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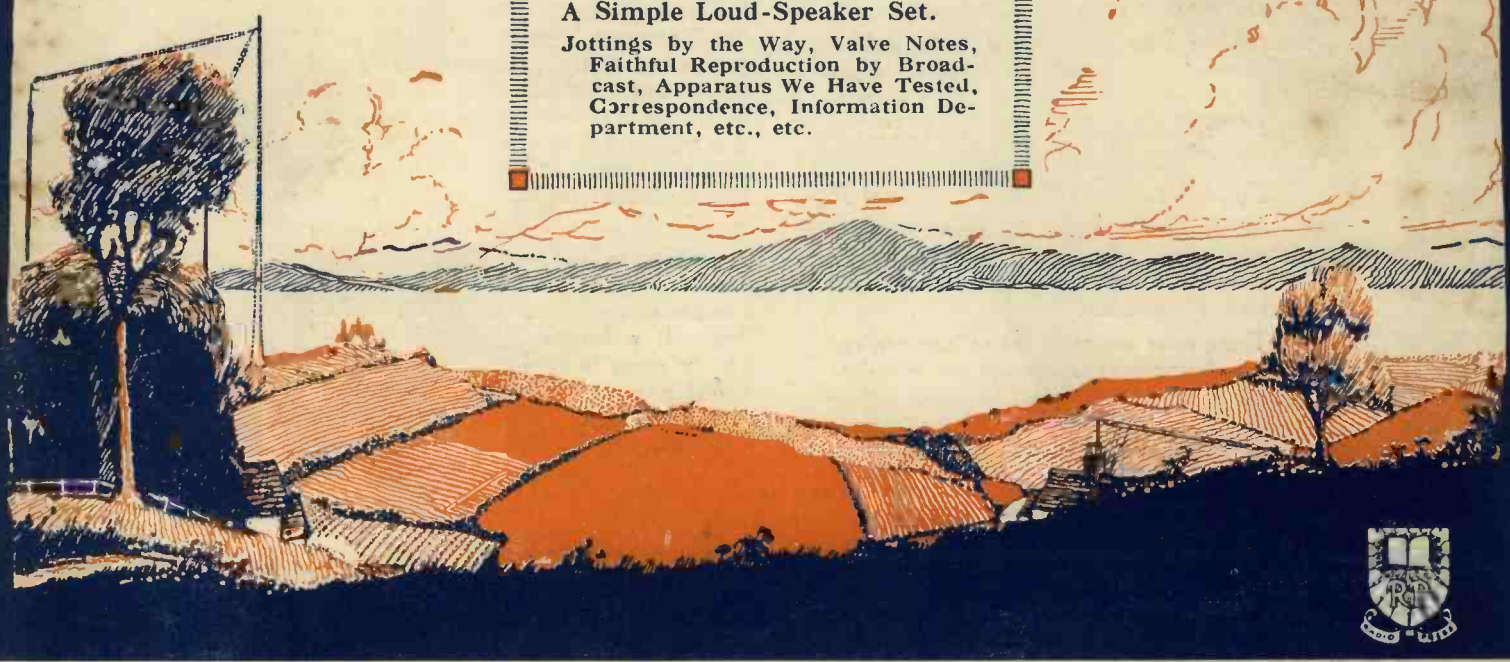
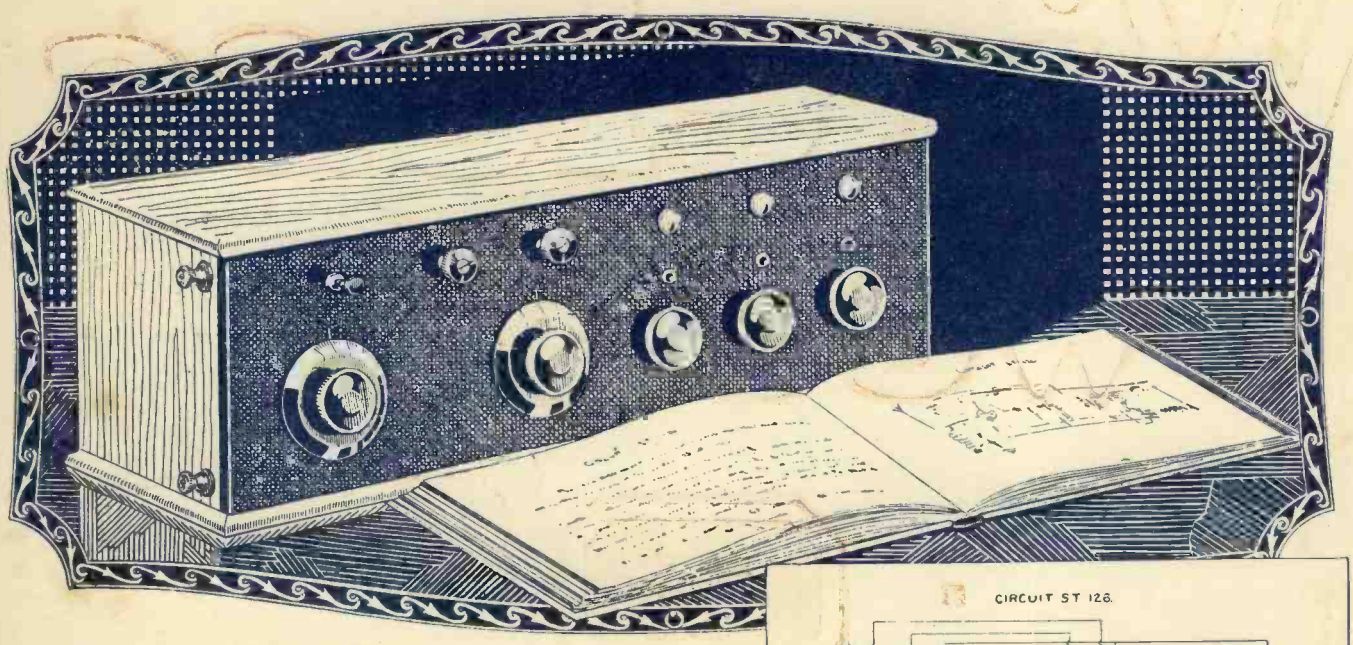
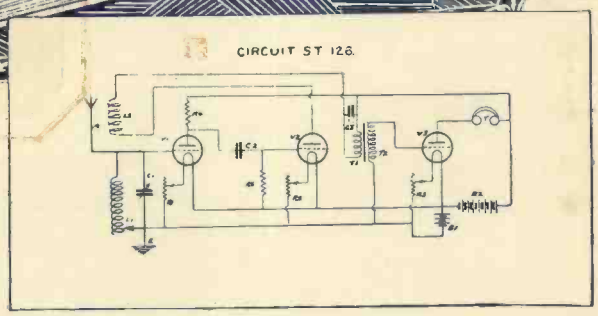


Experiments with an Oscillating Crystal Set

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





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More Practical Valve Circuits

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

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Editorial

The British Broadcasting Company's Success.

THE British Broadcasting Company, Limited, which has just held its first Ordinary General Meeting, is to be congratulated upon the position in which it now finds itself. The Chairman's Report makes excellent reading, both for the broadcast listener and the trade, while those people who held gloomy views on what would happen if one company alone were entrusted with broadcasting, will find cold comfort in its plain statement of facts.

On a number of occasions in the past we have felt it our duty to criticise the policy and programmes of the Broadcasting Company, and on future occasions will continue to do so where necessary. Taking everything into consideration, however, the most captious critic will admit that the results of the year's working have been admirable, while the programmes have been carefully balanced between vulgarity on the one hand and austerity on the other. There are, of course, always some people who will grumble at any programme, however presented, as it is an impossible task to appeal equally to all listeners on any one evening.

Considerable sections of the report are taken up by matters which we have already discussed editorially, such as the advisability of building more relay stations, the proposed experiments with the high-power station, and the relations between the Post Office and the Broadcasting Company.

On the financial side of the statement there is much of interest. Very large sums have been received from the Post Office on account of licence fees. The financial position of the Company is even stronger than would appear from a first glance at the figures. We are told that up to the 31st March there is an excess of revenue over expenditure of £3,811 19s. 10d., after setting aside a reserve to cover obsolescence of plant and depreciation of other fixed assets. The amount required to pay the dividend of 7½ per cent. on the cumulative ordinary shares absorbs £3,088 9s. 4d., and the balance of £723 10s 6d. is being carried forward. It should be noted that a substantial portion of tariffs notified by members of the Broadcasting Company as having accrued to the Company has been carried forward to future periods on the assumption that the revenue from tariff is not applicable to the accounting period alone in which they are received. It is, of course, the policy of the Company to give the best programmes and service they can afford, the dividend being limited by their agreement to 7½ per cent.

We hear with considerable satisfaction the decision to abolish all tariffs from the 1st July, and the agreement between the Broadcasting Company and the Post Office that there shall be one uniform licence fee of 10s. The Broadcasting Company is, in the words of the Chairman: "Operating in many respects as a public utility service," and the strong financial position in which the Company finds itself makes it no longer necessary for them to attempt to increase their revenue by such expedients as tariffs and competing with other interests. Certainly the British public have a right to feel proud of their broadcasting service, which is already proving a model to other countries.

Tapping Plug-in Coils

By J. G. W. THOMPSON.

An Article describing how the wavelength range of these popular inductances may be extended

IT is hoped that the following ideas regarding the tapping of plug-in coils, and the uses to which they may be put, may be of interest to experimenters.

A point on the side of the coil is first selected as the desired tap position, and the wire prised up slightly with the point of a knife. The insulation is then carefully scraped away, and the end of a short length of wire of the same gauge as the coil-winding soldered to the bared portion. The other end of this wire is then clamped under the head of the screw which holds the two halves of the composition plug together, and the " tapping " part of the

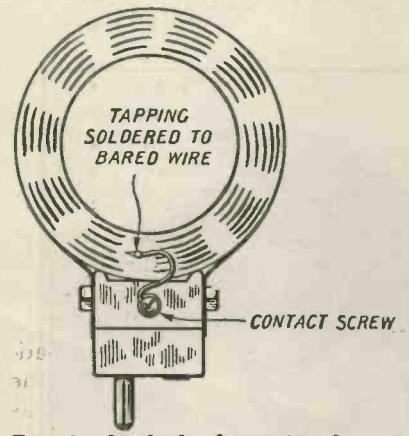


Fig. 1.—Method of tapping honeycomb coil.

business is done. This is shown in Fig. 1.

To make contact with the tapping—via the screw-head—a short piece of springy brass or phosphor-bronze strip is screwed to the " fixed " holder in such a way that when the coil is inserted the strip makes firm contact with the screwhead on the coil plug. (See Fig. 2.)

In the case of coils such as the " Burndept " or other makes having a *solid* plug, a small round-headed brass screw can be inserted in a tapped, "blind " hole in the face of the plug, care being taken that this screw does not make internal contact with the brass plug and socket embedded in the composition. If desired, two taps can be taken off the coil-winding by having a contact screw each side of the plug, and a contact strip each side of the fixed holder. It must be made sure that these two screws in coil-plug or fixed holder do not touch internally.

Such a method of tapping is

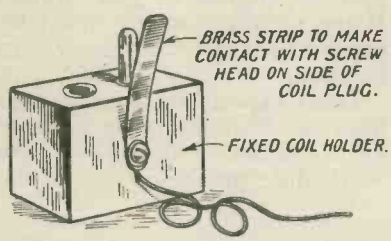


Fig. 2.—Contact strip on fixed holder.

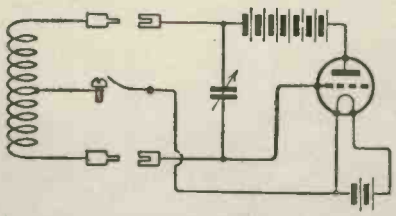


Fig. 3.—Heterodyne wavemeter or oscillator circuit.

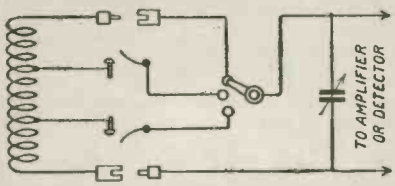


Fig. 4.—Tappings for a wide range tuner.

very neat, if carefully done, and has the advantage that the coil is in no way spoilt for use in a circuit where the tappings are not required.

The uses to which these tapped coils may be put are many and varied, and three examples are outlined below.

1. Interchangeable Heterodyne Wavemeter Coils

The circuit of a simple valve oscillator is given in Fig. 3, and it will be seen that a wide wavelength range may be covered by plugging in various coils, each of which should have a tapping approximately at the centre of the winding.

2. Wide-range Tuner

A few " double-tapped " coils (if available) will enable a wide wave-range to be covered if the two contact strips and one plug (or socket) of the fixed holder are connected to a 3-point switch mounted on the panel. Three inductance values may thus be obtained with the one coil, and with careful choice as to tapping points and size of coil a very

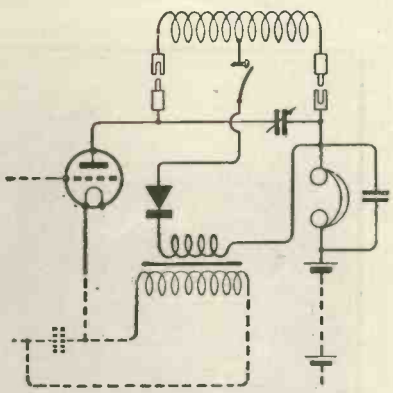


Fig. 5.—Crystal tapping in a reflex circuit.

wide wavelength range may be covered with only 3 or 4 coils and a variable condenser. This is shown in Fig. 4. Dead-end losses are possible in this arrangement, however.

3. Crystal-tapping for Reflex Circuits

It is sometimes an advantage in Reflex circuits employing a crystal to tap-off the crystal circuit from only a portion of the main anode inductance, to reduce the damping of the anode circuit. This is shown in Fig. 5.

These three examples will no doubt suffice. In conclusion, a

word as to the position of tapping points. The *electrical* centre of a honeycomb-pattern coil is not necessarily halfway between inner and outer faces, as at A in Fig. 6, but is nearer the outer face as at B. With honeycomb coils of few turns, the position of the exact tapping point will have to be found by trial and error, owing to there being only very few " layers " of wire to tap at the sides.

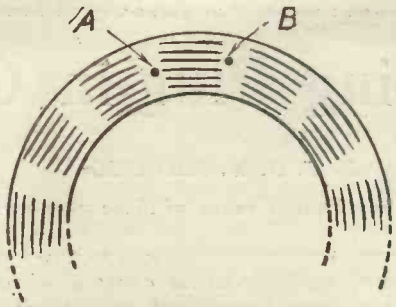


Fig. 6—Position of Tapping for Electrical Centre of Coil.

Each side of the coil should be tried, and also different positions on the same " layer " round the circumference of the coil until the correct point is found. In the larger sizes matters are easier, and, of course, in single-layer solenoids, such as the " Burndept " short-wave series, there is no difficulty whatsoever.

□ □ □ □ □ □ □ □ □

Summer Dont's

DON'T leave high-tension batteries or cells used for filament heating purposes lying for long periods in places exposed to the full heat of the sun. The fact that wax or pitch may run is a matter of minor importance. What really matters is that heat causes the moisture in the cells to evaporate and therefore very much shortens their lives. There is, of course, no such thing as a dry cell. Those to which we give that name have their electrolytes brought to the consistency of a jelly by the admixture of isinglass or gum arabic. If the moisture is driven out by evaporation the cell ceases to function.

Don't expect that your set will have the same range in summer as in winter. Conditions are vastly different at this time of the year, for we do the bulk of our reception in daylight. It must not be forgotten, too, that trees which in winter were mere dry poles devoid of sap are now thickly covered with juicy foliage and are exercising a pronounced blanketing effect. Therefore do not think if distant signals are weaker than they used to be that something is the matter with your receiver or destroy the peace of your neighbours by the misuse of reaction.

A novelty in field days was held recently in Bucks. by the Western Metropolitan Association of Affiliated Societies, comprising all the West London Radio Clubs and Societies. Sending and receiving stations were erected in the open at Gerrard's Cross, Batchworth Heath, and Stanmore. Our photograph shows the station at Gerrard's Cross.

GOOP-WAYFARER No. 761

Synopsis of Previous Chapters

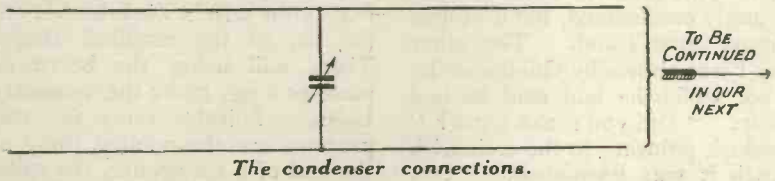
YOU CAN BEGIN NOW!

PROFESSOR GOOP and Wayfarer, a combination of brains such as is rarely seen, have devised the most wonderful circuit ever brought out. They decide to give it to the world, not all at once, for that might be too great a shock, but gradually. They have already described how the tuning inductance is wound with genuine s.w.g. wire upon a former made from a common drawing-room curtain pole. Thrilling revelations of undreamt-of efficiency are about to be disclosed.

BEGIN THIS NEW GREAT SERIAL NOW!

The Next Step

By this time even the least skilled constructor should have completed the aerial tuning inductance which was fully described in the last instalment. Before being quite satisfied with his work he should submit it to the most rigorous tests, for, as some sage has aptly remarked, "the strength of a chain is that of its weakest link," and the quality of a wireless set must be judged by its worst component. Never allow any component to be your worst. Remember always that the tiniest short circuit, the least slackness in your soldered connections, a gap of a bare half-inch between wires that ought to meet, are sufficient seriously to impair the working of even the most perfectly designed set. Therefore lay about you manfully with the soldering iron, bearing in mind the proverb, "Spare the solder and spoil the set." Borrow a monkey wrench for tightening up your terminals, and when all is done, test, test, test. One of the simplest and best ways of seeing that your inductance is all that it should be is to conduct a little test, which should be carried out at a friend's house. It can, of course, be done at home, though I strongly advise the borrowing of the friend's abode for the occasion since certain small inconveniences may arise which it is better that he should suffer than you. Choose preferably a friend whose house is fitted with electric light, for gas, though quite useful for soldering, is of no great value for testing circuits. Remove a bulb from one of his light fittings and in its place insert a socket to which are attached two leads. Switch off. Bare the ends of these leads and affix them to the top and bottom of your A.T.I. Switch on. If the main fuse blows, you may feel quite satisfied that your coil is up to the mark. However, should the coil burn out whilst the fuse remains intact, you need not lament its loss, for such a coil is obviously not strong enough to give good service, and would certainly have succumbed the very first time your aerial was struck by lightning. The friend whose hospitality you enjoy may be a little annoyed, but you can soothe him down by explaining that he is covering himself in glory by sharing in the labours of a wireless pioneer, and pioneering is always full of ups and downs. Should this fail to calm him, shake the dust from off your feet and say that you will never go inside his house again. He would probably not have asked you in any case, but you have made your test, which is all that really matters to you.



The condenser connections.

The Problem of Spare Time

If your inductance has burnt out you must, of course, rewind it, which will mean that you will have to get a hustle on in order to keep pace with the instalments of this serial circuit. It may be difficult to find the necessary time, but no real wireless enthusiast is ever deterred by such little things as this. If your time is limited you must make more spare time. This can be done in several ways. One of the simplest is to give up the slothful habit of sleep for a week, by which you will gain at least fifty-six hours, an ample allowance for doing necessary tasks. Another is to foreswear eating; by this method three hours a day or twenty-one hours a week can be saved. My own tip, which is an extremely useful one, is to visit my doctor wearing a mournful expression and complaining of pains in the head. Being a good fellow he promptly diagnoses overwork and orders me a week's holiday, which relieves me from the necessity of doing ordinary work and provides ample leisure for wireless construction. If only one day is required, an aunt should be buried. A good supply of moribund aunts is, in fact, essential to any real wireless man, for he is thus able to snatch days for important tasks at the

cost of a shilling telegram to the office. My friend Poddleby, whose enthusiasm knows no bounds, has interred no less than 239 in the last four years, and has now fallen back upon grandmothers.

Building the A.T.C.

We now come to the construction of the aerial tuning condenser, the position of which in the circuit is shown in the drawing. I may say here that it is not absolutely essential to fit this condenser, and that those who like to have three or four broadcasting stations coming in at the same time will find that they can obtain this effect to perfection by winding the inductance to suitable size and omitting the A.T.C. Most of us, however, prefer to have one at a time, and the trouble taken in making the A.T.C. will, I feel sure, be amply repaid by the quality of the results. There are many people who, when they require a condenser, simply go out and buy one. This practice cannot be too strongly condemned, for it verges almost upon fraud. The other day I was shown by Gubbsworthy a set which he had said he had made. "Did you make those?" I asked, pointing to the coils with which it was garnished. "Oh, no, of course not; I bought those." "And this, and this, and this?" I questioned, dabbing my finger upon condensers, rheostats, coil-holders and transformers. He had to admit that he had bought every one. I then pointed out that, so far from having made the set, he had done nothing but drill a few holes in a slab of ebonite and solder a few wires to things. Now, obviously this is not real wireless construction. When I, and I hope you, make a set, everything is turned out in the home workshop. Anyone with any real feeling for wireless can see that it is far better to spend five shillings over making a fixed condenser than to buy the thing for eighteenpence.

The Materials Required

For building the A.T.C. we require a number of metal plates. The ordinary enamelled soup plate may be used if desired, but this does not make a very neat job. By far the best plates are those which come from tins holding fifty cigarettes. When you have removed the lid you find that you are still unable to help yourself to the cigarettes because they are sealed up like sardines. To get at them you make use of a little cutter in the lid, which turns out a thin disc of just the right size for the purpose. You will require forty-nine of these for the A.T.C., and as there is only one per tin, you will have to buck up with your smoking if you are to be in time for next week's instalment. Should you be a non-smoker, take your stand at the door of a tobacco shop and approach each emerging customer with the simple words, "Got any cigarette lids, mister?" When you have collected the required forty-nine you can go to your workshop and begin. You should now borrow a bought variable condenser from the least desirable of your friends. This you will use as a pattern. Take the condenser to pieces and place one of its fixed plates upon the first tin lid to be attacked. With a large pair of scissors looted from your wife's work-basket cut the tin to the required shape. Then, still using the borrowed plate as a jig, make the necessary holes. Suitable tools for this purpose are the pointed thing at the end of a tin opener, the spike of a policeman's helmet (which is often to be obtained from the kitchen after dinner), or if none of these is available, a breast drill. The moving plates are made in the same way. When all the drilling and cutting have been done, the plates should be thoroughly flattened. A good way of doing this is to invite your heaviest relative to spend the week-end with you and to place the plates inserted between the leaves of a volume of the *Encyclopædia Britannica* beneath his mattress.

