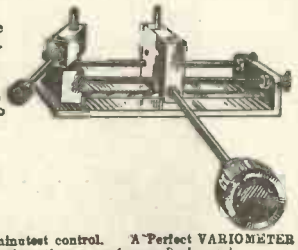
The "MIKROTUNE" MAKES TUNING SIMPLE & CERTAIN

Reversible Coil-holder.

Adds 50% value to any set.

12/6



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PICKETT'S Insulated Cabinets = for 100% results. From 1/6 each, highly polished.
All designs and sizes

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Patent Pending.

The "Bretwood" Grid Leak (Guaranteed) tunes a carrier wave from the silent point up. The "Bretwood" is recognised by highest experts and experimenters as the only *variable* and *reliable* Grid Leak.

PRICE **3/-** Postage 3d

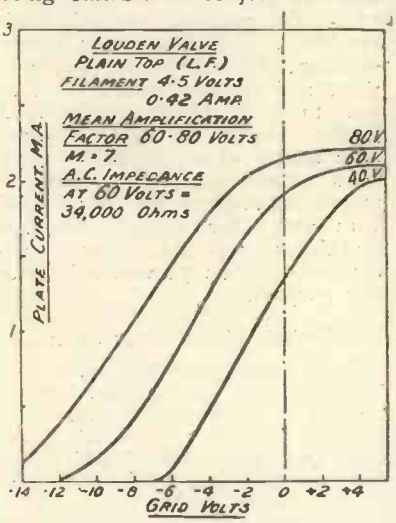
If you are not satisfied within 7 days, money will be refunded.
RADIO IMPROVEMENTS, LTD., 12-18, London Mews, Maple St., London, W.

Barclays 162

cellent characteristics for this purpose; a straight portion of considerable length around zero grid volts at each of the H.T. values chosen in the range given by the makers—40, 60 and 80 volts. The amplification factor worked out from these characteristics at the extremely satisfactory mean figure of 12, in the 60- to 80-volt range; the A.C. impedance at 60 volts came out at about 47,000 ohms, a quite suitable figure for an H.F. amplifier, where large plate currents are not called for.

In qualitative tests in actual reception (with 50 volts H.T.), and in measurements of signal-strength resulting under test conditions, in comparison with our standard R valve, the Louden H.F. valve showed an excellent performance, sensibly improving on the performance of the standard valve. It oscillated with rather less ease than the latter, which was of lower impedance. As a detector the H.F. type was not so good as the L.F. valve.

The characteristics of the L.F. type (Plain Top) showed the desirable long straight portion displaced well to the region of negative grid voltage. The A.C. impedance was lower, about 34,000 ohms—a normal figure—and the mean amplification-factor was around 7 in the 60-80 volts interval. This must be considered quite a satisfactory figure for a general purpose L.F.-detector valve. A good value of grid-bias was indicated, and on actual test in reception, using 80 volts H.T. (or higher), this was found advantageous, 4-6 volts being suitable in conjunction with



80 volts H.T. In these circumstances very good and distortionless amplification resulted, again showing appreciable gain on our standard R valve. A considerable amount of L.F. energy could be handled successfully, particularly by raising the filament volts nearly to 5 and using ample H.T.; there was no sign of softness in these circumstances.

In detection, using 50 volts H.T., this L.F. type gave excellent results, but oscillated with rather less ease than the R valve compared with it.

We can most certainly recommend these valves for the purposes indicated, for use where a valve consuming 2 watts of filament current still has application. The performance of the two sample valves was extremely satisfactory in comparison with valves both costing more and using considerably more current.

Colvern "Vernier" Tuning Condenser

From Messrs. Precision Screw Co., Ltd., come samples of their No. 3 (standard pattern) "Colvern" two-plate fine-tuning or "vernier" condenser. This is an extremely neat little device, arranged for the usual type of single-hole fixing by means of a bush and large nut, and having two semi-circular plates 2¼ in. diameter giving pretty fair clearance when in the minimum position. It is provided with two small terminals at the side of the composition base and a silent spring-contact to the moving spindle. A small, neat knob

controls the device. The space occupied behind the panel is noticeably small.

On trial it was found to operate smoothly and satisfactorily, giving a fine-adjustment range from about 15 micro-microfarads maximum to just under the low minimum of 2 micro-microfarads. With a special screw-threaded spindle, No. 2 type (not standard), the range was from 1.5 to 12 micro-microfarads, a larger displacement of the moving plate not lowering the minimum capacity very far, on account of the close setting of other parts of the device. Tested as a neutrodyning condenser in the writer's version of the neutrodyne circuit with tuned-anode, in a two-valve high-frequency amplification set, good control over self-oscillation resulted when using the minimum capacity of this instrument, together with a No. 50 plug-in coil in a two-coil holder.

A Plate Milliammeter

Messrs. W. G. Pye & Co., of Cambridge, have submitted for test a small type of milliammeter suitable for panel-mounting or for mounting on a base-board, which is marketed at a figure very little higher than that asked for the flimsy (and often sadly inaccurate) foreign instruments generally available. This is 3½ in. diameter and 1½ in. high, enclosed in the usual brass case, but with terminals at the side. A zero adjustment device is provided —an important refinement for quantitative work, such as determination of valve characteristics. The range is from 0 to 5 milliamperes in 1-5ths, readable easily to 1-10ths, and the needle is fairly dead-beat. The accuracy proved sufficient for any reasonable purpose, and the instrument stood up well to a temporary overload. A plate milliammeter should be included as a matter of course in any high-class multi-valve set, just as measuring instruments are provided with any other complex electrical machinery; this instrument is undoubtedly of a type well suited for this purpose.

Pressland Safety Lead-in

Some measures of permanent protection against lightning (and severe "static" discharges in general) is provided by the "Pressland Safety Lead-In," a sample of which has been submitted by the Pressland Electric Supplies, Ltd. In this, a narrow safety-gap is left between the centre rod of the ordinary lead-in insulator fitting and the inner edge of a brass ring encircling the former. The brass ring is connected by a stout metal strip to a large earthing terminal, for direct connection to the earth *outside* the house. The inner end of the centre rod is connected to the aerial terminal of the set in the usual manner, the aerial being connected outside to the centre rod. Generous terminals are provided for this purpose. The fitting is made in three sizes, 6 inches, 9 inches and 12 inches. An ebonite collar provides a greater length of leakage-path at the critical point, since this part is exposed to rain. The fitting appeared to be substantially made, and well finished; and should relieve the listener of some anxiety when thunder approaches.

"Concite" Crystal and Cat's Whisker

Messrs. Conradi & Braun have sent us for test a specimen of their "Concite" crystal and cat's-whisker, which are enclosed in a small sealed glass tube. The crystal is a galena of normal appearance; on test it gave good results, both as to proportion of sensitive spots and signal strength observed. It appeared to be sensitive right through, and was not unduly brittle. The cat's-whisker enclosed with it did not meet with our approval, as it appeared to be of much too small a spiral and unsatisfactory in use. With a better type of whisker the ordinary average for a good galena crystal combination was attained.

IGRANIC
Honeycomb
Coil

When you build— or when you buy

a radio set—look for this mark on the component parts—

RADIO IGRANIC DEVICES

It will mean that you cannot fail to get the best results, for Igranic Components are designed by radio engineers and built by electrical control craftsmen.