Washers and Things

The spacing washers may be a little trouble, but the task of making them is not really so formidable as it might seem. Purchase a few yards of brass tubing and cut it up into ½-inch lengths. Now file each of these down until they are precisely .088 inches thick. As only seventy-five washers are required for the fixed plates, this task will not take a great deal of time. Washers for the moving plates are made in the same way, but for these you will require a fatter brand of tubing. All that is now needed is three suitable bolts, a piece of 2B.A. studding, a few nuts and a knob. The last is best acquired from a friend's set whilst he is looking the other way. Most amateur-made sets have too many knobs, so that you are really doing the friend a good turn. When the condenser has been erected you may spend the next two or three days in trying to persuade its plates not to touch one another as the knob is revolved. It might be thought that a mere caressing touch here and there would not signify, but really it is very important indeed; in fact, the prevalence of intermittent deafness amongst wireless constructors is to be traced mainly to this cause.

Finishing the Condenser

The finishing touches can now be applied to the condenser. This process consists in taking it down the garden and dropping it gently into the dustbin. You may now sally forth with a clear conscience and a Fisher and purchase a .001 μF condenser. You will have no need in the future to do any violence to your truth-loving principles, for when your friends inspect the new set you will be able to say truthfully and without the slightest deviation from the straight path, "Yes, I made my aerial-tuning condenser."

(Another powerful instalment next week.)

WIRELESS WAYFARER

Royal Society of Arts.

EXTRA MEETING.

An Extra Meeting of the Society will be held on Wednesday, July 2nd, at 4.30 p.m., when a Paper will be read by Senator Guglielmo Marconi, G.C.V.O., LL.D., D.Sc., a Vice-President of the Society, on Results Obtained over very long distances by Short-Wave Directional Wireless Telegraphy, more generally referred to as the "Beam System." Mr. Alan A. Campbell Swinton, F.R.S., late Chairman of the Council, will preside.

How every Crystal User may become a Valve Expert

By E. REDPATH, Assistant Editor.

The second of a special series of articles intended to form a simple but complete guide to all readers who have not yet added valves to their receiving equipment.

BEFORE leaving the two-electrode valve entirely and passing on to a consideration of the more modern and almost universally employed three-electrode valve, an understanding may very conveniently be gained of several rather important points.

Characteristic Curves

In order to ascertain exactly what is taking place under certain conditions, the valve is connected up with the necessary instruments in circuit; various adjustments are made and readings taken, and from these a curve or graph is plotted. By explaining the idea of characteristic curves and pointing out the amount of information to be gained from them in reference to the comparatively simple two-electrode valve, it is thought that the beginner will be better able to understand and "visualise" the action taking place in the three-electrode valve as indicated by any particular curve.

The writer is well aware how prone many readers are, in their eagerness to arrive at practical details, to skip such items as characteristic curves as being too theoretical or as being dry and uninteresting, or possibly as being too difficult to be mastered without considerable trouble.

Such ideas are quite wrong. Firstly, characteristic curves are of the greatest possible assistance to the practical man and experimenter. Secondly, a little practice in following and attempted visualisation of the action taking place, as already mentioned, will be found to both add to the interest and assist in overcoming difficulties.

Properly understood, a characteristic curve shows, practically at a glance, the general classification of a valve, its special qualifications or failings, and its suitability for different purposes; all of which is, or should be, vital information to the practical man.

Plotting a Characteristic Curve

The arrangement for obtaining the characteristic curve of a two-

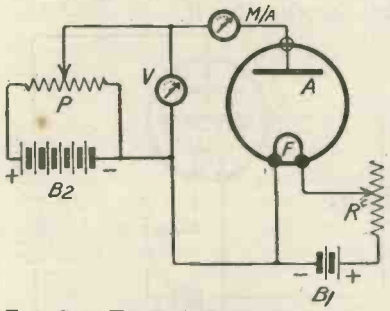


Fig. 3.—Typical arrangement apparatus for obtaining anode voltage. Characteristic curve of a 2-electrode valve.

electrode valve is shown in Fig. 3, in which A represents the anode or plate of the valve; F, the filament; R, the filament

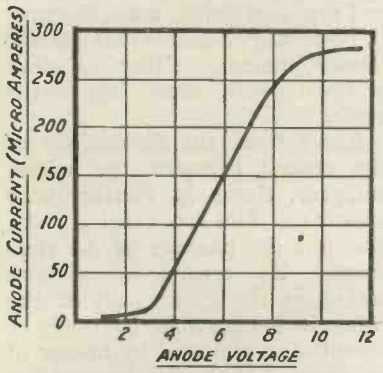


Fig. 4.—Typical characteristic curve of a 2-electrode valve.

rheostat; B1, the filament battery; B2, the anode or plate battery shunted by the potentiometer P; V, a voltmeter to indicate the potential of the anode with respect to the negative side of the filament; and M/A, a low-reading milli-ammeter, to indicate the current in the external circuit due to the flow of electrons from the filament to the anode across the space.

Suppose the filament to be made incandescent by current from the battery B1 and the variable contact of the potentiometer (P) to be at the negative end. Under these conditions the reading of the voltmeter will be zero (i.e., the anode will be at the same potential as the filament and the electric field will be nil).

The reading on the milli-ammeter will either be zero or an exceedingly small value, because any electrons emitted from the hot filament will be attracted to the most strongly positive body near at hand, which is the positive side of the filament. If the variable contact on the potentiometer is now moved step by step towards the positive end, the increased voltage on the anode will be indicated by the voltmeter (V), and the increased flow of electrons through the valve by the milli-ammeter (M/A). The filament current (or, in other words, its temperature) must remain constant throughout, or the readings will not be properly co-related.

Plotting these readings on squared paper, with the anode voltage reading along the horizontal and the anode current reading up the vertical axis, a curve will be obtained which is termed an "anode voltage-anode current" characteristic curve, the anode voltage being the independently variable factor. Fig. 4 is a typical curve, and, by careful observation, the following important and practical information can be gathered from it:—

(a) Until the anode is made positive to the most positive part of the filament, little or no anode current flows. The point upon

the curve where no anode current flows at all is called *extinction point.*

(b) The electron flow does not increase regularly. The rate of increase is very slow until, at about 3 volts positive, a comparatively rapid acceleration occurs. This point is called the *critical point.*

(c) The large increase in electron flow for a small change in anode voltage continues until, at about seven volts, *the rate of increase* begins to fall off.

(d) At about 12 volts positive the electron flow remains practically steady and further increase in anode voltage produces no increase in electron flow (or anode current). This point upon the curve is termed the *saturation point,* indicating that, for a given temperature of filament, the maximum number of electrons are reaching the anode.

In the case of a very " soft " valve higher anode voltages may cause heavy ionisation to set in, with consequent sudden increase in anode current and liability of damage to the filament.

The clearly defined critical point (exaggerated somewhat in order to illustrate more clearly) indicates that the valve under test was fairly " soft," and is due to the slight ionisation which commences when the attractive force exerted by the anode becomes strong enough to cause the electrons to acquire the necessary velocity.

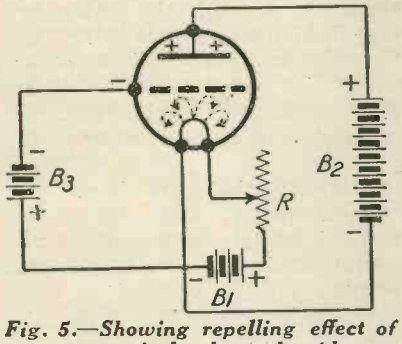


Fig. 5.—Showing repelling effect of a negatively charged grid.

Had the valve been a hard valve (high vacuum) the rate of increase in electron flow would have been much more regular, the bend in the curve at the critical point being considerably reduced, whilst a real saturation point could have been reached, beyond which further increase of anode voltage would have no effect, owing to the entire absence of ionisation.

The Three-Electrode Valve

Having discussed the action of the two-electrode valve at some length, with a view to making quite clear the elementary principles upon which the action of all valves depends, we pass at once to the modern three-electrode " hard " valve. As the name implies, this valve is provided with an additional electrode in the shape of a grating or spiral of wire placed between the filament and the anode, and known as the *grid.* The filament will now be to some extent screened from the anode, and though many electrons will pass through the spaces of the grid and reach the anode, some will strike the wire of the grid and be absorbed by it.

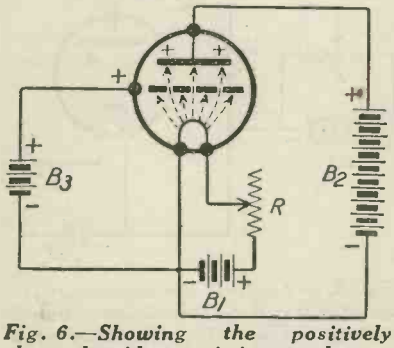


Fig. 6.—Showing the positively charged grid permitting, and even assisting, the flow of electrons.

The number getting through therefore depends to some extent upon the closeness of the grid. There are many different shapes and types of grids, and they may all be arranged under two general classes, namely, either as close or open grids, according to the mesh.

Apart from the dimensions of the spaces between the wires, however, there is another very important fact concerning the grid and the passage of the electrons. By means of a wire sealed in the glass wall of the valve it is possible to apply a potential to the grid by means of an external battery connected between it and the filament.

If the grid is made negative to the filament it tends to drive the emitted electrons back into the filament, as indicated in Fig. 5. If the grid is made positive compared to the filament, the positive charge upon the grid assists the electrons away from the filament towards the anode. Some electrons will strike the grid itself, whilst others will pass through

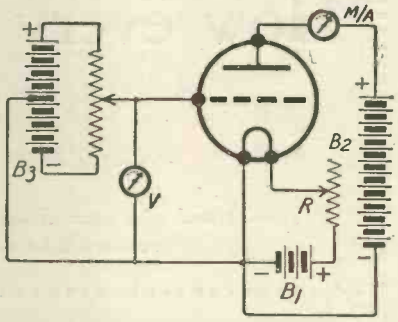


Fig. 7.—Arrangement for obtaining " Grid Voltage - Anode Current " characteristic curve.

the apertures and travel on to the anode, as indicated in Fig. 6.

From this it will be seen that the grid affords a means of controlling the flow of electrons from filament to anode, and that such control is effected by *change of grid potential.* The operation, therefore, of the three-electrode valve may be summarised in the statement that the flow of electrons through the valve under working conditions is controlled by the potential of the grid with respect to the filament.

By an arrangement of apparatus as indicated diagrammatically in Fig. 7, various readings of anode current (electron flow) at different grid potentials, both negative and positive with regard to the filament, could be taken and plotted upon squared paper to a suitable scale. In this case it will be noted that the independently varied factor is " grid voltage," and accordingly the resultant curve is known as a " grid voltage-anode current " characteristic curve. For each particular curve the anode voltage and filament current should remain unaltered throughout.

Figs. 8 and 9 are typical characteristic curves of modern three-electrode " hard " valves having open mesh grids. The actual details of the shape and arrangement of the three electrodes (filament, grid and anode) are too familiar to require further illustration.

Action of Modern Valves

Owing to the very high degree of vacuum obtained in modern valves, no ionisation occurs, even when comparatively high potentials (100 volts or more) are applied to the anode. It follows therefore that—

(a) The whole of the current through the valve consists of a stream of negative electrons emitted by the hot filament.

(b) In the absence of any positive ions, the space between the filament and grid will be occupied by a cloud of negative electrons, known as the negative space charge.

(c) The characteristic curve will not have a clearly defined critical point (as in Fig. 4), but will tend to become practically a straight line.

Due to the comparatively large spaces between the wires of the grid, its screening effect upon the filament is small, so that :—

(a) Electrons will pass through the grid spaces, avoiding actual contact with the wires of the grid, even though the grid itself is at a negative potential compared to the filament.

(b) Anode current extinction point may only be reached when the grid is made very negative to the filament.

(c) Current flow in the grid circuit, due to electrons intercepted by the grid, will only have a small value.

Referring to the characteristic curve, it may be noted that after a certain initial grid voltage is passed, the flow of electrons to the anode increases rapidly, so that, with a suitable adjustment, a small change in grid voltage causes a large change in anode current. This is a very important fact, upon which the action of all valves depends, although their individual characteristics may vary greatly.

Glossary of Elementary Terms

Further theoretical principles will be explained as occasion demands, when dealing with the practical application of valves in various types of receiving circuits. As the present article completes the necessary introductory theory, it is considered advisable to give a brief glossary of elementary valve terms as mentioned in the present and preceding articles.

Anode (also called "plate" and "sheath").—The positively-charged electrode in the valve, to which are attracted the negative electrons emitted by the hot filament.

Blue Glow (also called "blueing").—A bluish light appearing inside the valve indicating that heavy ionisation is occurring. Immediate steps must be taken to stop this action by reducing

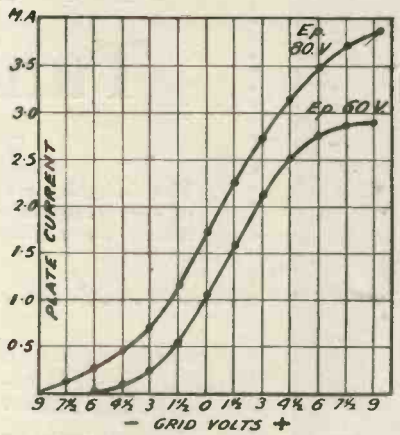


Fig. 8. Characteristic curves. The lower one shows the effect of "softening," due to usage.

anode voltage or filament current.

Critical Point. — That point upon a characteristic curve where a small increase of potential will result in a large increase of anode current, but a corresponding decrease in potential results in a small reduction only of anode current.

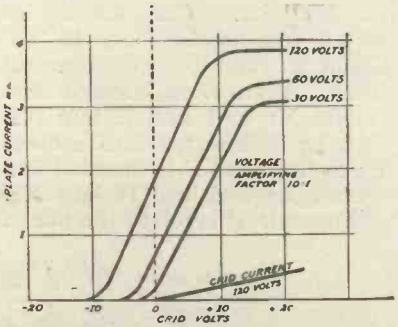


Fig. 9.—The characteristic curve of the Xtraudion valve.

Extinction Point.—That point upon a characteristic curve where anode current is reduced to zero.

Electric Field—in a Valve.—The electro-static strain between anode and filament due to their difference of potential, the anode being always charged positively.

Electronic Velocity. — *The* speed of the negative electrons (*a*) on emission from the hot filament; (*b*) under influence of the electric field.

Grid.—The "third electrode," placed between the anode and the filament of a valve, and controlling by its electrical potential the flow of electrons from filament to anode.

Grid—Open.—A grid in which the spaces between the wires are comparatively large. Such a grid has a comparatively small screening effect.

Gas Pressure.—In a valve this is always considerably lower than atmospheric pressure. Regard as the converse of vacuum.

Ions — Positive. — Molecules which, having lost one or more negative electrons, remain with an excess positive charge.

Ions—Negative. — Molecules which, having gained one or more negative electrons, have an excess negative charge.

Ionisation—By Collision.—An effect due to the impact of electrons from the hot filament with gas molecules within the valve. If relative velocity is high, positive ions and increased number of electrons result.

Molecule—Neutral.—A molecule which is unaffected by electric fields because the positive and negative charges within the molecule are exactly equal.

Mean Free Path.—The average distance travelled by electrons from hot filament before colliding with gas molecules.

□ □ □

NEXT WEEK :—The addition of valves to crystal-receiving sets. Constructional details of the necessary apparatus and an explanation of its theory and action.

Continental Broadcasting.

In view of the growing interest taken by amateurs of this country in Continental programmes, and also because of the numerous errors in regard to hours of transmissions of foreign stations, which are at present appearing in the wireless Press, we have secured the collaboration of Capt. L. F. Plugge, B.Sc., F.R.Ae.S., F.R.Met.S., the well-known authority on Continental broadcast reception.

Capt. Plugge has consented to give our readers a reliable and comprehensive time-table of the principal Continental transmissions, the first of which will appear in our issue for July 9. He will also contribute a series of articles on the fascination of foreign reception.

In these articles the methods to adopt to discover the Continental stations on the tuning keys will be dealt with in an elementary manner, and our readers will also be kept in touch with the latest news affecting foreign programmes and transmissions.

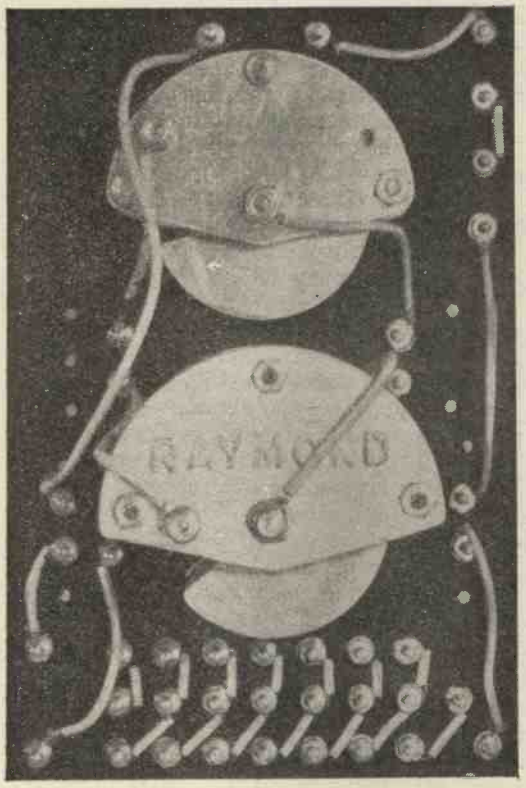


Fig. 9.—A view of the underside of the panel showing the simplicity of the wiring.

An All-Wave Tuning Unit

By H. BRAMFORD.

The following article explains the various methods of operating this receiver, constructional details of which were given in the previous issue of this journal.

The Circuit

A circuit diagram is shown in Fig. 10. The terminals, sockets, and Clix sockets are numbered as in the previous diagrams in order to assist the reader to follow out the instructions with ease. The preliminary principles are as follows—Lead E is plugged into the coil sockets for aerial connection, and lead G for earth. Leads F and H, when plugged into sockets X9 and X12, give an open circuit. A loose-coupled inductance is obtained by plugging in leads E and G for aerial to earth connections, and leads F and H are plugged into further coil sockets for the circuit connections. Leads A, B, C and D actuate the two variable condensers, which may be placed in series with the aerial by connecting between X9 and X10, or, in parallel or series, with each other. The method of doing this will be described later.

Arranging the Coils

It is advisable to first explain the various arrangements in which the coils may be placed for different types of inductances, and for this purpose five examples are given in Fig. 11.

Example A, which is the simplest, is arranged in the following manner:—Connect aerial to T2. Insert a suitable coil for the range desired into sockets S1 to S2. Plug lead E into socket X1 and lead G into X2. Lead F is inserted into socket X10 and lead H into X12.

Example B is a loose-coupled arrangement for which two coils are required, L1 and L2. Coil L1 is inserted into sockets S1 to S2. Connect aerial to terminal T2. Lead E is inserted into socket X1 and lead G into X2. Coil L2 is inserted into sockets S5 to S6. Lead F is inserted into socket X3 and lead H into X4.

Example C involves the use of two coils in series, and for this purpose the instructions are similar to example A, the coil L1 being inserted into sockets S1 to S2 and L2 into S3 to S4. Lead E is plugged into socket X1 and lead G into socket X3. Leads F and H are then placed as in example A.

Example D shows a similar arrangement to example C, employing three coils in series, L1, L2, and L3. The connections are made as before, L3 being plugged into sockets S5 to S6 and lead G into X4.

Example E shows an arrangement similar to example B, with the addition of a reaction coil L3. The instructions for example B are followed as before, and coil L3 is plugged into sockets S9 to S10, a lead from the plate of the valve being plugged into the socket X5, and a further lead

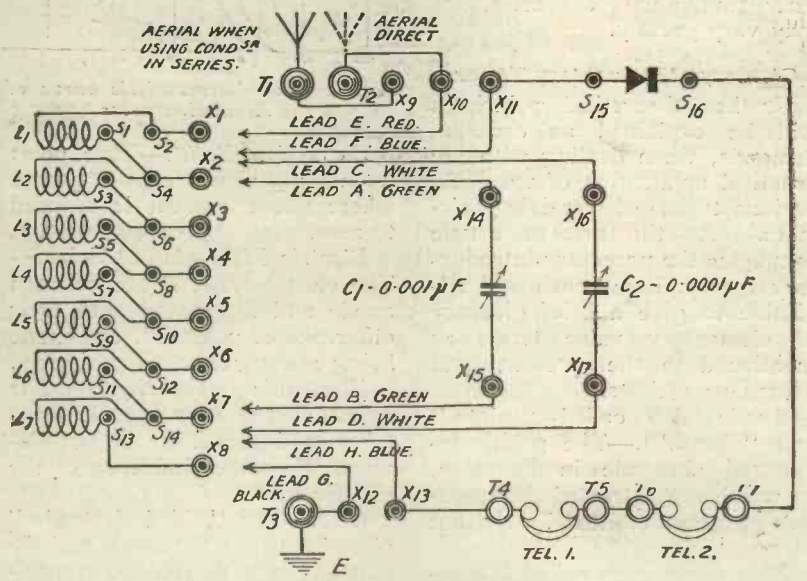


Fig. 10.—The circuit arrangement of the receiver.

from the phones being plugged into socket X6. Tuning is obtained between these coils as before.

Arranging the Condensers

Having mastered the placing of the coils for different purposes, we may turn our attention to the condensers. Eight examples are shown in Fig. 12.

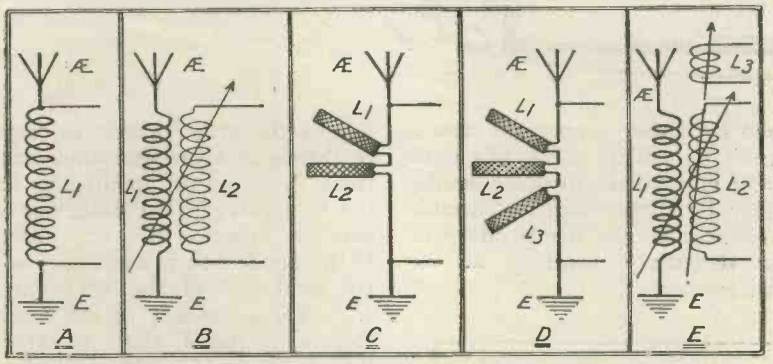


Fig. 11.—Possible arrangement of the coils by interchanging the clip plugs.

Example A is similar to example A of Fig. 11 as regards the coil, and the condenser C1 is placed in parallel with the coil L1 for tuning purposes. To connect the condenser, plug lead A into socket X11 and lead B into X13. This arrangement is suitable for local broadcasting.

Example B is similar to example B of Fig. 11 the condenser C1 being connected in parallel with the coil L1, and C2 in parallel with L2. The condenser connections are as follows:—Plug lead A into socket X10 and lead B into X12. Lead C is plugged into socket X11 and lead D into X13. This arrangement takes the form of a loose coupler, L1 being tuned by C1 and L2 by C2.

Example C shows the condenser C2 in series with the aerial and C1 in parallel with the coil L1. First connect the aerial to T1, the coil connections being as described for example A. Plug lead C into socket X9 and lead D into X10. Leads A and B are then connected as in example A. This arrangement is suitable for shorter wavelengths, the aerial being tuned by the condenser C2.

Example D is similar again to example A. Both condensers C1 and C2 are in this case placed in parallel with each other, and also with the coil L1. This gives a capacity of 0.0011 μF, being the total capacity of the two condensers, C2 acting as a vernier adjustment. Condenser C1 is therefore plugged into the sockets mentioned in example A and lead C is plugged into socket X14 and lead D into X15. In this case tuning is obtained first with the condenser C1, and the final adjustment is made with C2.

Example E employs a coil L1, tuned by the condenser C2 in series with the aerial, this arrangement acting as a wavetrap. The coil L2 and the condenser C1 are arranged as L1, C1 in A. To connect the condenser C2, plug lead C into X9 and lead D into X10, the aerial being connected to terminal T1. To connect the coil L1, insert between terminals T1 and T2.

Example F shows a loose-coupled arrangement having the condenser C1 in series with the aerial and the coil L1. The condenser C2 is in parallel with the coil L2. Connections are made as in example B, with the exception of the C1 leads. Lead A is plugged into socket X9 and lead B into X10, the aerial being connected to T1.

Example G shows a similar arrangement to example F, with the condenser C1 in series with the aerial and primary coil L1 only. Connections are made as before, the leads for condenser C2 being left out.

Example H is similar to example B, C1 being placed in parallel with L2, C2 being omitted. A reaction coil is added, as described in example E of Fig. 11.

Further range may be obtained by placing two or more coils in series with each other, as described in example C and D of Fig. 11. The size of the coils used in each case is best left to the experimenter, as these values would differ in accordance with the efficiency of the aerial in use. Several other arrangements may be made with a little ingenuity on the part of the experimenter, little practice being required to become familiar with the principle and operation of this undoubtedly useful addition.

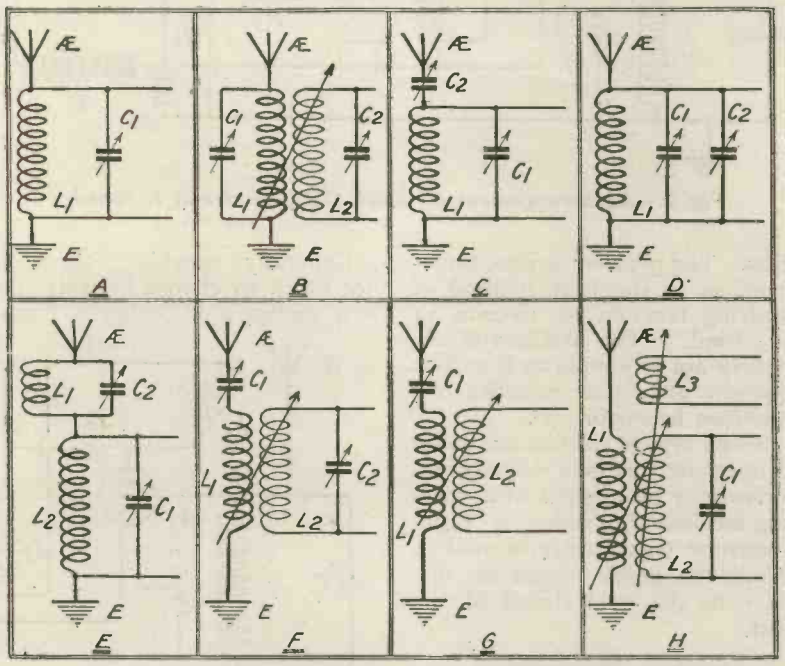


Fig. 12.—Showing a variety of tuning circuits which are obtainable.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

Adding Reaction to Transformer-Coupled Circuits

THERE is rather an increasing tendency towards the use of high-frequency transformers for coupling valves together, particularly in reflex circuits. The problem arises, therefore, as to the best method of applying reaction to circuits of this kind. The problem is obviously not as simple as it at first appears, and some remarks will therefore be opportune.

Seven typical circuits are given to illustrate methods whereby reaction may be applied to a wireless receiver in which a high-frequency transformer is used to couple the anode circuit of one valve to the grid circuit of the next.

Aperiodic Transformers

For short wavelengths the aperiodic transformer, in which neither the primary nor secondary is tuned, is all but valueless. Results are really only obtained when the natural wavelength of the transformer corresponds to the wavelength to be received. It is therefore customary to tune the transformer, and this may be done by either tuning the anode circuit or tuning the grid circuit of the next valve; in other words, either by connecting a variable condenser across the primary or the secondary winding of the transformer.

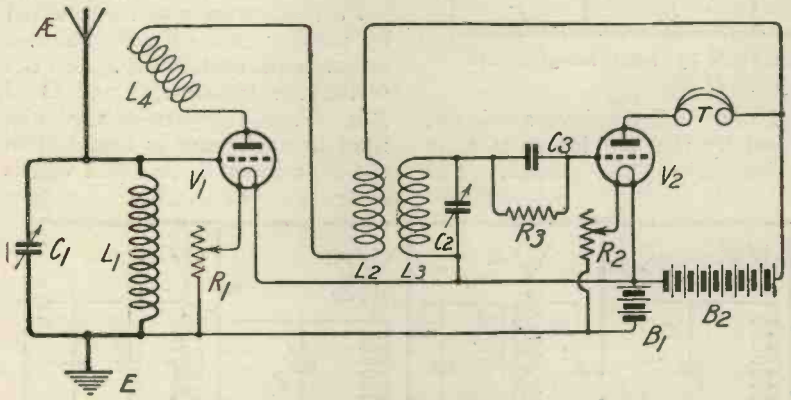


Fig. 1.—An arrangement in which the grid circuit is tuned.

Generally speaking, there is not much to choose between the two methods of tuning a transformer, but I am inclined, myself, to prefer tuning the grid circuit in most cases. There is nothing to choose as regards signal strength, but when the anode circuit, or primary winding of the transformer, is tuned by means of a variable condenser, there is a greater tendency for the first valve to oscillate, due to capacity reaction in the valve. If the anode coil is aperiodic, and the grid coil of the next valve (*i.e.*, the secondary of the transformer) is tuned, there is rather less tendency for the preceding valve to oscillate. I have, however, explained how the coupling of a tuned circuit to an aperiodic anode coil will cause the anode circuit to act very much like a tuned anode circuit, and the extent to which the valve will oscillate will depend upon the tightness of the coupling between the aperiodic anode coil and the tuned secondary coil. The looser the coupling, the less the tendency for the first valve to oscillate.

Commercial Patterns

The ordinary commercial high-frequency transformer has fixed winding, and therefore we cannot vary the tendency of the first valve to oscillate by varying the degree of coupling between the primary and secondary. On the other hand, there is usually a medium, rather than a tight, coupling between the coils, parti-

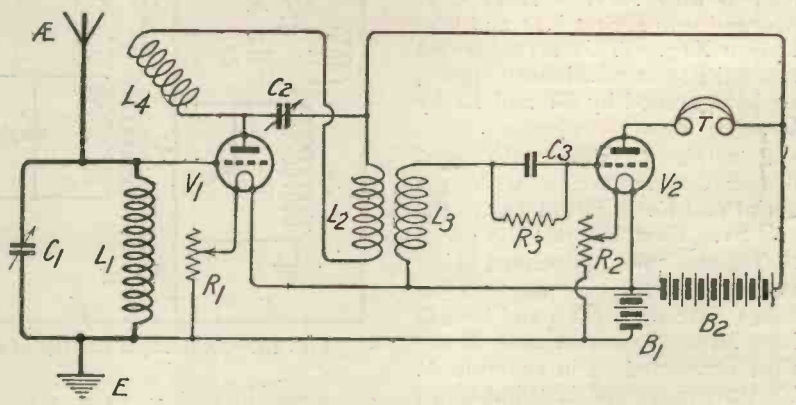


Fig. 2.—Here the primary of the transformer is tuned.

cularly in the best makes. The result is that, generally speaking, there is less tendency to oscillate if the secondary winding is tuned.

I propose, however, to give here some different circuits showing how reaction may be obtained, both in the case of those circuits using a tuned primary and those using a tuned secondary.

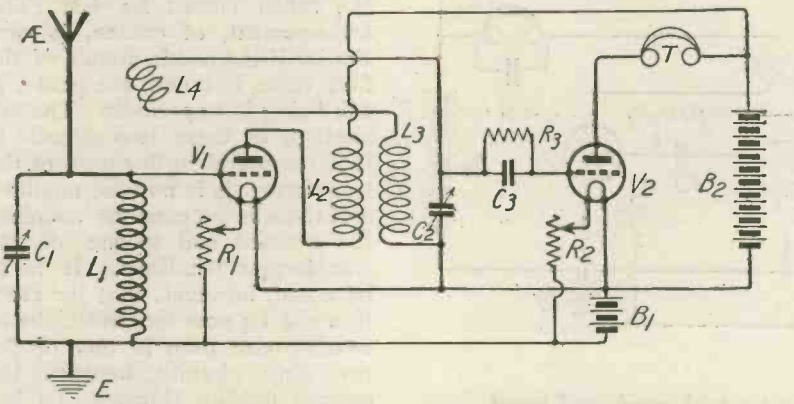


Fig. 3.—Circuit with reaction coil included in secondary circuit.

Fig. 1 shows a circuit in which the grid circuit is tuned, a reaction coil L4 being connected in series with L2. The chief point to notice here is, that if the inductance of the coil L4 and the inductance of L2, which is in series, is such that when the capacity of the valve and the self-capacity of the inductances bring the natural wavelength of the anode circuit to approximately that which is being received, the first valve will tend to oscillate, and this effect may be most marked. The addition of a small reaction coil, say a No. 25 plug-in coil, in series with the primary of the transformer, will usually not make any difference, but if a large size of reaction coil is used self-oscillation may occur, even though the reaction coil is kept well away from the aerial inductance L1. To enable a small reaction coil to be used, instead of using parallel aerial condenser-tuning as shown in Fig. 1, constant aerial tuning may be employed, or the variable condenser, at present in parallel with L1, may be connected in series with it.

Fig. 2 shows the arrangement when the primary L2 of the transformer is tuned. The point raised in connection with Fig. 1 is not so important here, because we are definitely and intentionally tuning the anode circuit of the first valve. It is, however, still desirable to keep the reaction coil as small as possible, but the danger, of course, is that with the ordinary commercial transformer that the reaction coil in series with the primary winding shunted by the condenser will give too high a wavelength. If, for example, a transformer is designed to cover a wavelength range of 300 to 600 metres, as many of them are, the inclusion of a reaction coil in the primary winding which is to be tuned will result in the initial wavelength being considerably higher, and it may be that the tuning is now higher than that of the wavelength of the station to be received. An obvious suggestion, of course, is to use a size smaller in the transformer.

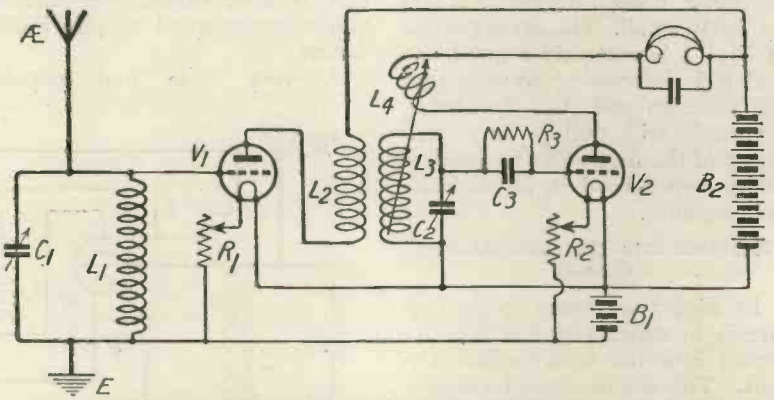


Fig. 5.—Reaction into the intermediate circuit.

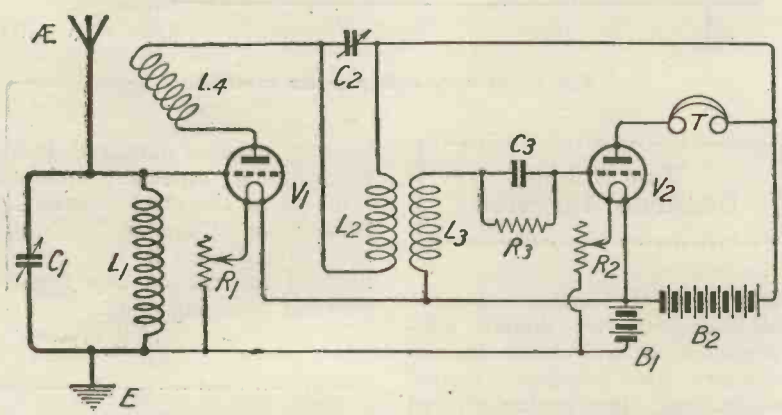


Fig. 4.—An interesting but little employed method of introducing reaction.

When the secondary of the transformer only is tuned, a reaction coil coupled to the aerial coil may be included in the secondary circuit. Such a circuit is illustrated in Fig. 3, and now we find the inductance L4 in series with L3, a variable condenser C2 being now used to tune the grid circuit of the second valve. The reaction coil should be kept as small as possible, and it must be remembered that the introduction of the reaction coil will increase the minimum wavelength which may be tuned in on the transformer.

Fig. 4 shows an interesting method of introducing reaction which, while not new, is rarely employed. It will be seen that the reaction coil L4 is now not actually in the tuned primary

circuit of the transformer, which circuit simply consists of the primary winding L2 and the variable condenser C2. The reaction coil L4 does not make a material change in the tuning of the circuit L2 C2. Here, again, it is desirable to keep the reaction coil L4 fairly small. The arrangement of Fig. 4 is certainly a good one and it is interesting to note that the reaction coil L4, by being reversed, will nullify any tendency of the first valve to oscillate of its own accord in an undesirable manner.

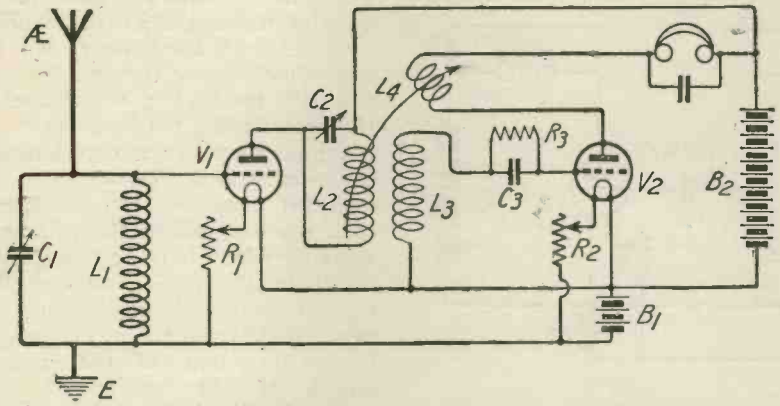


Fig. 6.—An alternative arrangement with anode coil tuned.

Reaction into the Intermediate Circuit

In Fig. 5 we come to the first circuit in which reaction is introduced into the intermediate circuit. The reaction coil L4 is now included in the anode circuit of the second valve, and is coupled to the secondary winding of the transformer. In the case of many fixed high-frequency transformers it is difficult to introduce reaction into them, and consequently this particular circuit is not likely to be so popular, although it is certainly effective. The obvious alternative arrangement is that shown in Fig. 6, where the anode coil is now tuned, the reaction coil being coupled to this inductance.

A very safe and popular method of introducing the reaction is that illustrated in Fig. 7. The reaction coil is now connected in the anode circuit of the second valve, and is coupled to the grid circuit of the first, so that reaction is introduced into the aerial circuit and also into the tuned circuit L3 C2. The arrangement, of course, is very similar if the anode circuit of the first valve is tuned, the grid circuit being left aperiodic. The advantage of these two circuits is that the wavelength range of the transformer is in no wise modified and there is no need for coupling the reaction coil to one of the transformer windings. It is to be noted, however, that the reaction coil L4 now requires to be of smaller size than in any of the preceding circuits, because the current flowing through L4 has been amplified by two valves, and is therefore more powerful. This means that the effective coupling between the reaction coil and the aerial coil need be less.

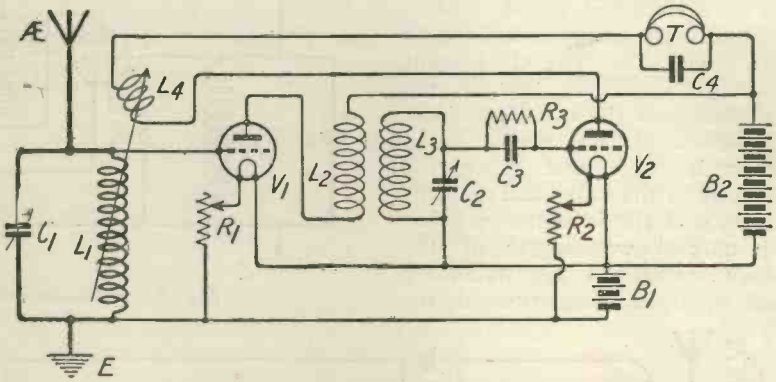


Fig. 7.—A very safe popular method.

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Two Simple Questions Answered

What does it mean when signals are quite strong on first switching on, but fade away almost to nothing in a few minutes, the process being capable of repetition after a few moments of rest?

Usually it means that the accumulator or H.T. battery is run down, and its voltage recovers when standing, but falls rapidly again in use.

What is the best kind of wire to use for winding tuning coils: cotton covered, silk covered or enamelled?

A great deal depends upon the type of coil which is to be constructed, and the method for varying the number of turns in circuit. Enamel-covered wire is most suitable for coils to which a slider is to be fitted. Double cotton-covered or double silk-covered wire are about equally suitable for winding tapped inductances, the cotton-covered wire having perhaps a slight preference because the thicker covering ensures a greater spacing between the actual wires of adjacent turns. Incidentally the cotton-covered wire is much cheaper. For honeycomb, basket, or duolateral coils double cotton-covered wire is most suitable. The silk covering frequently becomes damaged during the winding, especially upon the removal of the steel rods of the former or "spider." Single silk-covered wire is not recommended for use on any type of wireless receiving coils.

CHANGE OF ADDRESS.

We are asked by Burne-Jones & Co., Ltd., to point out to our readers that they have now moved to Magnum House, 288, Borough High Street, London, S.E.1.

A Three-Valve Circuit on the Omni Receiver

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

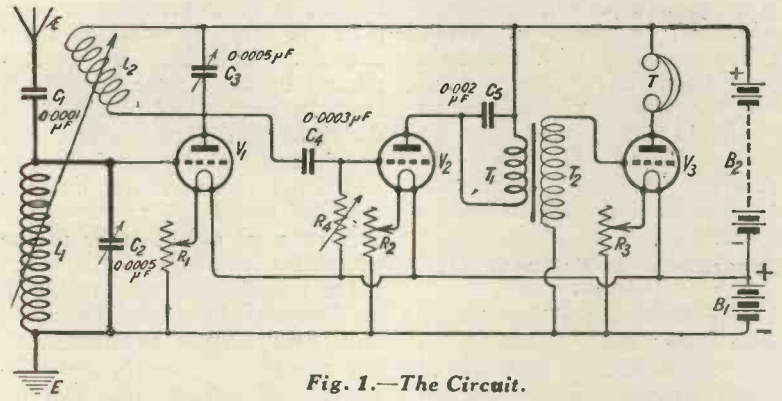


Fig. 1.—The Circuit.

A VERY popular and efficient three-valve circuit is that shown in Fig. 1, which consists of one stage of high-frequency amplification, followed by a valve rectifier, and a note magnifier.

It will be seen that constant aerial tuning is used, the condenser C1 of 0.0001 μF capacity being included for this purpose. In the grid circuit of the first valve we have the aerial tuning coil L1, which is tuned by the condenser C2 of 0.0005 μF capacity. The coil L2 in the anode circuit of the first valve is tuned by the condenser C3, also 0.0005 μF, and is coupled to the coil L1 to produce reaction. The grid condenser C4 may have a value of 0.0003 μF, while for R4, a resistance between 1 and 3 megohms will be suitable. The primary T1 of the intervalve transformer T1 T2 is placed in the anode circuit of the detector valve, and shunted by the condenser C5 of 0.002 μF. The secondary T2 is connected across the grid and negative filament lead of the note magnifying valve V3. The telephones T are connected in the anode circuit of this valve.

The coil L1 will be a No. 50 for the reception of broadcasting below 420 metres, while for wavelengths above this, a No. 75 coil may be tried. A No. 50 coil will probably prove most suitable for the anode inductance L2, though for the higher broadcast wavelengths a No. 75 should be tried.