Igranic Radio Devices include: Honeycomb Coils, Variometers, Vario-couplers, Bi-plug Coil-Holders, Tri-plug Coil Holders Filament Rheostats, Battery Potentiometers, Intervalve Transformers, Vernier Friction Pencils, etc., etc. *All carry a six months' guarantee.*

Make a point of seeing them at the

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IGRANIC FILAMENT RHEOSTAT

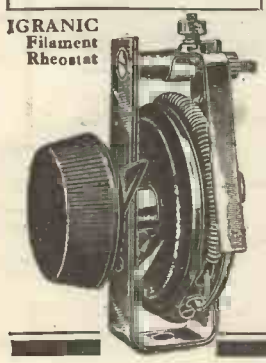
A splendid instrument for filament control under all conditions. Method of construction ensures smooth and silent operation. Designed for individual valve control. Adjustable contact fingers. Supplied in two types—Plain and Vernier, with 4, 6, 8 and 10 ohms resistance.

Prices: Plain 4s. 6d., Vernier 7s.

IGRANIC HONEYCOMB COIL

Low self-capacity—Small absorption factor—Minimum H.F. Resistance—No dead end losses—High self-induction—these are the qualities of the ideal inductance. They are found to perfection in IGRANIC Honeycomb Duolateral Coils. Made in 20 sizes to cover wave-length ranges of 100 to 23,000 metres.

Prices vary with sizes.



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BRANCHES: Birmingham, Bradford, Cardiff, Glasgow, Manchester, Newcastle.

Ask your dealer about them.

Write for List Y39.

A LOUD SPEAKER FOR 30/-

Hullo everybody! I know you will forgive me if I indulge in a little bit of trumpet blowing, but I simply can't help feeling a shade pleased.

To begin with, the dreaded slump associated with the summer months simply didn't materialise—any more than the summer itself, and the sale of every one of my products has shown a steady crescendo. I have to thank my Production and Sales departments for this, but most of all I have to thank you. Now I want to do something for you in return.

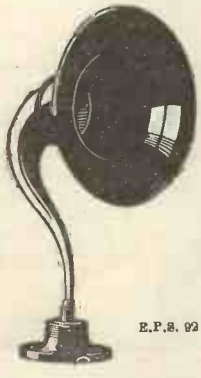
The Fellows Junior Loud Speaker, with its adjustable diaphragm, pleasing lines, and rich, mellow tone is too well known to need introduction. Perhaps you have coveted one. Well, there is now no need for you to deny yourself any longer.

Its price has been reduced to 30/-.

For the price of a second pair of telephones you can enable everyone to listen in at once!—another illustration of

Quality Apparatus at Low Cost.

FELLOWS WIRELESS



E.P.S. 92

The Junior Loud Speaker.

A remarkably efficient small loud speaker for medium sized rooms; fitted with adjustable diaphragm and only

30/-

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

S.E.C. (RICKMANSWORTH) asks whether it is better to use magnetic or capacity reaction on wavelengths above the British Broadcast band, and also what capacity the condenser should be for electrostatic reaction.

Magnetic and electrostatic reaction are both equally efficacious. The advantage of magnetic reaction is that it is much more easily controlled than electrostatic, or capacity, reaction, and is more suitable for short wavelengths. Capacity reaction is very handy for the longer wavelengths, however, the following values being suitable. For waves of 100 metres up to 12,000 a small micrometer adjusting condenser of .000005 mfd. will be suitable. A condenser of .00001 mfd. capacity will react from about 1,000 up to 30,000 metres. For the best results it is essential that the condenser should be capable of very fine adjustment.

F. R. J. (BRIGHTON) asks, with reference to a single transmitting circuit, (1) what size of coil should be used for a 200-metre wave, and (2), in connection with a choke control circuit, what would be a suitable size for the choke, and how to make the same.

(1) An aerial coil for the 200 metres wave may be made by winding about 30 turns on to a 6-in. former, the latter preferably being of the "skeleton type." Ordinary 7/22 aerial wire is suitable for this inductance. (2) As a general rule the value of such a choke is not very critical, but should have a value of about 6 henries. A suitable choke can be made by winding 20,000 turns of No. 40 s.w.g. single silk-covered wire on to an iron core ¾ in. in diameter and 4½ in. long. Care must be taken regarding insulation between the windings and the core, owing to the considerable potential variations set up across the choke, which sometimes rise to double the normal anode voltage.

G. W. N. (CANTERBURY) wishes to run wires from his receiver, in one room, to his loud-speaker, in another, but says that preliminary trials have resulted in howling, which he has not been able to eliminate. He asks whether the proposed arrangement is practicable and, if so, how he may overcome the howling.

The arrangement is usually quite practicable, especially if a low-resistance loud-speaker is used. Occasionally, however, the long leads upset the workings of the receiver, and cause the howling

which our correspondent is experiencing. The howling may usually be eliminated by shunting a fixed condenser of .002 or .003 mfd. across both ends of the extension line.

J. C. P. (CHELSEA) is troubled by interference by inductance from neighbouring electrical machinery, and asks how this may be eliminated.

Owing to the fact that low-frequency transformers pick up such disturbances themselves, to a certain extent, we advise you to dispense with low-frequency amplification, substituting stages of high-frequency, if necessary. Further, a frame aerial may be tried, or a counterpoise earth and an inductively coupled tuner. A stage of tuned high-frequency amplification will usually reduce the interference considerably.

J. R. M. (DORKING) requires to measure high resistances of 100,000 ω to 5 Ω, and wants suggestions for an accurate method.

The most suitable method for the accurate measurement of resistances of the order mentioned is to determine the rate of leak of a charged condenser through the given resistance. For further details we refer you to any standard work on electrical measurements.

C. G. (BRISTOL) asks for a reliable method of comparing signal strengths.

The method in general use is to shunt the telephones with a variable resistance, and to adjust the latter until signals are rendered just inaudible. The resistance in shunt is then determined. Suppose that the resistance of the 'phones is R, and that on two occasions resistances R1 and R2 respectively were used in shunt as above. Then a simple calculation will show that the signal strengths are in the ratio $R+R_2 : R+R_1$.

L. H. W. (KING'S LYNN) asks whether the windings of high-frequency transformers may be loosely coupled, and what effect this will have on general reception.

The loose coupling of H.F. transformer windings is possible, and greater selectivity will be obtained, but only at the expense of signal strength. Loose coupling will also reduce the tendency to self-oscillation of the H.F. valves.

G. W. S. (CROYDON) asks why the use of a Square Law Condenser is preferable to that of an ordinary type of variable condenser.

In any circuit containing inductance (L) and capacity (C) the fundamental wavelength to which it will resonate is proportional to $\sqrt{LC}$. Consequently, if the inductance is maintained constant, the wavelength change is proportional to the square root of the change in capacity. The plates of Square Law condensers are so constructed that a rotation of a given number of degrees on any part of the scale will correspond to the same change in wavelength. Thus the wavelength is proportional to the scale reading, and any fixed inductance may be calibrated if necessary. With an ordinary type of variable condenser the wavelength is not proportional to the scale reading, the increase of wavelength being more rapid from 0° to 45° than for the remainder of the scale. Consequently, the use of a Square Law condenser provides for more even tuning, the various wavelengths being further separated and spread out over the entire scale.

P. C. W. (HULL) asks if earthing the cores of his L.F. transformers in a 3-valve set (detector, 2L.F.) will eliminate the distortion he experiences.

This may cause partial elimination of the distortion, but another remedy lies in the use of suitable anode voltage for the last two valves, and the choice of correct negative grid bias. Reference to the October 22 issue of *Wireless Weekly* is advised.

When breathless your Struggles With Crystals have left 'ee', Turn out your old Screw Cups, And put in a Refty.

CONTRIBUTORY CAUSES

The consistent tendency of Receiving Sets to reproduce extraneous noises is, more often than otherwise, put down to that endless source of hiss, noise and bubbles—the H.T. Battery. Yet experiments show that condensers of very large capacity apparently fail to smooth out the current. It may be taken that the trouble lies elsewhere. Substitute a *Watmel Variable Grid Leak* and note the difference.