Connections

The circuit may be adapted to the Omni receiver by making the following connections on the terminal board :—

51— 3	13—40
11—17	6—22
17—18	22—45
18—12	46—21
26—25	21—24
25—52	2—21
4— 9	29—48
9—10	30—16
1— 2	8—31
4—19	23—24
27—14	32—40
14— 5	48—52

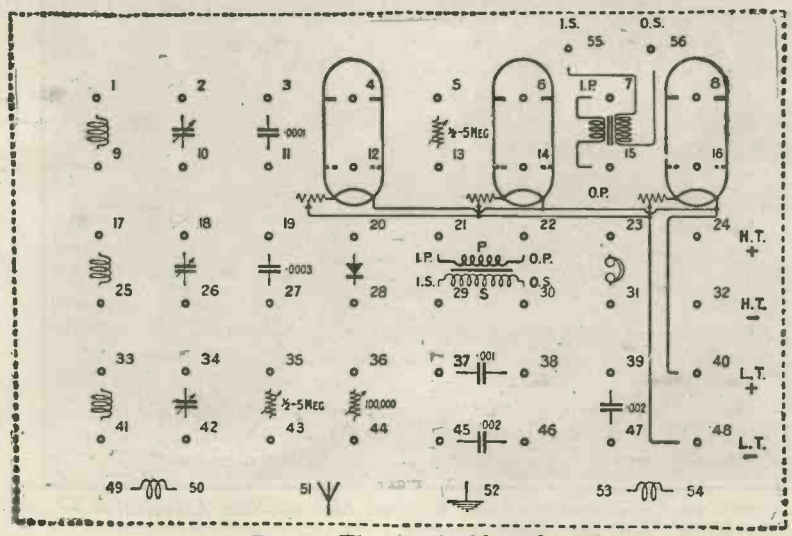


Fig. 2.—The terminal board.

The centre socket of the three coil holder is that of the aerial tuning coil, for which a No. 50 or No. 75 should be used according to the wavelength to be received. For the anode, a No. 50 should be plugged into the moving holder at the back. Having connected the telephones and batteries to the set, the valve filaments should be adjusted to the correct brilliancy, and with the two coils well apart the nearest station should be tuned in with ease.

Operating the Circuit

Those experienced in operating sets containing more than one tuned circuit will vary the two tuning condensers simultaneously, but relative beginners had best adopt the following procedure :—

First, tune to the best signal strength by means of the aerial condenser only ; then, upon varying the anode tuning condenser to its best point, signals should be considerably stronger. Now retune on the aerial condenser, when signals will become still stronger and the anode condenser may be finally adjusted. The knob of the variable grid leak in the centre of the panel should be turned until the most suitable resistance is in use. Variation of the coupling between the coils L1 and L2 adds a complication to tuning, but is necessary to obtain best results. The anode coil should be brought up slowly, at the same time compensating for the change thus made in the tuning, by variation of the aerial tuning condenser as well as the anode condenser. If this does not result in an increase in signal strength, the leads to the anode coil must be reversed. This is effected by disconnecting 2—21

and 4—9, and joining 4—2 and 9—21. If, on the other hand, the set oscillates with the coils in any position relative to each other, the reversal of the leads to L2 should be carried out as before. This will result in "reverse reaction," which will neutralise the tendency to violent oscillation.

Experiments to Try with this Circuit

Using the 0.0005 μF condenser across the anode coil gives rather sharp tuning, and one of smaller capacity will result in easier and finer tuning. By placing in series with the anode tuning condenser a fixed condenser of 0.001 μF capacity, the maximum capacity of the variable condenser is reduced to a little over 0.0003 μF. This is effected on the Omni receiver by disconnecting 10—9 and joining 10—38 and 37—9.

Series aerial tuning may be tried by disconnecting 25—26, and joining 26—51, and the merits of the two methods of tuning compared.

It may be found that the set works best with the coils as far apart as permitted by the coil holder, in which case it is a good plan to try separating them entirely. This may be accomplished by taking the anode coil from its socket and placing it in the right-hand fixed socket of the panel, and making the following additional connections on the terminal board: 4—53, 21—54.

A reversal of the leads to the secondary winding of the inter-valve transformer may result in an increase in signal strength, and is carried out by disconnecting 29—48 and 30—16, and joining 30—48 and 29—16. Reversing the primary leads may also make a difference; disconnect 21—24, 2—21 and 22—6; join 21—6, 2—22 and 22—24.

Should oscillation by any chance prove practically uncontrollable, the positive side of the L.T. battery, instead of the negative, may be connected to earth. Disconnect 48—52 and join 40—52.

When the preceding experiments have been tried and the best connections found, the range and volume of sound obtainable will cause some readers to wonder whether "Super" circuits are worth while.

"Earthed" Wireless Set Burned by Lightning.

That wireless sets are not immune from damage by lightning, although the aerials may be "earthed," is shown by an incident which occurred in Herefordshire during the severe thunderstorm.

Major L. Beaumont Thomas, Brampton House, Madley, Hereford, had, by means of a double pole knife switch, connected his aerial direct to the earth wire, disconnecting the set from aerial and "earth" by about three inches.

About 9 p.m. the aerial was struck by lightning. Aerial, knife switch and earth wire were shivered, and the woodwork of the window was burned and the set badly damaged.

[Note.—It is advisable while "earthing" an aerial as a protection against lightning, to remove the set altogether from aerial and earth.]—*Lloyd's Sunday News.*

The portable wireless station at Stanmore on the occasion of the Western Metropolitan Association of Affiliated Societies' Field Day, held recently.

The "Tuned Cathode" Circuit

An interesting new arrangement for stabilising high-frequency amplifiers.

The accompanying circuits illustrate a method of connecting high-frequency circuits due to Mr. J F. Johnston, of Altrincham, To these circuits he has given the name "Tuned Cathode," but as will be seen on careful examination, the title is somewhat of a misnomer, as the anode circuit is still tuned even when the tuned circuits are placed where indicated. We received these circuits early in April last, but have not published them before, pending our own tests of the method which now appears to be at least sufficiently interesting to publish. It should be pointed out, however, in making comparisons between this and the better-known methods that at first the efficiency may appear to be lower. This is due to the fact that with, say, two stages of ordinary tuned anode coupling, the set will be on the verge of oscillation, and, therefore, one will get in addition to the ordinary high-frequency amplification the fullest reaction amplification as well. In Mr. Johnston's method the use of a reaction coil is necessary in order to bring up the set to the oscillation point. A comparison should only be made when the methods are compared almost on the oscillation point. Readers' results will be welcomed.

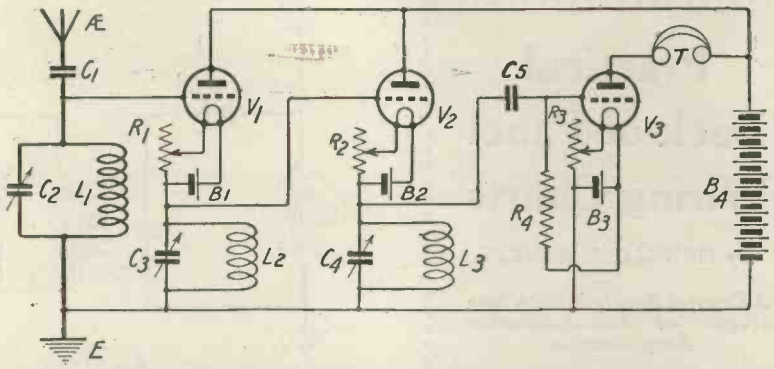


Fig. 1.—A simple arrangement with two stages of high frequency. Notice that the circuits C4 L3, and C3 L2 are both in the grid circuit of V2.

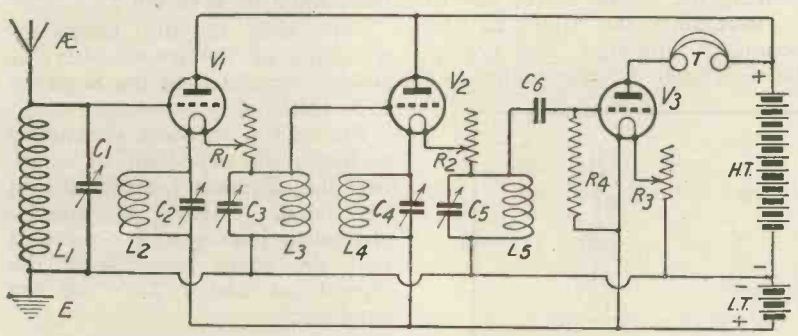


Fig. 2.—Another arrangement. The condensers C2 and C4 can be dispensed with under suitable conditions.

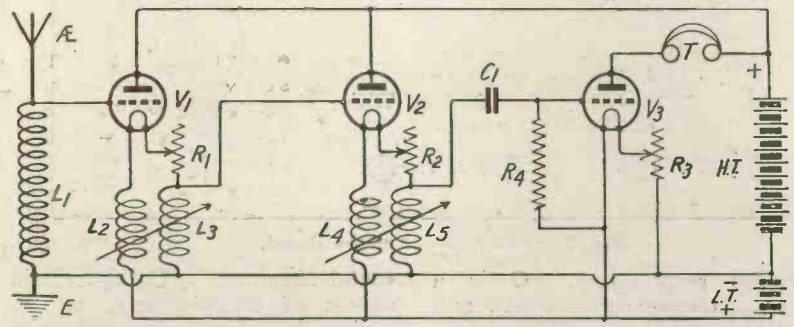


Fig. 3.—An arrangement with variometers, the two windings of each being connected separately.

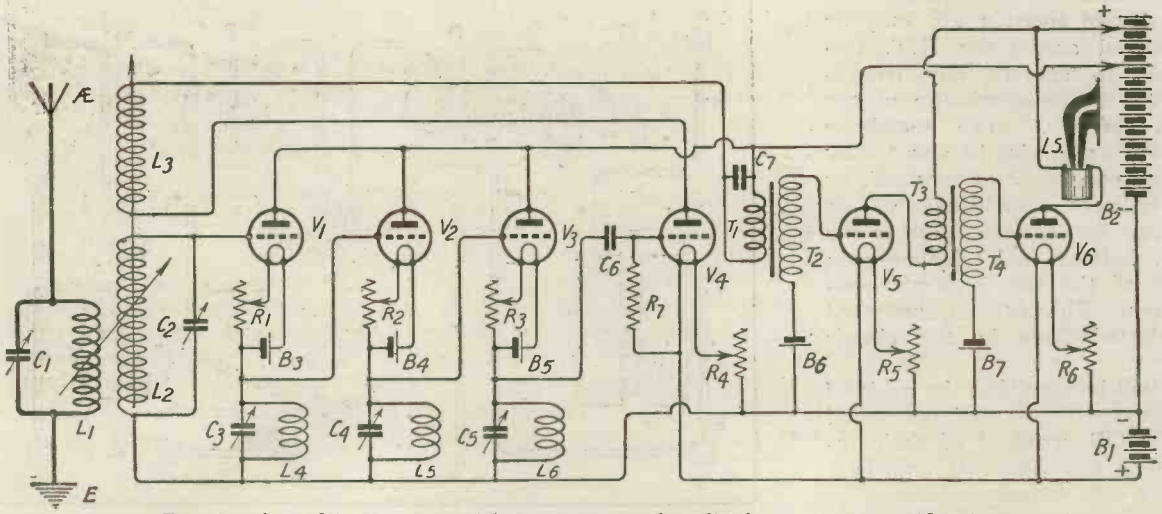


Fig. 4.—A multi-stage set with two stages of audio-frequency magnification.

Practical Back-of-Panel Wiring Charts

By OSWALD J. RANKIN

A Crystal Receiver with two stages of Low-Frequency Amplification

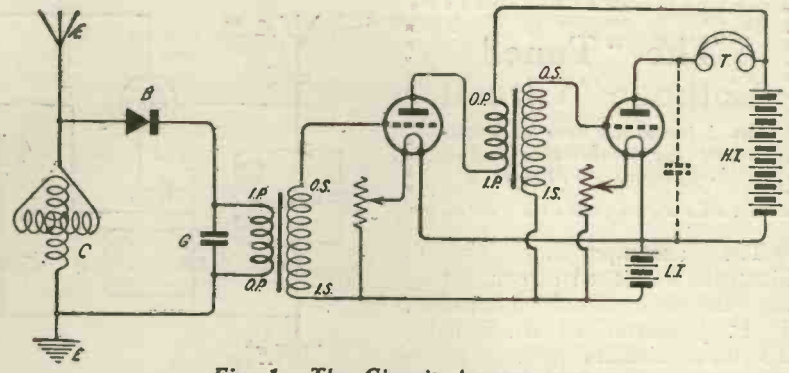


Fig. 1.—The Circuit Arrangement.

THE tuner C is a variometer of the ordinary commercial type. B is the crystal detector, and D and F are the first and second intervalve transformers respectively. G is a fixed condenser of .001 μF, and is connected across the primary winding of the transformer D. A reservoir condenser having a capacity of about 2 μF may be connected across the H.T. terminals to smooth any irregularities in the discharge of the H.T. battery. The telephone terminals may also be shunted by a fixed condenser of .001 μF, or alternatively, a condenser of .01 μF may be connected across the H.T. battery and telephones in place of the two separate condensers. The latter is illustrated by dotted lines in the circuit diagram.

It will be seen that the grids of the two valves are each connected to the OS terminal of their respective transformers, and best results are usually obtained in this manner. It is advisable, however, before permanently securing the wiring of the set, to try reversing the leads to the secondary windings and noting the difference in the volume of sound obtained. Using certain makes of transformers, an increase in signal strength will probably result. If results are not so good, the original connections must be reverted to.

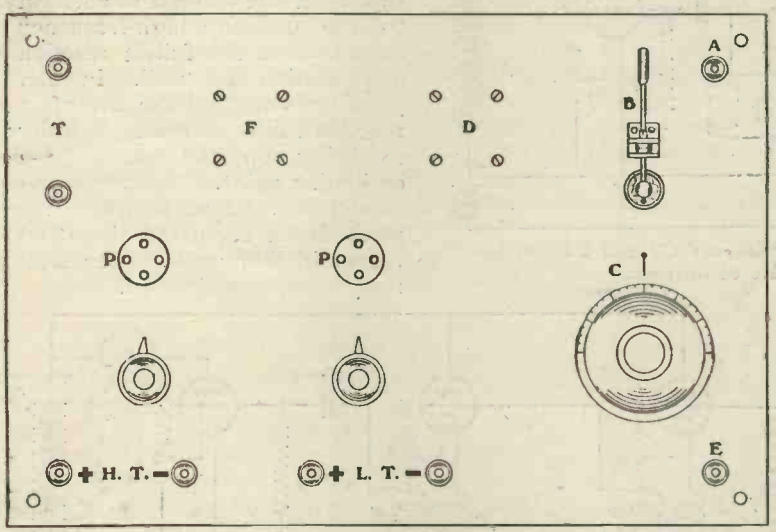


Fig. 2.—The Lay-out of the Panel.

One side of the secondary windings of the transformers is always connected to the *negative* L.T. terminal.

Should the set show a tendency to howl, the expedient of earthing the filament battery should be tried. This is accomplished by joining with a piece of wire the earth terminal of the crystal set and L.T. + of the amplifier.

The Key to Distance

A good set is useless without good coils, and the surest way to obtain coils of whose efficiency you are *certain* is to make them yourself. Get a copy of "Tuning Coils and How to Wind Them," by G. P. Kendall, B.Sc. (Radio Press, Ltd., 1s. 8d., post free), learn what constitutes a good coil, and then wind yourself a set which will bring in those American stations.

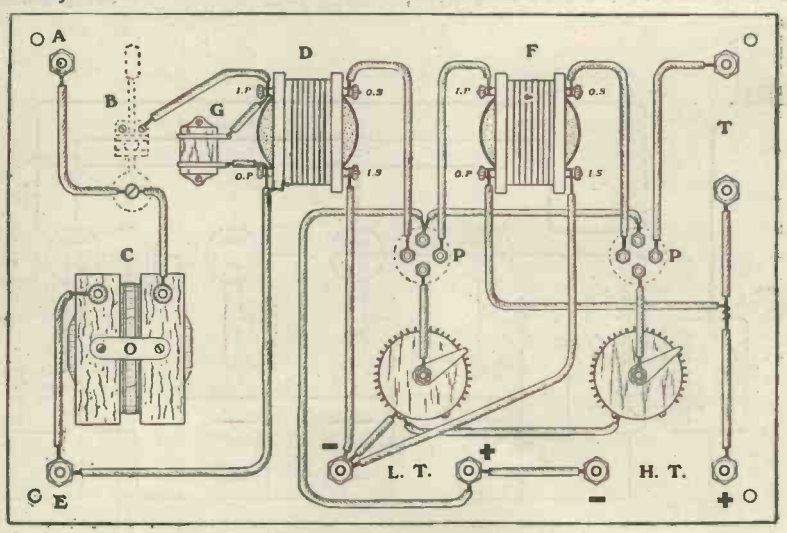
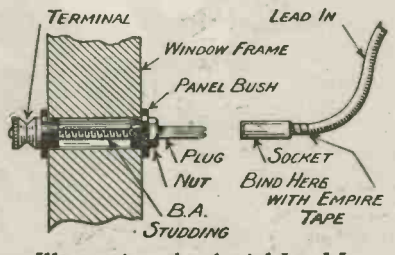


Fig. 3.—Practical Wiring Diagram.

A Handy Aerial Fitting.

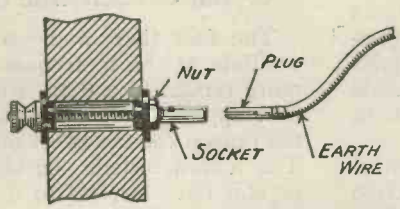
ONE wants to be able to earth the aerial by some quick and easy method and to bring it into use when required without trouble or waste of time. Aerial switches, if properly arranged, are all very well in their way, but they have the disadvantage that, as they must be placed out of doors, they soon begin to suffer from the effects of exposure. Also they must as a rule be fixed to the outer wall of a house, hence they do not really insulate the building from the aerial in case the latter should by any chance be struck by lightning. For some time past the writer has adopted the method of placing large terminals at the outer side of both lead-in tubes and of providing aerial and earth wires with a hook at their ends. When the set was out of use the two leads were simply hooked together and allowed to swing free. To attach them one pulled them in by means of a string and secured a hook to each terminal.

A still better way of connecting up the aerial has been evolved during the last few weeks, and any readers who care to try out this will find that it is most satisfactory. It can be adapted to any existing kind of lead-in tube with the greatest ease. The requirements are as shown in the drawing—two pairs of plugs and sockets. These can be bought from advertisers for a penny or twopence a pair. Deal first of all with the lead-in tubes. These will usually contain a rod made of either 2 or 4B.A. studding. Drill and tap the bases of one plug and one socket to fit this rod, and screw them on, placing a lock-nut beneath each. These serve to get both perfectly tight, and in the case of the socket the nut enables adjustments to be made so that the rod does not protrude far enough into the hollow to prevent a plug inserted into it from going properly home. Attach the plug to the aerial lead-in tube and the socket to that for the earth-wire. The reason for this will be apparent in a moment. Now run a No. 26 drill through the bases of both of the other pair. The hole in the socket will have to go right through to meet that which is already there, and that in the plug should be about ½-inch deep. Thoroughly clean all the strands at the ends of lead-in and earth-



Illustrating the Aerial Lead In.

lead, and twist them tightly together, so that they will go into the holes made in the plug and socket. Apply a dressing of flux both to the twisted ends and to the insides of the holes drilled. Then push the wires in, but take care in the case of the socket that they do not enter too far, and solder with a very hot iron. If it is possible to get the earth-wire and the lead-in to a gas-ring, the best method is to place lumps of solder round the shoulders, and to heat up in the flame until the solder runs in. But if this is not feasible it will be found that the



The Earth Connection at the Lead In.

job is quite easy so long as a hot clean iron is used. Place the socket on the aerial lead-in and the plug on the earth-wire. To bring the set into use all that one has to do is to plug in both wires, whilst at the end of the reception the aerial is earthed by the simple process of detaching the leads and plugging them together. The plugs and sockets used must be a good tight fit for one another. The reason why the socket is used on the aerial lead-in is that rain-drops running down the wire will not be able to get into the joint. A binding of Empire tape round and above the soldered joints also prevents moisture from getting in amongst the wires and setting up corrosion.

R. W. H.

Sets on View.

WITH reference to our previous announcement regarding the exhibitition of sets in the offices of Radio Press Service Department, 19, Devereux Court, Strand, the list of sets now on view is as follows :—

Modern Wireless—

3-valve dual.
ST100 with extra H.F. valve.
2-valve H.T.-less set.
Selective crystal set.
Puriflex 3-valve set.
All-wave crystal set.
2-valve amplifier de luxe.
3-valve portable set.
Single-valve set for all wavelengths.

Wireless Weekly—

W.W. H.T.-less set.
Omni receiver.
All-wave tuning unit.

R.P. Envelope Sets—

No. 1 ST100 set.
No. 3 Simplicity 3-valve set.
No. 4 All Concert de Luxe 3-valve set.

All these sets may be inspected in the testing room of the Service Department, where the examination of readers' sets is performed. Sets made up from Radio Press publications can be dealt with by the new Department, which carries out a thorough examination and reports upon any faults present for a nominal fee, the owner paying carriage both ways where he cannot call personally.

Will readers who desire only to see one of the instruments on view please limit their visit to an inspection only, in order that the work of the Test Department staff may be interrupted as little as possible.

Successfu
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By JO

The first account of any

Mr. John Scott-Taggart with the oscillating crystal set.

THE reports of the work of M. Lossev, the Russian engineer, prompted me to carry out a large number of tests with crystal detectors for the purpose of seeing whether results were commercially reproducible or of interest to experimenters in this country.

I indicated in my editorial remarks last week that effective oscillation on low frequencies had been accomplished, and this week I am able to say that I have been able to obtain oscillations of radio frequency with a crystal detector, and to use these for the reception of continuous wave signals using the heterodyne system.

Before describing the actual set used, a few words regarding the operation of the circuit would not be amiss.

Crystal Characteristic Curve

The fact that a crystal will oscillate at high frequencies is more remarkable than would at first appear, when one considers the reason for the effect obtained. The characteristic curve of a crystal detector, up to a certain point, is rational. As the voltage across the crystal, however, is increased beyond a certain point (in the neighbourhood of 15 to 20 volts in the case of a steel-zincite combination) the curve becomes very uncertain, and during this unstable portion of the curve it is possible to obtain low- and high-frequency oscillations with the crystal, but beyond this point on the curve stability returns and oscillation ceases.

The circuit for producing oscillations is exactly comparable to that employed in an arc, and it is illustrated in Fig. 1. It will be seen that a battery B1 applies a suitable potential through a high-resistance R2 to the crystal detector. Across this detector is connected a condenser C and an inductance L.

I find that the value of the battery B1 depends on the sample of crystal used, the particular combination, the value of R2, of course, and the particular adjustment of the detector. The ordinary crystal detector using galena, as employed in ninety-nine out of a hundred sets to-day, was found unsuitable for producing oscillations of either high or low frequency, although it was possible to obtain short bursts of oscillation which, however, varied in frequency and rapidly died out. I found that the best combination was that recommended by M. Lossev—namely, steel and zincite. I tried different samples of zincite, and two out of three gave results. With the third I could get no oscillations at all, although with patience no doubt a point could have been found on the crystal which would give oscillation. Of the other two crystals, one was considerably better than the other, so that it must be appreciated that complications will arise due to unsuitable crystals. I may say at once that the adjustment of a crystal for oscillation is probably ten times as difficult as the adjustment of it for the reception of wireless signals in the ordinary way. The experimenter, unless he happens to hit on a particularly good

l Reception with the scillating Crystal

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

practical results obtained, in this country, by means of an cillating crystal for wireless reception.

sample, must therefore have considerable patience.

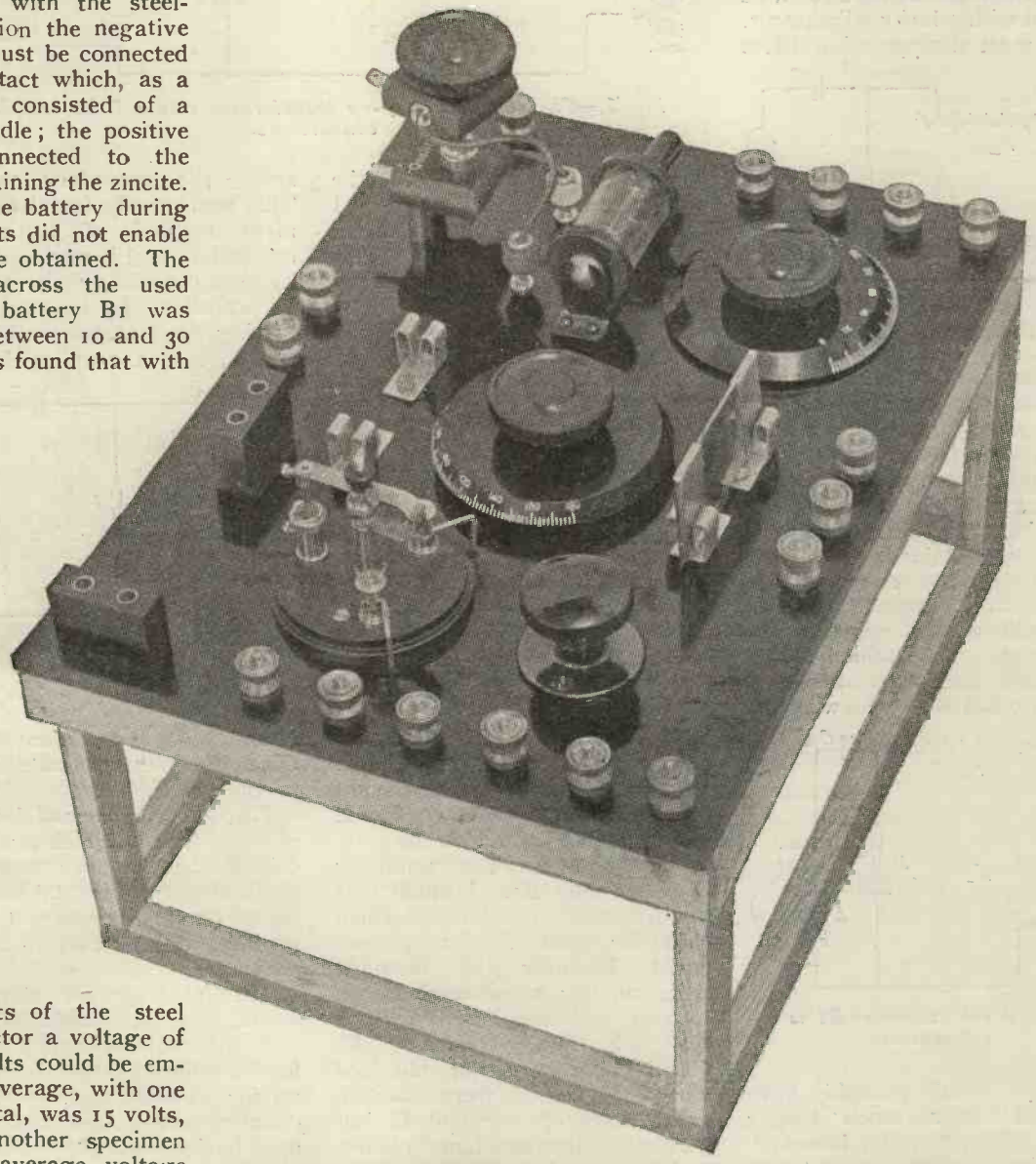
Steel-Zincite Combination

I found that with the steel-zincite combination the negative of the battery must be connected to the steel contact which, as a matter of fact, consisted of a gramophone needle; the positive terminal is connected to the crystal cup containing the zincite. A reversal of the battery during these experiments did not enable oscillations to be obtained. The actual voltage across the used portion of the battery B1 was made variable between 10 and 30 volts, and it was found that with some adjustments of the steel and zincite detector a voltage of as low as 10 volts could be employed, but the average, with one specimen of crystal, was 15 volts, whereas with another specimen of crystal the average voltage was 20 volts.

The variable resistance R2, in the experiments, was a Post Office resistance box enabling any resistance from 10 to 8,000 ohms to be obtained. I found that oscillations could be produced with any value of resistance from 600 to 2,000 ohms, but it was, of course, necessary after every readjustment of the resistance to alter the voltage of the crystal battery, because increasing the resistance R2 would naturally reduce the potential difference across the crystal.

Producing Oscillations

A good deal of searching on the crystal was found necessary



The specially designed receiver used by Mr. John Scott-Taggart in his experiments. For clearness of illustration the coils have been removed.

to obtain a suitable point for the production of oscillations, and at every new adjustment a variation of the battery B1 was made. It was found, however, that the voltage at which oscillations could be produced was more or less constant, and the simplest method was to leave the battery alone and search on the crystal until oscillations were produced, a slight readjustment of the battery B1 sometimes being made. It was found necessary, in many cases, to wait a moment after adjusting the crystal, because the oscillations sometimes built up slowly, but once they were in progress quite a steady note could be obtained with a lucky adjustment.

The most disappointing effect

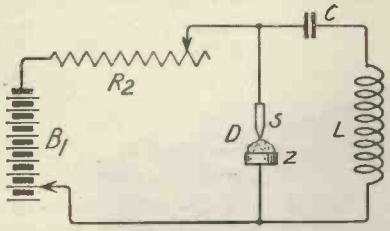


Fig. 1.—The circuit used for producing oscillations.

which was in most cases obtained was that the note refused to remain steady, and usually after a short time began to fall in pitch, and finally disappeared. This was found in most cases to occur, but, provided a suitable spot was obtained, the note would remain quite steady. As pointed out in my editorial last week, with a good adjustment a steady note was obtained for an hour, and the apparatus was then switched off, otherwise the

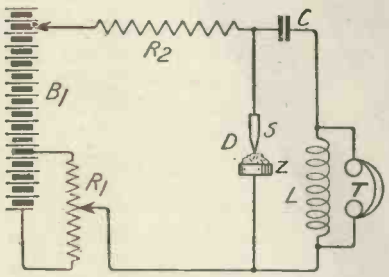


Fig. 2.—A potentiometer R1 is a refinement.

oscillations would probably have continued for a much longer period. The struggle, however, to obtain a suitable adjustment of the detector, or rather oscillator, lasted frequently for half-an-hour, and in some cases longer.

Nor, when the adjustment was once found, was it very robust. The slightest vibration or the smallest alteration in voltage, or the pulling out of a coil, resulted in a cessation of oscillations. In short, the crystal was very fickle; the oscillations would only continue if one were fortunate.

Condenser Values

As regards the values of the condensers C and L in the Fig. 1 circuit, the first step I tried was to use a 1250 coil for L and a 0.25 μF for C. This produced good low-frequency oscillations which could be detected by connecting high-resistance telephones across the inductance coil L. This arrangement is illustrated in Fig. 2, which also shows the refinement of a potentiometer R1 connected across a part of the battery B1 or across a 6-volt accumulator in series with B1. I found that low-frequency oscillations which could be heard in the telephones could, however, be obtained when as low a coil as No. 300 plug-in coil was used with a 0.25 μF fixed condenser C. Oscillations were not obtained when telephones were used in *substitution of* the coil L, but perhaps if low-resistance phones had been used oscillations might have been produced.

Different sizes of condenser C were tried from 0.25 up to 5 microfarads, and oscillations of corresponding frequencies were obtained. Changes from one condenser to another very frequently stopped the crystal oscillating and a readjustment was found necessary.

Fig. 3 illustrates the use of a step-up transformer of the usual intervalve type in which the primary is connected across the inductance L and telephones across the secondary winding. This was merely found a convenient method of testing for oscillation, and it was found that by not connecting the winding T1 at all to L, but by simply placing the transformer over the coil L, that a coupling between L and T2 was sufficient to produce the required note in the telephones T.

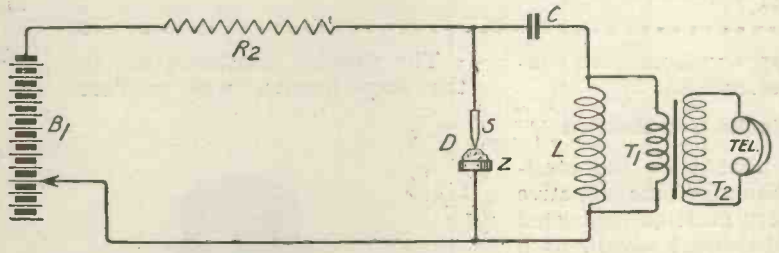


Fig. 3.—The use of a step-up transformer across L for telephone connections.

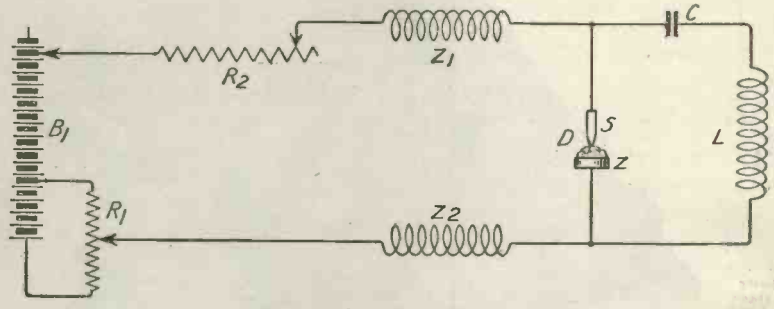


Fig. 4.—A modification using chokes.

Fig. 4 shows a modified form of the circuit in which two choke coils Z1 and Z2 are connected in the leads to the crystal contacts, in an analogous way to that employed in the case of the arc generator.

The photographs show the actual apparatus employed.

This actual set is probably the first oscillating crystal set built up for wireless reception in this country, and a brief description may be interesting.

From the circuit diagram, as illustrated in Fig. 5, it will be seen that the oscillation portion is similar to Fig. 4. Provision

is made for connecting different condensers in series with the coil L1. As shown in the figure, a variable condenser C2, of 0.001 μF capacity, is used for adjusting the wavelength of the heterodyne oscillations which are induced from the coil L1 to the aerial coil L2. In parallel with C2 can be connected capacities of any required size by means of the useful McMichael flat condensers which fit into holders and are interchangeable. Two terminals are taken from the coil L1, and telephones may be connected across these for the purpose of testing for low-frequency oscillation in initial experiments. Terminals are also taken to the two sides of the condenser C1 to enable specially large capacities to be connected in this position, *e.f.*, 0.25 μF.

Actual Results Obtained

The set gave very good continuous wave reception on a number of stations, including Ongar (GLA) and the Air Ministry station (GFA).

The choke coils Z1 and Z2 were 1,250 plug-in coils, but much smaller ones would probably give equally good results, and in some cases might be unnecessary. The resistance R2 was 800 ohms, and the voltage across the slider on R1 and the tapping on B1 was 21 volts. The condenser C1 was a 0.002 μF condenser, while the coil L1, in some of the experiments, was a No. 300. In the same experiments the coil L2 was a No. 150, while C3 was a 0.0005 μF condenser, although a 0.001 μF component would be used in redesigning the set. The detector D2 was simply the usual galena type of detector employed on the ordinary broadcast receiver. The coupling between L1 and L2 is variable.

The resistance R2 is not included in the actual set, but two terminals are provided for it, because a resistance box outside the set was employed for experimental purposes.

There is very little doubt that the signals received on the set were heterodyned by a harmonic of the actual oscillations produced by the crystal, with the coils and condensers used. A condenser was tried across the detector D1, but this did not seem to make any difference, although recommended by M. Lossev for short wavelengths.

The set behaved, as a whole, exactly like a valve set using a separate valve oscillator, and the beat note was perfectly pure and could be varied by tuning C2 in the usual way. The results were extremely interesting, and indicated that the crystal oscillator might prove useful for the heterodyne reception of continuous wave signals.

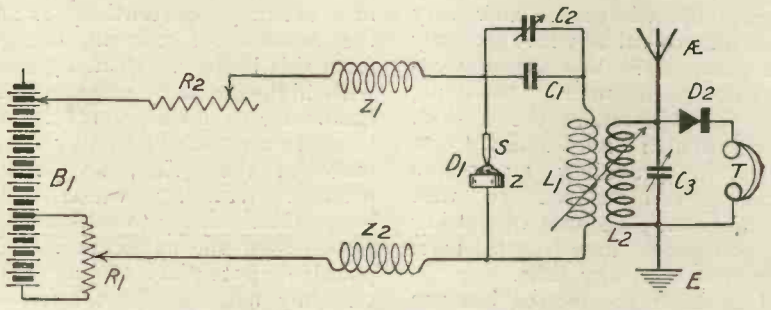


Fig. 5.—The actual circuit employed in the experiments.

Whether the trouble of adjustment is worth while is rather a different question, and unless specially suitable crystals are found, or some suitable coherer employed, it is doubtful whether really reliable results can be obtained.

There is a very general tendency for a variation in the frequency generated, and although when oscillations were once started they were quite powerful, and if of audible frequency would readily work a loud-speaker, the crystal exhibited a tendency to stop oscillating when it wanted to, and in some cases it would oscillate for half-a-minute, then stop for half-a-minute, and then start oscillating again, and so on. A proper crystal combination might, however, result in quite a reliable continuous wave heterodyne.

The Crystal Oscillator and Broadcast Reception

As regards the application of the crystal oscillator to broadcast reception, I am not at all hopeful. The absence of constancy and absolute reliability, which would be essential, makes it very doubtful whether anything more than experimental results can be obtained.

The idea, of course, would be to keep the crystal just off the oscillation point, and so introduce a reaction effect into the receiver circuit. This could be done, for example, by varying the damping of the circuit, or by altering one or more of the values in the crystal-oscillator circuit, *e.g.*, the potentiometer or the resistance R2. The very fine adjustment, however, which would be necessary would probably not remain steady, and for this reason I very much doubt whether we shall hear of this interesting arrangement in connection with broadcast reception on short wavelengths.

The "high-tension battery" is also troublesome. A fair voltage seems to be an essential feature of the crystal arrangement. This reduces the argument against the valve to smaller dimensions, the only objection left being in connection with the filament battery and the initial price of the valve. As the filament battery can now be reduced to the size almost of a flash-lamp battery with suitable dull-emitter valves, one is almost tempted to wonder whether the valve itself is worth trying to abolish.

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Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

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

HAVE you noticed that those distant stations which came in so easily during the winter are now very difficult to raise with precisely the same set? We are now experiencing summer conditions, and you will realise the wisdom of the British Broadcasting Company in providing an ample number of stations so that listeners may be sure of getting a good programme from at least one station at any time.

I mention the matter because I am inclined to think that sets, both home-made and commercial, are being condemned for lack of sensitiveness which is not theirs, and which will only be remedied by the return of winter conditions.

* * *

Remember, too, that your aerial and earth system may be suffering from defects due to atmospheric conditions and the season. Your earth connection, which heretofore has reposed comfortably in a mass of moist earth, may now be so dry as to afford very little conductivity in the soil. Still further, you may not have noticed those creeping tendrils from nearby vegetation which have slowly grown over the insulators and reached the aerial wire itself, thus affording a high-resistance leak to ground.

* * *

If you began your wireless listening about September last, it is probable that your high-tension battery is nearly exhausted by this time. If your battery is a good one—and there are many excellent makes on the market nowadays—the drop in the voltage will have been very gradual, and the consequent reduction in signal strength scarcely noticeable from evening to evening. You may, however, be very surprised to find that, on connecting up a new high-tension battery, your signals are vastly improved.

Speaking of high-tension batteries and their life, reminds me that several minor adjustments in a set may substantially affect the amount of current drawn from this battery. In many sets with high-frequency stages, it is customary to use a potentiometer to apply a positive bias to one or more of the grids, so as to produce damping which will lessen the tendency to self-oscillation. Now the application of a positive potential of a grid certainly has the effect referred to, but by causing the valve to work on a different part of its curve, it will cause a great deal more current to be drawn from the high-tension battery. Here are a few figures, the result of test this last week-end.

* * *

The receiver used was my original Transatlantic set (without note-magnifying valves). There are, as you know, three valves in the set—two of the V24 type and 1 QX. Using a common battery of 60 volts for the plate and with suitable filament adjustments, the total current taken from the high-tension battery is 3.7 milliamps when the potentiometer is fully on the negative side, and no less than 8.8 milliamps when the potentiometer is taken right over to the positive side, there being of course a steady increase between the limits. This will give you some idea of the drain on the high-tension battery when positive bias is used for stabilising purposes.

* * *

A very useful piece of apparatus now marketed in America by a well-known firm of electrical instrument makers, is a "radio test set," specially designed for the serious experimenter, the manufacturer, and the dealer in wireless equipment. It consists of a neat case (very much like those used for portable typewriters), in which are carried five instruments and a valve socket. The several instruments, any of which may be used separately, are a 0 to 1.2 filament ammeter, a 0 to 6 filament volt-meter, a 0 to 120 plate volt-meter, a 0 to 10 plate milliammeter and a +10. 0. 10−grid volt-meter. It is therefore only necessary to insert the valve in its socket, and to connect up the necessary battery, in order to be able to plot characteristic curves rapidly and accurately. The whole outfit, complete with instructions, sells for $75 (about £15 of our money). I have not yet seen its equivalent in this country.

* * *

Will readers please note that, much as I would like to do so, I find it impossible to reply individually to all of the personal letters addressed to me at this office. The fact that a personal reply is not sent is no indication that the letters are not appreciated, particularly when they deal with readers' experiences in one direction or another, or when they touch on matters which are dealt with in "Random Technicalities." I therefore take this opportunity of thanking a very large number of friends for appreciative remarks, and also for criticisms. Such letters are very useful to all of us.

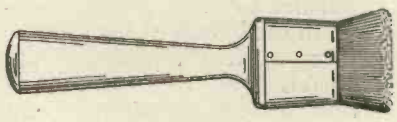
The Radio Society of Great Britain

An informal meeting of the Radio Society of Great Britain will be held at the Institution of Electrical Engineers, Savoy Place, W.C.2, on Wednesday, 9th July, at 6 p.m., at which Mr. P. R. Coursey, B.Sc., F.Inst.P., will give a talk on the manufacture of condensers. The talk will be illustrated with lantern slides. Members of affiliated societies are cordially invited to attend. Tickets of admission may be obtained by application to the Honorary Secretary of the R.S.G.B., 53, Victoria Street, S.W.1.

The Dust Problem

THE worst of wireless from one point of view is that it entails the use of ebonite panels, and there is nothing like ebonite for collecting dust. Even if you cover up your set very carefully when it is out of use you will nearly always find that it manages somehow to acquire a thin layer of dust which spoils its looks until the panel is cleaned. And the job of cleaning a large set is not at all a straightforward one if you tackle it in the ordinary way with a duster. There are so many little places that simply cannot be got at satisfactorily. If you use separate valve legs (as you should) for your valve holders you will soon find that there is a deposit of dust in the spaces in between them which is very difficult to remove. And there are many other awkward places, as, for instance, between the studs of a selector switch or the clips of a double-pole change-over switch, between pairs of terminals that are fairly close, round the edges of condensers mounted on the panel, and the chinks and crannies between the core and the drum of a low-frequency transformer.

Still, if you want efficiency, dust must be got rid of, for its presence may seriously impair the working of the set. It must be remembered that high-frequency currents travel only over the surfaces of materials. Now, it is of little use to provide insulation by means of ebonite if you allow its surface to become covered with a skin of dust which may contain a large proportion of conductive matter. Things



The cleaning brush suggested in this article.

become worse in damp weather, for dust is strongly hygroscopic and collects an appreciable amount of moisture from the atmosphere. When this happens the surface insulation resistance of the panel may drop down to less than one-tenth of what it originally was, with the result that various queer things happen, especially in the high-frequency circuits. The writer has recently hit upon a way of dealing with the dust problem which makes it a matter of two or three minutes to dust the panel of even a large set studded with terminals, valve legs, switches and components. It is simply to use one of those flat soft brushes about an inch wide (a hard brush is absolutely useless, for it simply pushes dust about and does not remove it), used for washing in skies in water - colour painting. These cost from 1s. to 3s. apiece, according to their size, and they are very well worth it to the wireless man. Thanks to their soft hairs, they actually pick up the dust from the panel, and it can be shaken out of them every now and then. One uses such a brush broadside on in places where there is plenty of room, and turns it sideways for getting in between valve legs and going into other cramped spots. If a brush of this kind is kept in a drawer of the wireless table two minutes' work before the set is brought into use will ensure that the panel is absolutely dust free, and therefore in its best insulating condition. Be careful, though, to switch off both H.T. and L.T. before you use the brush, otherwise its metal part may cause short circuits.

R. W. H.

□

Common Faults in Reflex Circuits

SIR,—With reference to Mr. Kendall's interesting article on "Reflex Faults" in your last week's issue. The following details of an obscure fault in a ST100 receiver may be of interest.