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to intending purchasers

The Watmel Wireless Co. wish to notify the trade and public that their Variable Grid Leak Patent Application No. 206098 was contested in the Comptroller's Court, and on Appeal; in both instances the Patent Grant was upheld and costs awarded.

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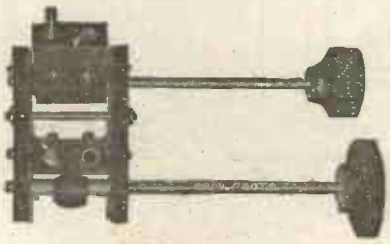

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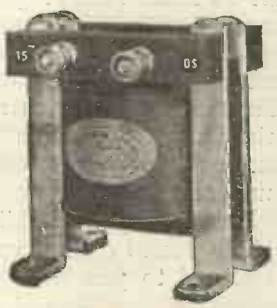

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Types WR.1. and W.R.2. as above, but with resistance incorporated in base to operate off 2-, 4- or 6-volt accumulator 23/6

WHILE the explorer of long ago had to set sail and face almost incredible hardships in his praiseworthy efforts to chart the globe, his successor sits by the fireside and logs foreign Broadcasting Stations with almost absurd ease. From America to the borders of Russia and from Scandinavia to the shores of the Mediterranean the ether is available for his exploration.

But the man who is enthusiastic over long-distance reception will see that he is not handicapped either by his Set or his Valves. His Set should employ at least one stage (and two for preference) of high-frequency amplification, and for his Valves he should use those which have been specially developed for the work.

Undoubtedly the most popular high-frequency amplifier to-day is the Cossor P2—the valve with the red top.

Its striking success is undoubtedly due to its design. As every wireless enthusiast knows, the working of a valve depends upon the correct use being made of its electron emission. You must have noticed that when your accumulator begins to fail and the filaments

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Get Cossor Valves—they cost no more

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of your valves grow dim that your Set falls off in sensitiveness and volume. A clear case that the emission from the filaments has decreased.

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Remember that for high-frequency use you cannot afford to risk efficiency—feeble oscillations from Stations thousands of miles away will strike your aerial and you'll be none the wiser if your Valves are not sensitive to them.

The remedy is in your hands—for high frequency use select the Valve specially developed for the purpose and chosen by the vast majority of Valve users in this country—the wonderful Cossor P2.

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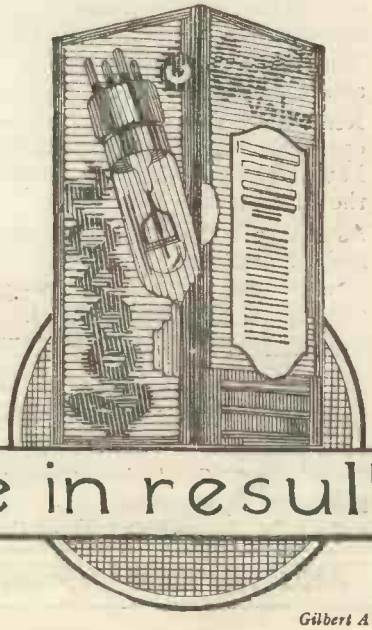

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but what a difference in results!

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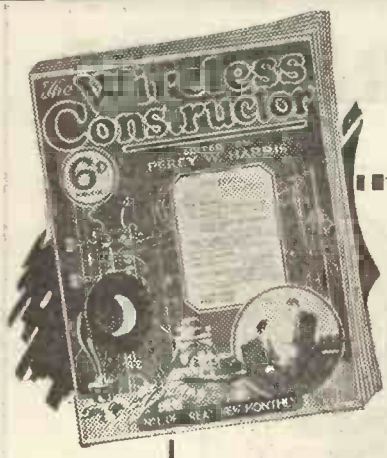