The symptoms of the fault were these :—When first put into operation, signals would be full-strength for a period of two or three minutes, when with no other warning than a slight "click" they would "go off" to little more than crystal strength. No amount of re-adjustment would effect a cure, and the only means of putting the set in action again appeared to be to pull out the anode coil (of the plug-in variety), and immediately replace it, whereupon signals would come in at full strength once more, the whole process being subsequently repeated. Only instantaneous disconnection of the anode coil was required to effect a temporary cure.

After much concentrated thought and mental "tracing-out" of circuits, the primary of the first (reflex) transformer was suspected. This, when first tested, had appeared to be O.K., but on subsequent testing it was found that the "dis." was intermittent—the transformer would function perfectly for a few minutes, and while doing so would show up O.K. on test; immediately the "click" and loss of strength appeared, however, the primary, on test, would show a "dis."

The transformer in question was of a well-known and expensive make; when replaced by an equally good pattern, however, the trouble completely vanished. This goes to show that even though a transformer may appear to be O.K. on test, it is not necessarily above suspicion.

The removal of the anode coil appears in some way or another to remove the load from the transformer, thus having the effect of producing a shaky sort of contact. The actual reason for this is somewhat obscure; I suggest that it might be due to some form of magnetic movement of the windings, but this is, of course, open to question. I should welcome suggestions on this point.—Yours faithfully,

B. CURTIS ELLIOTT (2ALR).

Ealing, W.

Intermittent disconnections are probably the most difficult type of fault to locate, particularly in transformer secondary windings, where they produce in some cases just the symptoms observed by this reader.

G. P. K.

Faithful Reproduction by Broadcast

By P. P. ECKERSLEY, M.I.E.E.

The discussion following upon the paper recently read before the Radio Society of Great Britain.

(Continued from page 253.)

Mr. P. K. Turner

I should like Captain Eckersley to deal a little further with the question of where the distortion lies in the receiver. Captain Eckersley has suggested that it is mainly in the loud-speaker, but I am not quite sure that it is only in the loud-speaker. Whereas I am sure that none of my present hearers ever have distortion in their sets, there are quite a number of people called broadcast listeners, and the percentage of distortion in their receivers is, roughly, 90 per cent. in the set and 10 per cent. in the loud-speaker, because they do not get the chance to play about with the loud-speaker.

Setting aside the fact that resistance coupled amplification is better theoretically, it is quite possible to get, with transformer coupling, infinitely better results than are obtained by most sets in the hands of broadcast listeners that I have seen, and one of the main points in which we can help these people is in the valves they use. If one is going to get anything beyond the most moderate power for a small room, it is my fixed conviction that the ordinary "general purpose" valve is not sufficiently powerful for the job. It has not got a long enough straight part in its curve to deal with a loud-speaker unless it is grossly over-run. Even the dull emitter valve cannot be made to do the work properly.

There is one point about the series rejector in use with telephones. A very handy method of doing this, which enables anybody to play about with it without purchasing special chokes, is to insert, in series with the high-resistance telephones or loud-speaker, the primary of an inter-valve transformer, of which the secondary is shunted by the largest variable condenser which can be got. If you have a fairly heavily wound high ratio inter-valve transformer you will usually find that you can successfully make that a rejector for this purpose. It is necessary, also, or advisable, to insert ohmic resistance in the circuit of the rejector to prevent it "rejecting" too powerfully.

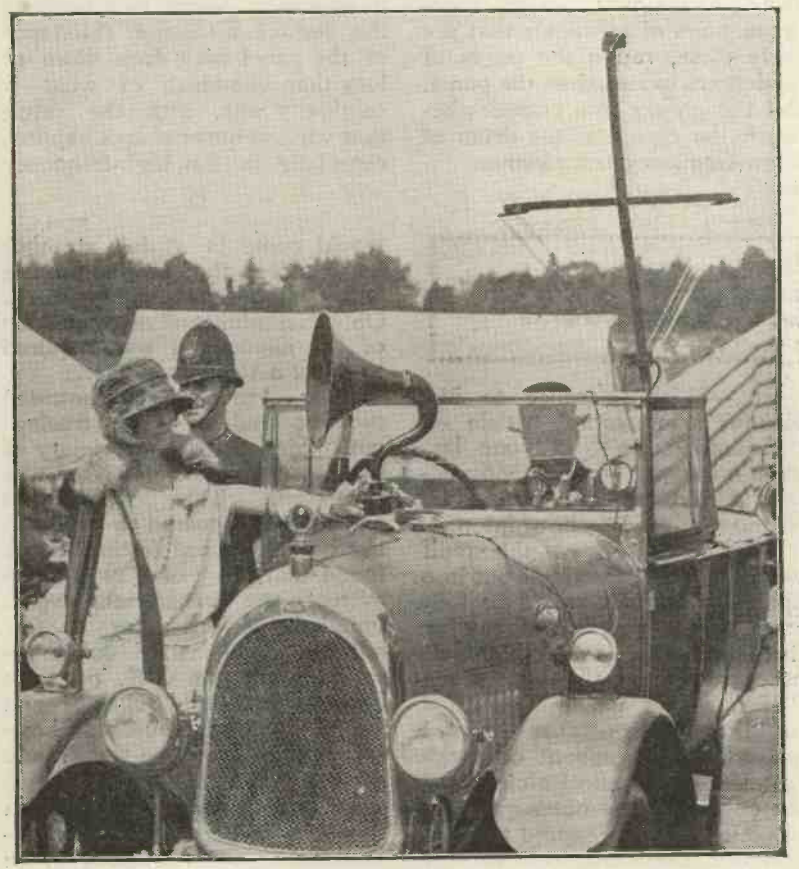
I test a lot of transformers and loud-speakers and valves, and I find that there are at least a dozen loud-speakers that give excellent results, but there is an enormous difference in transformers. A good transformer will give good results, which to the ordinary ear are hardly distinguishable from resistance amplification; but there are not many such.

Mr. Davis

If we assume that rectification is proportional to the square of the amplitude, then we get strong signals out of proportion to weak ones. Does Captain Eckersley make any allowance for that in the regulation of the output?

Mr. Lawes

It may interest some of you to know that the potential across a 400-microhenry coil with a series aerial condenser is about 6 volts at a distance of three or four miles from 2LO. With regard to



Our photograph shows Captain Twelvetrees, whose broadcast motoring talks are so well known. He is here seen with a portable receiver at the Ascot racecourse.

the use of a detector-valve, a short while ago I tested one of the cheap Dutch soft valves, and was surprised to find a very considerable improvement in the quality of a loud-speaker, coupled with increased loudness. I should like to say, also, in connection with Mr. Reeves' remark, that in my opinion the shape of the pole pieces of loud-speakers has not received sufficient attention. Some time ago, in testing loud-speakers for use on ships, I found that the shorter dimension of the area of the pole-face made a considerable difference to the loudness and quality. I therefore made a loud-speaker with laminated Stalloy pole pieces, the size being about ¾ in. by ⅜ in. across. That is about three or four times the usual size. Lately I have constructed a loud-speaker with similar poles, and I find the tone is much more mellow. Apparently the narrow pole pieces employed on some loud-speakers produce local disturbance of the diaphragm, having a rather high frequency, and that may produce a difficulty. Lastly I should like to take up a point mentioned by Captain Eckersley when he spoke about the organ notes. Some time ago, when being shown over 2LO, one of the gentlemen there said that the lower organ notes on Sunday afternoons were present at the transmission. I have never been able to get them. Now, taking a 16-ft. organ pipe, this will have a wavelength of 32 ft. The frequency is therefore about 40 cycles. That nice little picture on the board begins, I think, at 200. I would like to know whether the lower notes are present in the transmission. (Laughter.)

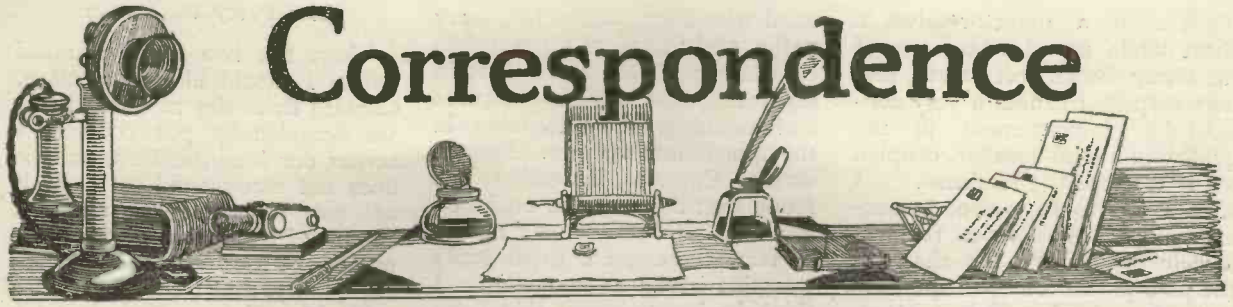
The President

I have been very greatly interested by this lecture because Captain Eckersley has dealt with the matter in a manner only possible on the part of those who have been deeply immersed in the subject for months. The subject has become so vast, and is so largely unexplored, that to the ordinary person it is practically a morass without any marked paths through it. That always happens where you have a new application of a variety of sciences, because where many sciences meet there are very rarely any individuals at hand who know all the necessary paths, and therefore a great deal of spade work has to be done in separating the various sciences and moulding them together in the appropriate manner. For example, Captain Eckersley has found that there are no books on acoustics. Of course, as a matter of fact, there are a great many scientific books on acoustics. I think he has to admit that there were some a yard thick—but he meant that they were so difficult for most people that it amounted to there being practically no books. Exactly the same difficulty occurred nearly 30 years ago in connection with electrical alternating currents. We had Maxwell's theory and Heaviside as the interpreter, and people of that day said that, although books were in existence they were of no use because they could not read them. Before the books could be used they had to be interpreted. A tremendous amount of research was involved in interpreting Maxwell's and Heaviside's original work, and I have no doubt the same thing will happen in acoustics. There is information in these books, but it remains for people engaged in research work, such as that which Captain Eckersley is doing, to translate those books into more general practical application, and that he is doing in a splendid manner. It is characteristic of him that he gives us a good deal of wisdom mingled with his humour, and I think he is right in saying that a great deal depends upon satisfying people in the art of suggestion. If you can give them some notes that suggest they are listening to a band, they believe they are listening to a band and are satisfied. (Laughter.) In other words, I think that in reproduction a good deal has to be left to the imagination. For instance, I believe that in a telephone conversation, 60 per cent. of the words would be unintelligible were there no context for the imagination to make use of for supplying the omissions and completing the meanings of the separate words. Possibly it is the same, and may always be the same with broadcasting, unless workers like Captain Eckersley can bring about true distortionless transmission and reception.

Mr. Percy W. Harris

There are two small practical points I should like to mention. Captain Eckersley mentioned that we occasionally put condensers across our loud-speakers, and he does not recommend us to do it as we introduce a resonant circuit. I have tried a very large number of loud-speakers of varying quality, and I certainly agree with Mr. Turner that quite a large number give excellent results, but it does seem to me that many of those loud-speakers are deliberately designed to be used with a condenser across them, for in many cases the absence of any shunting condenser across the terminals gives an unpleasant tone which is peculiar and noticeable in these loud-speakers. Placing a small condenser across the terminals of the loud-speaker remedies that defect. Perhaps Captain Eckersley can say whether it is the custom of the manufacturers of loud-speakers to allow for the presence of a condenser across the terminals, because in the average set the condenser is there and apparently the manufacturers are allowing for their use. One speaker mentioned the use of metallic horns and suggested that they were part of the cause of distortion. I do not know whether that is the case. I am inclined to think that the metallic horn is frequently blamed for defects which are not in it, and I believe that so long as the lower portion of the horn is made of rigid metal we do not get much distortion. A gramophone which has recently been placed on the market—an improved model of a well-known existing machine—has a decidedly improved quality. Up to the present wooden horns have been used, but in the new model the horn is constructed of cast iron, very thick. If the metal of the loud-speaker horn is thin all the way down to the small orifice (which is the case with some of the cheaper loud-speakers), there are unpleasant resonance effects. I do not know whether others agree with me, but I consider that the introduction of wooden horns on loud-speakers during the past year or two has not brought any improvement in quality.

(*To be continued*)



ST100

SIR,—As a regular reader of your paper who has seen many opinions passed lately with reference to the ST100, I have just constructed the set, and find it all that can be desired. I have heard all B.B.C. stations and also several Continental. Several of the B.B.C stations have been received with volume enough to work the loud-speaker. I have also, running from this set, about 35 feet of Flex which goes into the next house, with two pairs of head-phones connected. This does not appear to reduce the volume of sound with the loud-speaker I use.

I am enclosing photographs of the set as made and fitted entirely at home. I think you will agree that the arrangement is very compact. The accumulator and the H.T. are stored in the lower compartment of the cabinet with two switches connected from them to the panel. The set can be left tuned in, and merely switched off and on, thus making it so simple that a child can use it.

I am also thinking seriously of making the 5-valve Transatlantic set, and when I have it completed and tested, I will forward photographs for you to see.

Wishing your paper every success—I remain, yours faithfully,

R. J. LUSON.

N.W.10.

SIR,—I enclose herewith a photograph of an ST100 receiver which I have recently constructed for the West Hill L.C.C. School, Wandsworth, S.W.18, using Myers' valves and R.I. transformers. It is mounted in a vertical cabinet with removable glass back, so that components and wiring up can be easily seen by the boys of the school.

The object in making the receiver is to enable the educational talks from 2LO to be heard from a loud-speaker by the school, and also to illustrate science lessons, some of the elementary principles of wireless telegraphy and telephony being included in the scheme of science instruction.

Results obtained are exceilent. Within a few minutes of switching on after completion spark and C.W. stations were coming in strongly, and I distinctly heard a soprano solo with piano accompaniment in the telephones. According to the daily programmes of the B.B.C., Manchester was the only station transmitting at the time.

The volume of sound from the loud-speaker when receiving 2LO is terrific. The circuit is everything you claim for it, and everyone is very satisfied.

I propose to construct shortly another receiver with the same circuit in a Jacobean cabinet on the cabinet gramophone lines for my own private use.—Yours faithfully,

EDW. M. KNIGHT.

A handsome ST100 receiver made by Mr. R. J. Luson.

THE "OMNI" RECEIVER

SIR,—You may be interested to hear that using the single valve dual circuit ST74 on a modified "Omni," I tuned in a station on about 390 metres on June 5 at 11.30 p.m., which announced itself as Madrid. I also listened to it again on the night of June 10. Signals were clear and quite as loud as London on a crystal set (23 miles), atmospherics being not very bad.—Yours faithfully,

H. N. SWAN.

Longfield, Kent.

FROTHING

SIR,—Regarding your tip for the treatment of frothing accumulators, I have tried same with most satisfactory results. The kind of soap used, as would be supposed, appears to be immaterial.

The action of the addition would appear to be this: The acid electrolyte liberates the fatty acids from the soap, and these acids having a very low surface tension, by forming a thin film on the electrolyte, decrease the tendency to froth by lowering the surface tension.

This effect, as you are probably aware, is somewhat similar to the case of large power accumulators which frequently have a layer of oil on the surface to trap the acid mist caused by the decomposition of the electrolyte.

Theoretically, no harm whatever can come to an accumulator by the addition of a small quantity of soap such as you suggest, the only effect being the almost imperceptible weakening of the electrolyte by the hydrolysis of the soap, which effect is, of course, negligible.—I am, yours faithfully,

R. F. G. HOLMES.

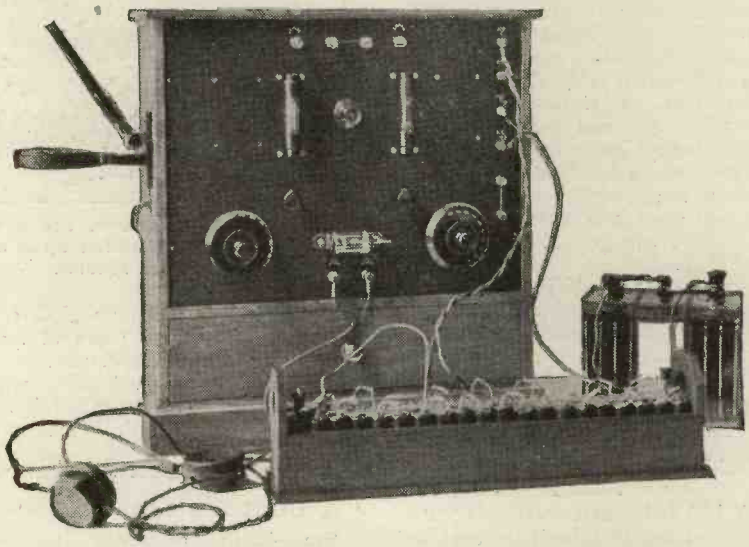
London, N.

P.S.—Since writing the previous I have confirmed my statement regarding the mechanism of the soap addition by adding five drops of oleic acid (the chief fatty acid constituent of soap) to a frothing accumulator. The frothing ceased almost immediately, thus proving the action to be due to the fatty acids liberated from soap owing to hydrolysis by the electrolyte.

R. H.

STRAY COUPLING

SIR,—I notice in *Wireless Weekly*, June 11, "The Cross-Coupling Question," reference is made to



The West Hill L.C.C. School, Wandsworth, ST100 receiver.

"nearly an impossibility to tune 2H.F. tuned Anode."

I have such a set which has been working for two years, and although I have no potentiometer and reaction on aerial, it is impossible to howl unless reaction coupling is jammed up. Many amateurs will testify to my reception of their telephony (on 4-10 watts) from all parts of England, constantly, and I have no real trouble tuning them in on my set. (There is dust ⅛ in. thick on it!) Set consists of loose coupled tuner wired away from actual set, and connected by thick copper rod, basket coils for anodes and slate-pencil gridleaks to L.T. +. Prim coil 75 (series condenser), secondary 75, and reaction 35. I find if bigger secondary coil is substituted set is inclined to howl. I have a large capacity accumulator 4v., do not use more than 50v. H.T., and can get all stations with 24v. H.T.

If users of 2H.F. would try this tuning arrangement and also the effect of reversing one of the anode coils. I am sure it will improve matters. With best wishes for future success of *Wireless Weekly*, —Yours faithfully,

H. BRAINE.

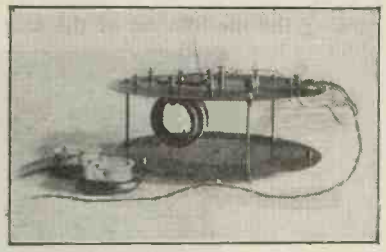
Dublin.

A NOVEL ARRANGEMENT

SIR,—I beg to submit the enclosed photograph of a crystal receiver which I have built on two gramophone records. It might perhaps be of interest to your readers.

The circuit employed is No. 2 in your book—"How to Make Your Own Broadcast Receiver."

With an *indoor aerial* consisting of five single copper wires across the ceiling on the first floor, and an empty Mackintosh's toffee tin for the earth buried 2 feet in the garden immediately below, this



A neat crystal receiver, the components being mounted upon a gramophone record.

simple receiver picks up 2LO comfortably, using four pairs of 4,000 ohm phones simultaneously.

Wishing your valuable paper every success.—Yours faithfully,

E. H. V. WILLIAMS.

London, S.W.

"A CURIOUS COINCIDENCE."

SIR,—With reference to Mr. E. D. G. Barnby's letter in a recent issue, I was myself within ¼ mile of the Brooklands Cemetery at the time the lightning shock occurred.

My impression is that the occurrence was made more of than was justified.

I had gone down to my father's house to use his garage to finish a small painting job on my light car and had just opened the doors when a very heavy clap of thunder made me jump round. (I may say that I am supposed to be the kind of man who would not jump if a load of bricks were dumped behind me unawares.)

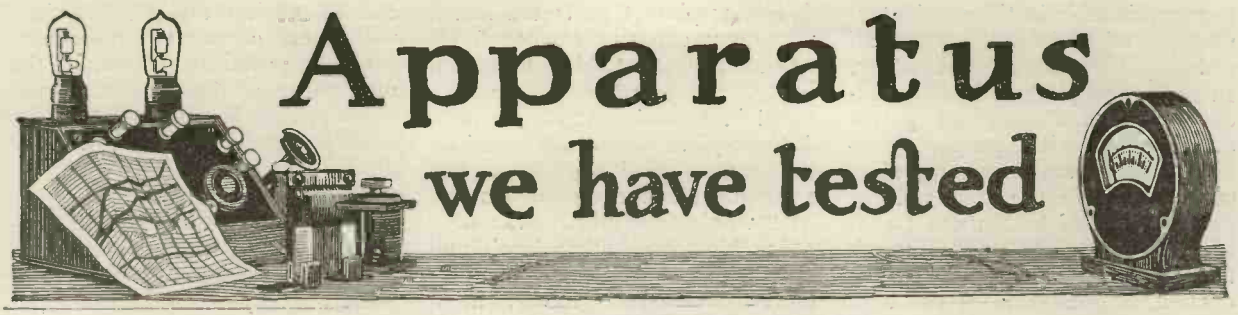
My wife said afterwards that she was dozing on a settee at home (about 1½ miles away), and the shock was sufficient to cause her to roll off on to the floor in her half-asleep condition.

I could see no trace of any damage in the cemetery caused by this shock; it may be of interest that there are here a very large number of wires on two sets of very high poles, and that the wires pass over along a belt of trees. I did not trouble to walk into the cemetery specially to look for damage, but I feel sure that if there had been any the daily Press would have let us know of it.

My own aerial and everyone else's, so far as I know, suffered no damage; the shock occurred about 2.30 p.m., Wednesday of Whit-Week.—Yours faithfully,

ARTHUR F. WILLIAMS.

Timperley, near Manchester.



Apparatus we have tested

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

A L.F. Transformer of Hedgehog Type

MESSRS. BEARD & FITCH, LTD., send a sample of the "Success" low-frequency intervalve transformer, which they handle wholesale.

This is of the hedgehog type, with a small core of iron wire turned back over the windings; but is enclosed in an ornate brass tubular case, with terminals on the ebonite end-plate. The whole is 2½ in. high and 2⅝ in. diameter. Holes are drilled in the lower flange for fixing.