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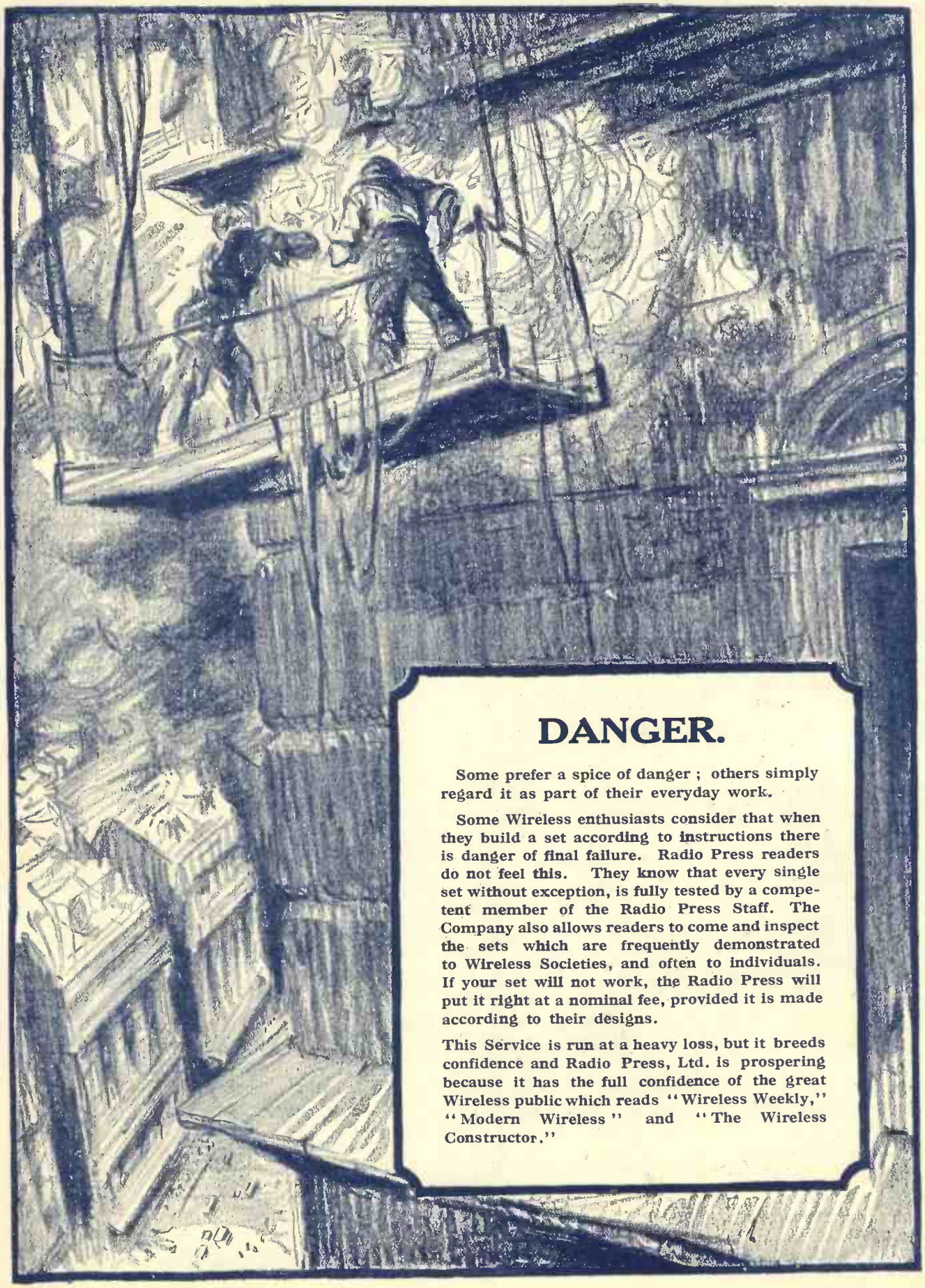

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