No particular provision is taken to ensure effective insulation of the leads where they pass through the iron wire core, and a piece of folded paper is relied upon to keep separate these wires where they connect to the terminals. On test the insulation resistance between primary and secondary was adequate. From the comparatively low D.C. resistance of both primary and secondary it was clear that a high impedance was not to be anticipated; in actual trial the comparison with other transformers and with the standard, the performance was very poor, the tone being muffled and distorted, whilst the amplification was low, being in fact no better than with a good choke-capacity coupling (around 3 times).

We cannot recommend this instrument to our readers in its present form.

L.F. Transformers

Messrs. H.T.C. Electrical Co., Ltd., have sent for test and report a couple of their low-frequency intervalve transformers, described as of 1 : 5 ratio.

These are small instruments measuring about 2⅝ in. by 2¼ in. by 1¾ in., of the ordinary pattern with closed iron core of stampings of rather small cross-section. Drilled brass brackets are provided for fixing, and small terminals on ebonite strips.

On test with the "Meg" tester at 500 volts D.C., the insulation-resistance was found to be

unexceptionable in the one instrument, and adequate for all ordinary purposes in the other. In actual reception of local broadcasting, with a stage of power amplification with proper grid-bias and a small-power valve, compared with the standard the performance of both these transformers was quite good, though the quality left something to be desired, a good deal of the bass notes being lost. The actual amplification measured was of the order of $4\frac{1}{8}$, compared with 7 for the standard large expensive transformer under identical conditions.

The general finish and appearance of this small transformer are of an attractive character.

A Variable Condenser with Corrugated Plates

Messrs. Formo Co. have sent for test a sample of their "Formo-Densor," a new type of variable condenser with plates having V-shaped circular corrugations; it is claimed that this, by increasing the effective area of the vanes, reduces the bulk of the instrument for a given capacity, and at the same time renders the instrument more sturdy.

The .31-plate type tested had a maximum capacity of .00756 μF on measurement, the minimum being .00025—rather lower than usual in a condenser of this size. A three-plate vernier arranged on the same spindle gave a fine adjustment of .00004 μF range. The whole instrument was only 3 in. high (excluding knob and spindle), and about $3\frac{1}{2}$ in. diameter. One-hole fixing, in a $\frac{3}{8}$ in. clearance hole in the panel, was provided for, and terminal tags for connections underneath. The end-plates were of composition; the whole structure appeared extremely rigid and mechanically sound. On test with 500 volts D.C. with the "Meg" tester the insulation resistance was unexceptionable.

An ingenious clutch device made possible the control of both main bank and single vernier plates by the same knob; by slightly depressing the latter the main bank were left at their setting and the vernier was separately controlled for fine adjustment. Some care must be taken that the end-wire motion of the single vernier plate does not produce short circuits, as it is difficult to see if the plates are clear with these corrugated plates.

On practical test, the mechanism worked smoothly and silently, and fine adjustment was readily possible by the vernier device.

Audio Chokes

From Messrs. H.T.C. Electrical Co., Ltd., come samples of their audio-choke coils, for use in low-frequency amplification circuits, etc.

These are about $2\frac{1}{2}$ in. long by $\frac{3}{4}$ in. diameter, and small terminal nuts on each of the square ebonite ends; brackets for fastening down on the panel, etc., are also provided. The resistance when measured came out at about 800 ohms.

In actual reception, using a stage of power-amplification with this choke-coupling, and proper grid-bias on a small power-valve a moderate degree of amplification resulted, about 1.5 compared with 7 for first-class transformer coupling under otherwise identical conditions. The quality of the reproduction of speech and music could not be described as remarkably good, with this small audio-choke.

Information Department

Owing to the tremendous increase in the number of queries, and the policy of the Radio Press to give expert advice and not merely "paper circuits," it was found necessary some months ago to enlarge our special staff. In view of the expense incurred we are reluctantly compelled to make a charge of 2s. 6d. for replies, according to the rules below. All queries are replied to by post, and therefore the following regulations must be complied with:— (1) A postal order to the value of 2s. 6d. for each question must be enclosed, together with the coupon from the current issue and a stamped addressed envelope. (2) Not more than three questions will be answered at once. (3) Complete designs for sets and complicated wiring diagrams are outside the scope of the department and cannot be supplied. (4) Queries should be addressed to Information Department, Radio Press, Ltd., Devereux Court, Strand, London, W.C.2, marking the envelope "Query."

J. B. Y. (BATTERSEA)—States that he is anxious to make up the 5-valve Transatlantic Receiver described in the June Number of "Modern Wireless," and as he already possesses an Omni receiver wonders whether he can use this latter instrument as part of the 5-valve set and suggests that he should incorporate the detector and two stages of low frequency amplification in the Omni Receiver, and make a separate panel for the two high frequency valves.

We are not inclined to advise breaking up in any way the high-frequency circuits of the Transatlantic set, which would of course occur if the detector was contained in the Omni receiver. Since the whole efficiency of the set depends upon the matching of certain circuits, so that they can be tuned by means of a double condenser, it is not likely that the incorporation of additional and probably much longer wiring between the two units would give good results. Probably the only satisfactory expedient is to build one unit containing the two high-frequency valves and rectifier, and use the Omni simply as a two-valve low-frequency amplifier.

J. H. W. (PETERHEAD)—States that a friend in South Africa has asked him for advice as to the kind of set to construct to receive the B.B.C. stations, and we are therefore asked to provide a suitable circuit.

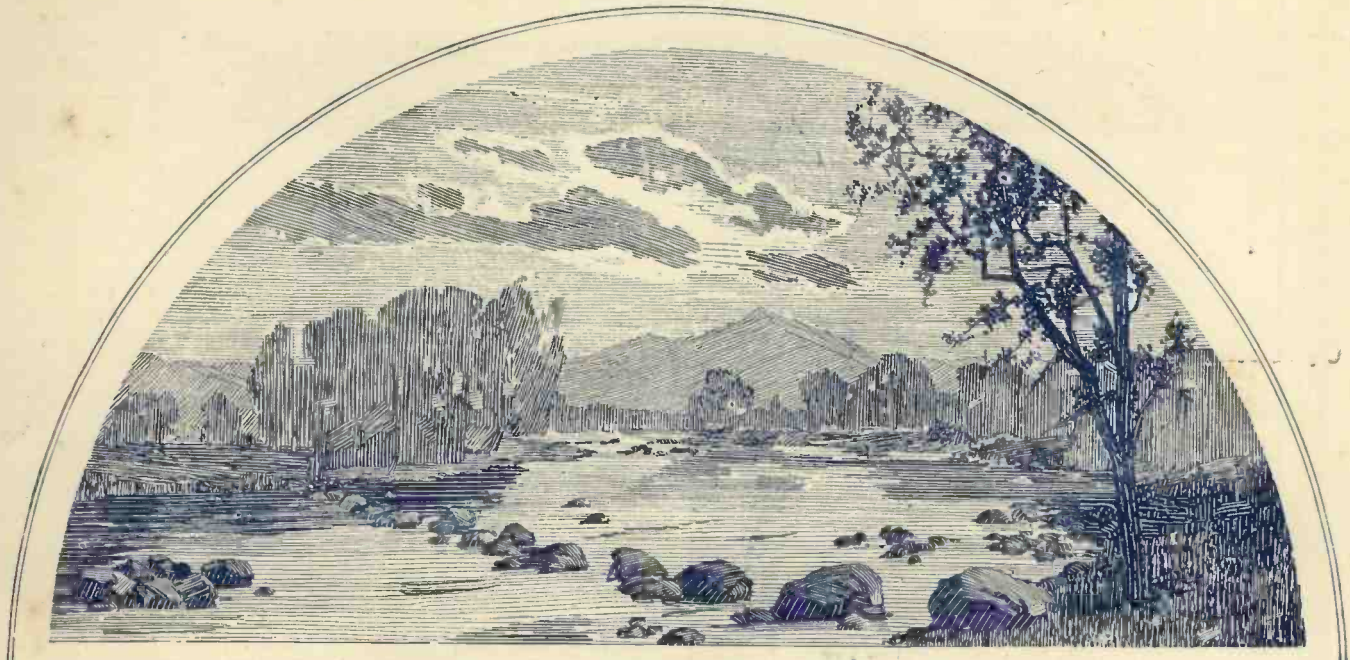
To have a reasonable chance of picking up the British stations in South Africa at least two high-frequency valves should be used, and one or more stages of L.F. It must be remembered that the efficiency of sets employing more than one high-frequency valve is very largely dependent upon the correct design of the receiver, the spacing apart of the components on the panel and the arrangement of the wiring. We therefore feel that a circuit diagram would not be of very much value, and we think that by far the best plan which our correspondent can adopt is to send his South African friend a copy of *Modern Wireless* for June, which contains a full and detailed design for a five-valve receiver.

A. W. L. (NORTHUMBERLAND)—States that he is using three semi-aperiodic high-frequency transformers for the broadcast band wound with 440 turns of No. 40 resistance wire upon a 1-inch diameter ebonite tube. He now wishes to make up two other sets, one to work on a wavelength of 1,600 metres and the other on 2,600 metres.

If wound upon a similar system, these transformers would be of unwieldy size for the longer waves, and therefore we suggest the use of slot winding. Obtain the necessary number of discs of ebonite ½ in. thick and 3 in. diameter. In their edges turn two grooves ½ in. deep and ⅛ in. wide. (Any machinist could do this for you.) Wind the primary in one groove, and the secondary in the other, with 200 turns for 1,600 metres, and 350 for 2,600 metres, using the same kind of wire as you previously employed.

A. T. (DUNDEE)—States that he is building a Transatlantic receiver as originally described in "Modern Wireless," and wishes to include a milliammeter, which he has been told should be inserted in the high-tension positive lead. He points out, however, that as there are separate high-tension leads to the receiver and the amplifier, he does not quite see how this can be done. He inquires whether he can insert the instrument in series between the telephones and the high tension positive, and inquires what will be a suitable reading for the instrument.

The position for the milliammeter depends upon whether you wish to read the total anode current for the whole set, or merely for one of the valves. If you desire to read the current for the rectifier, or the first or second L.F. amplifier, you could do it by inserting the milliammeter in series with the telephones, but if you desire to measure the total consumption of the receiver, you should insert the milliammeter between the negative of the high-tension battery and the H.T. negative terminal upon the receiver. A suitable range for the milliammeter will be 0 to 10 or 0 to 15 milliamps, so long as you do not intend to use large power valves.



STEPPING STONES TO SUCCESS

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

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

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7	How to Make a "Unit" Wireless Receiver ... ... By *E. Redpath.*	2/6
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12	Radio Valves and How to Use Them... By *John Scott-Taggart, F.Inst.P.*	2/6
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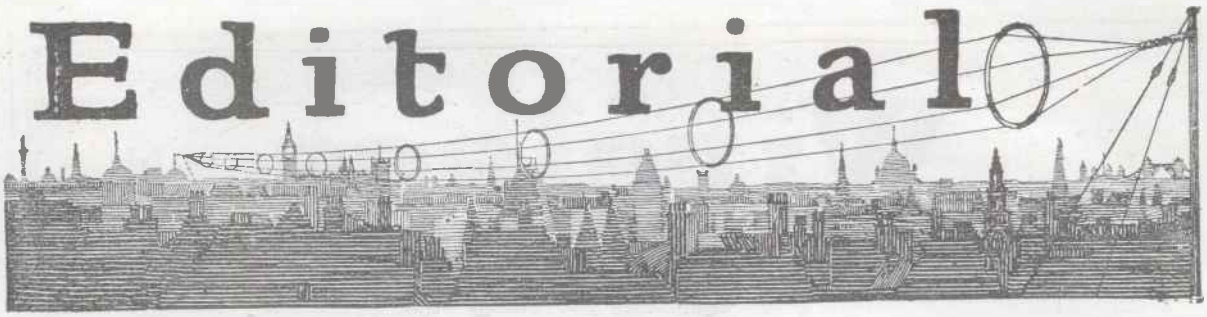
Editorial



100-Metre Progress.

ON ANOTHER page we reproduce the first portion of a most interesting and important paper given by Senatore Marconi before a recent meeting of the Royal Society of Arts.

In this paper the famous inventor summarises the work he has done with his assistants in the last few years in developing the practical application of wavelengths far shorter than any previously devoted to commercial work. Early in his paper Senatore Marconi recalled that the first practical wireless work was conducted by means of reflectors, and it is interesting to note that after a long interval (it is now 28 years since the young Italian first demonstrated his "black box" before the authorities here) we should return to wavelengths on which the pioneer work was done. Senatore Marconi's conclusions are clearly set forth in the paper, so that we need not refer to them in detail here, but it is interesting to note that the remarkable experiences of the amateur transmitters who made history last winter in their frequent communications across the Atlantic are fully confirmed by the experiments now revealed.

It is still early to estimate the full importance of the work which has been done on the short wavelengths, and it will be interesting to watch the attitude of the British Government in this matter. At the present time there is under construction at Rugby a giant station planned to use the high power which, up to the present time, has been necessary for consistent long-distance communication. Will the tall masts and the accompanying gear be scrapped? Will the great expenditure in such a high-power station be wasted? Still further, will it be considered advisable to suspend operations until newer methods have been more fully proved? These are but a few of the questions which will arise in the curious mind.

Probably the attitude taken will be to proceed with the present plans and to watch carefully any developments on the shorter waves. This country has suffered almost more than any other by the repeated delays in the erection of long-distance wireless stations, and the Post Office appears to think that it is better to complete a known system and then later compare the results with those obtained by any other system of radio communication which may have been brought to perfection.

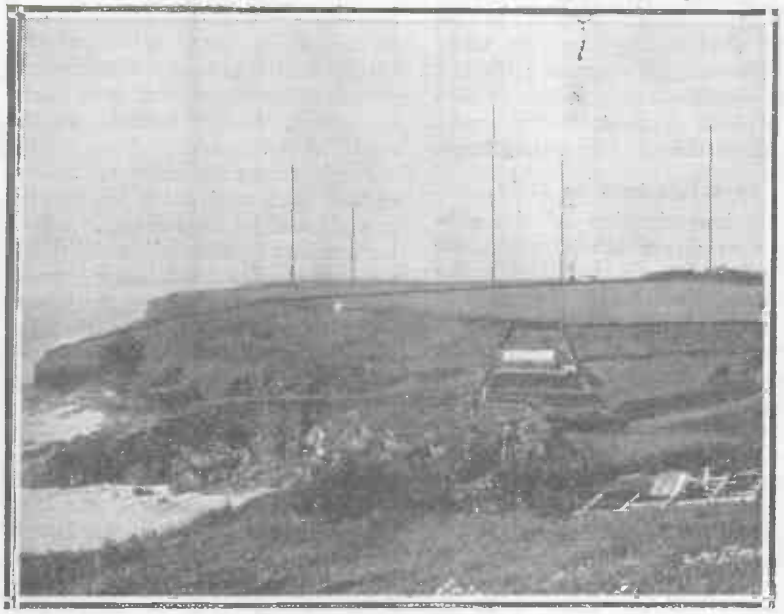
CONTINENTAL BROADCASTING
NEW "WIRELESS WEEKLY" FEATURE

On page 306 of the current issue we publish the first of a new series of tabular lists of Continental broadcasting, specially prepared for "Wireless Weekly" by Captain L. F. Plugge, B.Sc., F.R.Ae.S., F.R.Met.S., the well-known authority on Continental Broadcasting. We would emphasise that this table, which will appear at regular intervals, is not merely a compilation from foreign newspapers, but is a checked list of stations that really can be heard in this country on a good receiver. Next week a remarkable double-page key chart will appear, showing readers at a glance how many stations are audible at a given time.

Beam Wireless

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

A Paper read before the Royal Society of Arts on Wednesday, July 2, 1924, on results obtained over very long distances by short wave directional wireless telegraphy, more generally referred to as the beam system.



The Poldhu Station, where many of Senatore Marconi's Experiments were conducted.

THE study of short electrical waves dates from the time of the discovery of electric waves themselves, that is, from the time of the classical experiments of Hertz and his contemporaries, over thirty years ago; for Hertz used short electric waves in all his experiments when he conclusively proved that these waves obeyed the same laws as the waves of light in regard to speed of propagation, reflection, refraction and defraction.

Early Beam Experiments

I might also, perhaps, recall the fact that when I first came to England, about 28 years ago, I was able to show to the late Sir William Preece, then Engineer-in-Chief of the Post Office, the transmission and reception of intelligible signals over a distance of 1¼ miles of a beam system employing short waves and reflectors, whilst, curiously enough, by means of the antenna or elevated wire system I could only get signals, at that time, over a distance of half a mile.

Many years afterwards, through the courtesy of the Post Office, I was favoured with a copy of the Official Report of those early tests, which, from an historical point of view and in regard also to latest developments, makes now most interesting reading.

The Progress Made

The progress subsequently made with the long wave system was, however, so rapid, so comparatively easy and so spectacular that it diverted all research from the short waves, and this, I think, was regrettable, for it has only recently been discovered that these waves, which alone can be in practice confined in beams to definite directions, are capable of results unobtainable by the use of the lower frequency system which up to now has held the field for long distance radio communication.

The late Sir William Preece described my early tests at a meeting of the British Association for the Advancement of Science, in September, 1896, and also at a lecture he delivered before the Royal Institution in London on June 4, 1897.

On March 3, 1899, I went into the matter more fully in a Paper read before the Institute of Electrical Engineers, to which Paper I would recall your attention.

1899 Experiments

At that lecture I was able to show that it was possible, by means of short waves and reflectors, to project the rays in a beam in one direction only, instead of allowing them to spread all around, in such a way that they could not effect any receiver which happened to be out of the angle of propagation of the beam, and I described tests carried out before the Post Office Engineers at Salisbury Plain, pointing out the possibilities of such a system if applied to lighthouses and lightships, in enabling vessels in foggy weather to locate dangerous points around the coasts.

I also showed results obtained by a reflected beam of waves projected across the lecture room, and how a telegraphic receiver could be actuated or a bell rung only when the aperture of the sending reflector was directed towards the receiver.

Since those early tests of over twenty years ago, and for a very long period of years afterwards, so far as I can ascertain, practically no research work was carried out, or at least published, in regard to the application of very short waves to radio communication.

Reflector Difficulties

Research along these lines did not appear easy or promising; the use of reflectors of reasonable dimensions implied the use of waves of only a few metres in length which with the means then at our disposal were difficult to produce, and up to a comparatively recent time the power that could be radiated by them was small. This, and the supposed high attenuation of the waves over any distance of land or sea, gave results which appeared to be rather disappointing.

Some years ago, during the War, I could not help feeling that we had, perhaps, got into a rut by confining practically all our researches and tests to what may be termed long waves, that is, waves of some thousands of feet

in length, especially as I remembered that during my very early experiments, in 1895 and 1896, I had obtained promising results over short distances with waves not more than a few inches long.

Investigations in Italy

The investigation of the subject was again taken up by me in Italy early in 1916 with the idea of utilising beams of reflected waves for certain war purposes, as I was greatly impressed with the advantages which such a system would afford in minimising tapping or interception by the enemy, besides greatly reducing the possibility of interference with our own stations.

At subsequent tests during that year and afterwards I was most valuably assisted by Mr. C. S. Franklin.

The Royal Italian Navy also gave me all possible facilities for the carrying out of my tests in Italy.

Mr. Franklin's Work

Mr. Franklin since then followed up the subject with great thoroughness, and results of his investigations were described by him in an admirable paper read before the Institution of Electrical Engineers on April 3, 1922.

At a lecture delivered by me before a joint meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers in New York, on June 20, 1922, in which I described the results obtained up to that time by Mr. Franklin and myself, I felt I could not but express the opinion that it was most regrettable that the study of the characteristics and properties of short waves and their adaptability to directive methods had been so sadly neglected, and pointed out that very many important problems in radio transmission could only be solved by the use of the short wave directional system.

Reflector Details

The reflectors now used for this system are not composed of solid sheets of metal, such as those employed in my early tests in 1896, but of a comparatively small number of wires placed parallel to the antenna and spaced around it on a parabolic curve of which the transmitting or receiving antenna constitutes the focal line, as it was soon ascertained that this was a much more practical arrangement, and that, moreover, much better results could be achieved.

Suggestions for using reflectors of this kind were made by Brown in 1901 and by De Forest in 1902, but many essential conditions necessary for efficiency were apparently not realised by these workers at that time, which probably explains why no application of their arrangements was made for practical purposes.

Recent Patents

Since 1916 various patents have been taken out by myself and Mr. C. S. Franklin, and in the latest of these Mr. Franklin describes an arrangement in which the antennæ and reflector wires are arranged so as to constitute grids parallel to each other, the aerials or antennæ being energised simultaneously from the transmitter at a number of feeding points through a special feeding system, so as to ensure that the phase of the oscillations in all the wires is the same. It has been proved by calculations confirmed by experiments that the directional effect of such an arrangement is a function of its dimensions relative to the wavelength employed.

Spark Tests

During my tests of 1916 I used a coupled spark transmitter and the receiver was a crystal receiver. The reflectors employed were made of a number of wires tuned to the wave used, arranged on a cylindrical parabolic curve with the aerial in the focal line.

Reflectors with apertures up to $3\frac{1}{2}$ wavelengths were tested, and the measured polar curves agreed very well indeed with the calculated values.

The Italian experiments showed that good directional working could always be obtained with reflectors properly proportioned in respect to the wavelength employed, and with the apparatus then available the range obtained was six miles.

Work at Carnarvon

The tests were continued in Wales at Carnarvon during 1917, and through the introduction of further improvements, with a wavelength of three metres, a range of over 20 miles was readily obtained when using a reflector at the transmitting end only.

In 1919 further experiments were commenced in which Mr. Franklin succeeded in using electron tubes or valves for the generation of very short waves, the object then being to evolve a directional radio-telephonic system.

During further tests, and by utilising a 15 metre wave, clear and strong speech was received in Kingston Harbour at a distance of 78 miles from Carnarvon.

At a later date these tests were repeated over a land range of 97 miles between Hendon and Birmingham. The power supplied to the valves was approximately 700 watts, and the speech received was strong and of good quality.

(To be continued.)

Broadcast Licences

The Postmaster-General announces that the new and simple type of wireless-receiving licence is now on sale at post offices at a fee of 10s. This licence contains no conditions concerning the marking of apparatus, and it covers the use of any receiving set, whether purchased complete or made from parts, provided that the set or parts are of British manufacture. The licence will be issued in place of existing broadcast, constructor's and interim licences, as they fall due for renewal, and will cover any set which the holder of such a licence is entitled to use.

Now that the licence fee for home-made sets has been reduced and the conditions simplified, the Postmaster-General feels confident that there will be no attempt on the part of the "listening" public to avoid payment for a service which gives them so much pleasure. He thinks it right, however, to call attention to the fact that heavy penalties are prescribed by the Wireless Telegraphy Act, 1904, on conviction of the offence of establishing a wireless station without a licence.

Controlling a Tuned Anode Circuit

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

A valuable contribution to the discussion on how to obtain the best high-frequency amplification

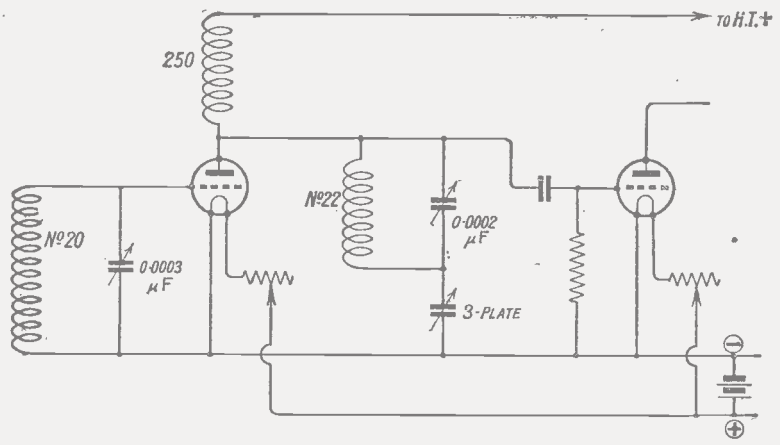


Fig. 2a.—The condenser used between the anode coil and the filament lead or "earth."

AN ever-present danger in a circuit employing high-frequency amplification by means of a tuned-anode (or tuned low-resistance transformer) coupling, is that of self-oscillation.

This statement will very likely be greeted by some scepticism on the part of many experimenters: *they* never get oscillation with a sharply-tuned anode; in fact they have to use deliberate magnetic reaction on the tuned-anode to get their set into a sensitive condition or for searching; and many diagrams of tuned-anode circuits are published from week to week in which this reaction on the tuned-anode is shown.

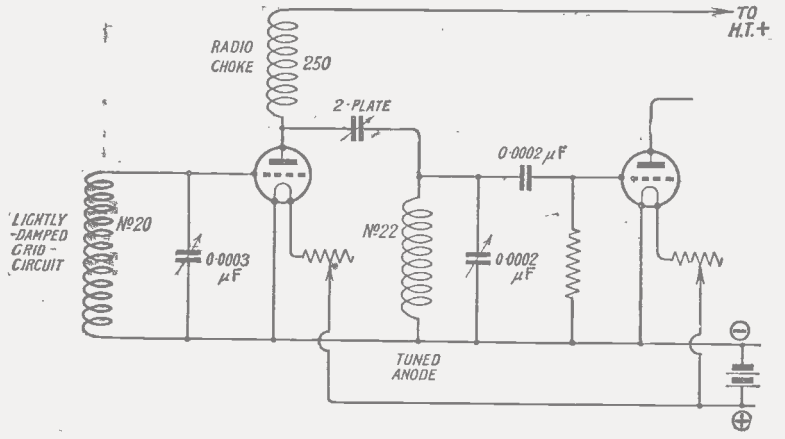


Fig. 1.—Use of the small condenser between the plate and the tuned anode coil.

A little closer examination of the circuits used will disclose the reason; in every case there will be found a (comparatively) heavily-damped aerial-circuit—even where damping by means of positive grid bias had not deliberately been applied. A *direct-coupled* tuning-inductance in the aerial-tuning device, with parallel tuning condenser, is already fairly heavily damped by the direct effect of the large aerial; when in addition the tuning-inductance is made of No. 26 wire (or even smaller) for the broadcast belt, and a large parallel tuning capacity used, the damping due to the very appreciable H.F. resistance of this fine wire on the higher frequencies will make itself felt. An expensive stability may be thus obtained, expensive because it is at the cost of both signal-strength and selectivity, and this loss cannot be wiped out (as is so often suggested) by the excessive use of semi-aperiodic magnetic reaction. When, in addition, a fine-wire semi-aperiodic type of tuned-anode coil is used (as is the case with so many commercial sets), the efficiency of the H.F. stage may be so much further reduced that a good measure of reaction directly on this tuned-anode must be used to get oscillation at all. And yet an efficient lightly-damped tuned-anode will oscillate wildly when brought within a foot of the A.T.I., or even when quite uncoupled with it magnetically, the tiny electrostatic coupling through the valve capacities being all-sufficient for reaction.

Effect of Loose Coupling

When ordinary loose-coupling, by means of a two-coil holder, is used in conjunction with tuning coils of low H.F. resistance, or when a sufficiently large coil is used with a small series variable condenser (*e.g.*, .0001-.0002 μF) in the aerial, we have a lightly-damped grid-circuit when the connection is made to the negative side of the filament. The same results with the type of semi-aperiodic loosely-coupled double coil advocated by Mr. P. W. Harris; the "constant-aerial-tuning" device of Mr. Scott-Taggart, if a .0001 μF series condenser and a *small* parallel variable condenser be used; and with the modified Reinartz type with which the writer has been experimenting for some time. With a small frame-aerial it is the same. With a low-resistance tuned-anode coil (or H.F. transformer primary) with small parallel tuning capacity (below .0003 *e.g.*) such a circuit will nearly always oscillate readily the moment the anode circuit is approximately tuned to the same wavelength as the grid circuit, on account of the electrostatic coupling through the valve itself, and although every care may be taken to avoid any sort of casual couplings.

Neutralisation

The Hazeltine neutrodyne device, in its original form or in the simple modification worked out by the writer for use with ordinary tuned-anode circuits, has as its purpose the neutralisation of this back-coupling through the valve, either completely or partially, so that induc-

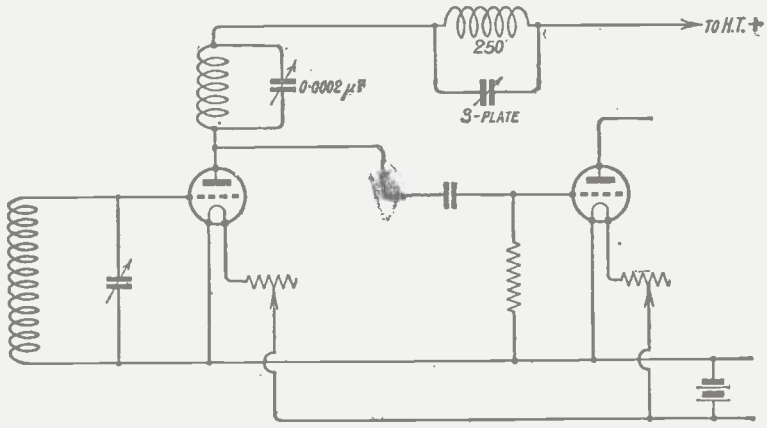


Fig. 2b.—An alternative method of placing the controlling condenser between tuned anode and "earth."

tances of good efficiency can be used without other damping devices, and good signal-strength and selectivity result.

The "series-tuned-anode" coupling, with both valve-capacities in series with the tuning inductance and each other, devised by the writer to overcome this trouble of instability in tuned-anode circuits, has a peculiar damping of its own, through the arrangement of the two valves in opposition, as it were, and the distribution of the P.D. across the various condensers in a different manner.

Critical Potential

With the conventional tuned anode, with both valve capacities in parallel, and the full oscillating P.D. applied across the anode and grid of the first valve in a H.F. amplification circuit, there is a certain point, which might be termed the *"critical potential,"* above which, when the oscillating potential in the tuned-anode circuit, excited by the relay action of the valve when signals are received on its grid, has built up sufficiently, self-oscillation will commence through this electrostatic feedback via the valve capacity. The value of this critical potential depends evidently on the degree of damping in the grid-circuit; for heavily-damped circuits it may reach a high figure, and with inefficient tuned-anode circuits with small oscillating build-up the critical potential may never be reached. Hence the boasted "stability."

Now if with an efficient, lightly-damped grid circuit, and a low-resistance efficient tuned-anode circuit (say of No. 22 d.c.c. wire and with .0001 to .0002 μF tuning capacity across it and of low-distributed capacity), we could in some way limit the maximum potential build-up in this tuned-anode without introducing resistance-damping—and therefore poor selectivity—so that we never exceeded this critical potential, it would be possible to reach the highest available amplification the circuit (with the particular valve and grid-damping) can give, with critical tuning and excellent selectivity.

The device suggested here will do this by altering the distribution of the P.D. across the various condensers which make up the complex oscillating circuit of the "tuned anode," and thereby keeping that across the grid and plate of the first valve below the critical potential of free oscillation. At the same time, being finely variable, the device allows of the finest possible control over reaction and oscillation, and has the further advantage of not altering the tuning of the circuit to an extent that complicates tuning-in appreciably.

It is suggested here, in a refined form, specifically in order to enable one to use a loose-coupled grid circuit without damping devices, and an efficient, sharply-tuned (and therefore selective) tuned-anode, either for simple reaction or for tuned-anode H.F. coupling. The same device can be used for controlling the customary form of semi-aperiodic magnetic reaction with swinging coils (Fig. 3).

The device is simply the use of a small series variable condenser introduced one side or the other of the tuned anode, isolating it to this extent from the rest of the circuit. It corresponds roughly to the reaction-condenser of the Reinartz circuit, though in that case the reaction-coil is semi-aperiodic. It can be placed either between the plate and the anode-coil, as in Fig. 1, or between the lower end of the anode-coil and the local earth or filament lead, as in Fig. 2a. In the first position the adjustment is more critical, and with sensitive circuits this condenser must be very small and of extremely low minimum.

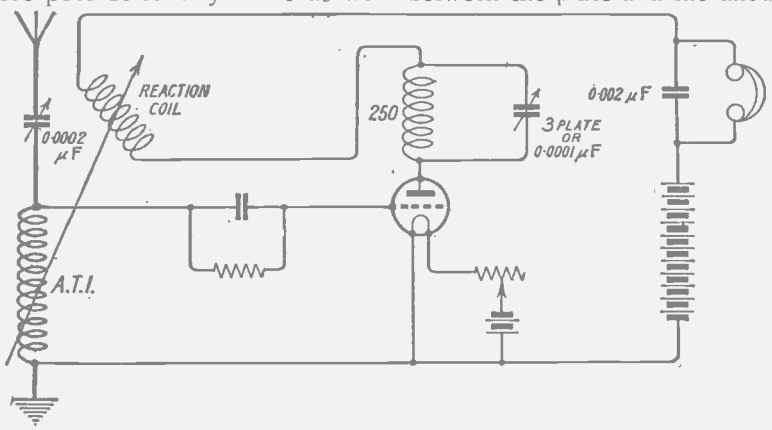


Fig. 3.—Controlling reaction in a set using a two-coil holder by the method described.

(To be continued)

GOOP-WAYFARER No. 761

BEGIN THIS GREAT NEW SERIAL TO-DAY

Synopsis of Previous Chapters

(Professor Goop and Wireless Wayfarer are giving to the world their great new serial circuit. In previous instalments the making of the inductance has been described and constructors have been told how to turn out beautifully finished variable condensers in the home workshop without doing the slightest violence to even the most delicate conscience.)

A Respite

No fewer than 14,652 readers have written in to ask me to reduce the pace a little in my serial description of that wonderful new circuit, the Goop-Wayfarer No. 761. Many of them have already completed the aerial tuning inductance, but the variable condenser has needed the devotion of all their spare time to the task, and even the manufacture of extra spare time by one of the methods outlined in last week's instalment has not enabled them to put the finishing touches to the A.T.C. One of the great difficulties appears to have been the collection of the inner lids of cigarette tins. I am told that there was almost a complete famine in the canned brands of fags at the end of last week owing to the enormous rush that was experienced. I can only say that I was seriously incommoded myself whilst riding last Friday in a 'bus between two gentlemen, each of whom was carrying home the required number of tins in a brown paper parcel. You have no idea of the number of hard corners that there are about a parcel of that kind. I had two ribs on one side and three on the other so successfully pushed in that I am now taking a Sandow course to push them out again.

No Undue Hurry

As I have no wish to hurry my readers unduly and as I am always only too glad for any excuse for shirking work in the summer time (spring, autumn and winter are also excellent seasons for indulging in this pastime; in fact, the only portion of the year when I really feel filled with a burning desire to work is that which falls under none of these headings). That sentence seems to have become rather too long, so we will break it off and start afresh. What I mean to say is that this week I intend to be merciful and to set you only a simple task which will take up so little of your leisure that there will be ample time for the laggard to catch up and for those who have managed to keep the hot pace set, to examine their handiwork carefully in order to make quite sure that there are no flaws in it. We will therefore merely connect to the condenser those leads which will eventually unite it to the wonderful circuit about which sooner or later (probably later) you will have the fullest details.

The Leads

It might be thought that no instructions at all would be necessary about the fitting of these leads, but no idea could be more erroneous. There are leads and leads. Dog leads are quite useless for the purpose, and you will not get good results should you employ rope, fencing wire or chain. Leads to work really well must be made of copper. It is of the utmost importance that you should understand all about this metal, and as I have two pages to fill up, we will now see exactly how it is obtained from the bowels of the earth. [No, we will *not*.—Ed.] Well, anyhow, do be careful to see that you get copper leads. Iron them out nice and straight, putting in a crease if possible on the upper side, for few things look more slovenly in a wireless set than leads which are not properly creased. With these few hints I think that you will be able to get through the work called for in this week's instalment without difficulty.

TO BE CONTINUED IN OUR NEXT

The leads to the condenser. These must be of tinned copper wire, ironed out flat, and nicely creased on the upper side.

The Helping Hand

I have just received what amounts almost to an S.O.S. from those who are employed in the manufacture of high-tension batteries. It appears that all this agitation about the high-tension battery which has been going on for the last few weeks has had a most terrible effect upon the trade. The high-tension battery, we were told, was to be abolished; therefore, those who were buying new sets delayed their purchases in the fond hope that they would soon have receivers which required no aid of this kind, and those who already

possess sets have absolutely refused to renew their high-tension batteries, no matter how noisy they have become. The distress amongst workers is becoming considerable, for a man who has specialised in high-tension-battery-cell-case-drawing can turn his hand to no other work. And what of the carbon-rod-turners, the pluscappers (these are the fellows who fit those neat little tin hats to the carbon rods), the wax-pourers, the pitchlarks, the strip-cutters, the socket-snippers, the card-sharpers, and the potwingles. Probably you have never heard of a potwingle. His is one of the most expert and specialised of callings, for he is employed entirely in the mixing of the depolariser for high-tension batteries. His responsibilities are appalling, for a few grains, more or less, of manganese dioxide put in or left out by careless potwingles will produce more atmospherics than all the sunspots of the century. In view of the sad state of affairs in the high-tension battery trade there is, I think, only one thing to be done. One must lend a helping hand and give a filip to this threatened industry. I feel, therefore, that a few hints on how to buy a high-tension battery and how to use it when you have bought it, will serve the double purpose of stimulating the demand for the useful articles and of enabling the nervous reader to deal with them with a feeling of perfect security.

How to Select Your H.T.B.

It may be taken as a good general rule that it is not wise to purchase high-tension batteries secondhand. When, therefore, you sally forth to make your purchase you should avoid those shops over whose doors swing the three golden balls of Lombardy. Thousands of high-tension batteries have been pawned since the coming of those amazing circuits, whose epoch-making qualities were so nobly trumpeted abroad. Thinking that I might do a good stroke of business I endeavoured to raise a little ready money on half a dozen old ones of mine, but was unfortunate in finding that my uncle was no beginner at wireless. No, take the advice of an old hand and buy your high-tension battery from a wireless shop. I think it is always best to take a friend with you. You can tell him, of course, that as a favour you will instruct him in the great art of choosing a battery, without mentioning that he is going to be useful in any way. Choose always a friend who has a small d.c. ohmic resistance. It is very seldom that wireless shops possess, or at all events produce a suitable voltmeter for testing high-tension batteries. This is where the friend comes in. We instruct him to wet the forefinger of either hand and to place the left upon the socket marked minus and the right upon that marked 120. The voltage of the battery can then be found by the simple formula:

$$E = \frac{L \times 20}{W}$$

where L is the height of his leap in inches and W his weight in stones. Thus, if the 120 volt battery is really up to snuff the ten stone friend should rise 5 ft. into the air. Poddleby, who has a singularly low ohmic resistance and weighs but eight stones, broke the world's high jump record recently when he tested a 200 volter for me. I had begged him urgently to send in his name to the British Olympic team committee, but I am sorry to say he shows a strangely unsporting spirit.

Examining the Battery

The salesman will bring forward for your inspection quite a number of high-tension batteries of various shapes and sizes. If he really knows his business he will guarantee for every one of them a working life of at least five years and a current rating equal to that of a turbine generator. He will probably endeavour to persuade you to buy the battery which he is using for demonstration purposes, assuring you that he knows it is a good one since in the three months in which it has been in use he has had ample opportunities of testing it. Do not be blandished in this way. Tell him that strong as your desire is to have the perfect battery your natural good feelings will not allow you to separate him from his old and tried friend. Buy your batteries always by weight, remembering that a good big'un will always beat a good little'un. Insist upon the salesman carrying his selection to the scales and see their weights recorded. If it is a hot day he will not be at all keen on this, but do not pander to his natural sloth. Having found the heaviest battery subject it to further searching tests. The friend will probably have gone home by this time, so you will not be able to make any further use of him. Shake the battery vigorously. If it rattles it will be microphonic, and a microphonic high-tension battery is one of the most terrible things that the wireless man can possess. Apply a match to the wax or pitch covering. If it burns it is genuine; should it refuse to light it is some spurious substitute which will never be satisfactory. Whilst the salesman is not looking take your pocket-knife and chip off a little of the wax or pitch of another battery of the same make as the one you intend to have to make quite sure that the cells below are not sells. Be careful to replace the lid before he turns round. Look carefully for the date of the battery. Unlike wine, high-tension batteries do not improve with age, and I am told that those of the 1922 vintage are now distinctly off colour, whilst even the 1923's can hardly be regarded as at their very best to-day.

How to Use Batteries

Treat your battery well, and it will treat you well. Though its shape makes it most convenient as a resting place for tools and so on, it should never be used for this purpose. A steel ruler, a flat file, or even a screwdriver laid for even the briefest period upon the high-tension battery will leave a lasting mark upon its constitution. It is most desirable that the wander plugs should make good contact, otherwise the battery may be blamed for noisiness for which it is in no way responsible. The best way of ensuring proper contact is to keep a blow-lamp and a soldering iron always upon the wireless table when the set is in use and to solder the plug firmly into its socket whenever a change is made in the anode voltage. High-tension batteries are frequently used, though seldom intentionally, for filament heating purposes. This practice is universally condemned by all wireless men save only those who are engaged in the manufacture of valves.

WIRELESS WAYFARER.

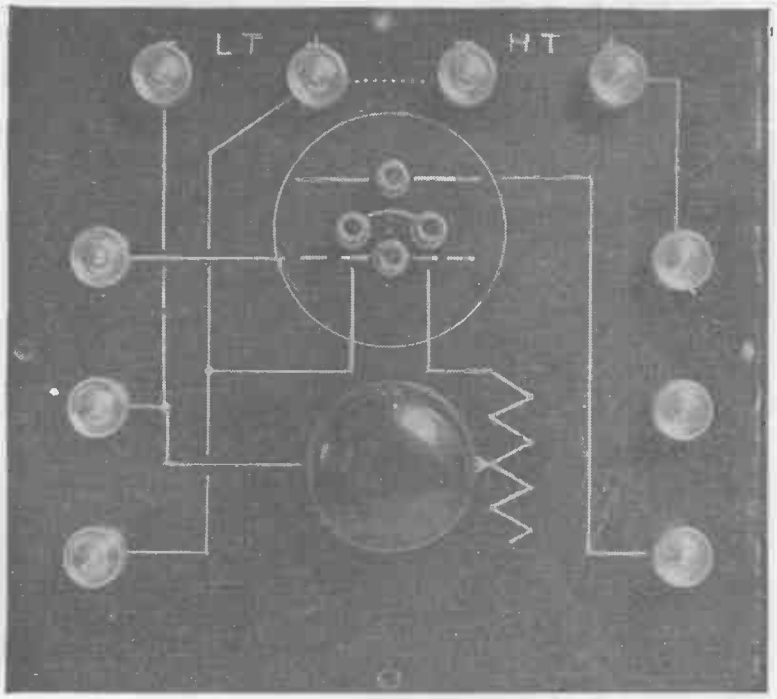


Fig. 1.—The "Diagram" valve panel specially designed for use in the circuit arrangements to be described.

How Every Crystal User may become a Valve Expert

By E. REDPATH,
Assistant Editor.

In this, the third article of the series, theory and practice are combined, and those readers who have followed the first two articles will find additional interest in the circuit arrangements described

HAVING dealt with the elementary theory of valves, and outlined their essential working principles, the writer now purposes describing some practical circuit arrangements.

Apart from the fact that no doubt many readers prefer an ounce of practice to a pound of theory, it is considered that a suitable admixture is very desirable, as not only is the reader's interest better maintained, and consequently his gain from the reading materially increased, but by the actual handling of apparatus and the making of various adjustments and connections concurrently with a study of the "reason why" and the exercise of a little imagination in visualising the action which is occuring, the desired information is most readily assimilated.

Apparatus Necessary

It will, of course, be recognised that before experimental work in connection with valves can be carried out, the owner of a crystal set will require to provide himself with certain additional apparatus. For the purpose of this present series of articles, the writer has designed the special "Diagram" valve panel illustrated in the photographs, Figs. 1 and 4.

The only special features about this panel, of course, are, firstly, the engraved lines indicating the connections at the back of the panel and the conventional theoretical outline of the three-electrode valve, and, secondly, the provision of additional terminals so that battery connections to the panel do not interfere in any way with whatever other connections are necessary when the panel is employed in various circuit arrangements.

Reference to Fig. 1 will show that the complete panel is really equivalent to the valve portion of a theoretical diagram translated into practical form and provided with the necessary filament rheostat, valve-holder and convenient terminals. It is considered that the idea will prove of assistance to beginners, who often experience a difficulty in bridging the gap between the purely theoretical and the practical wiring

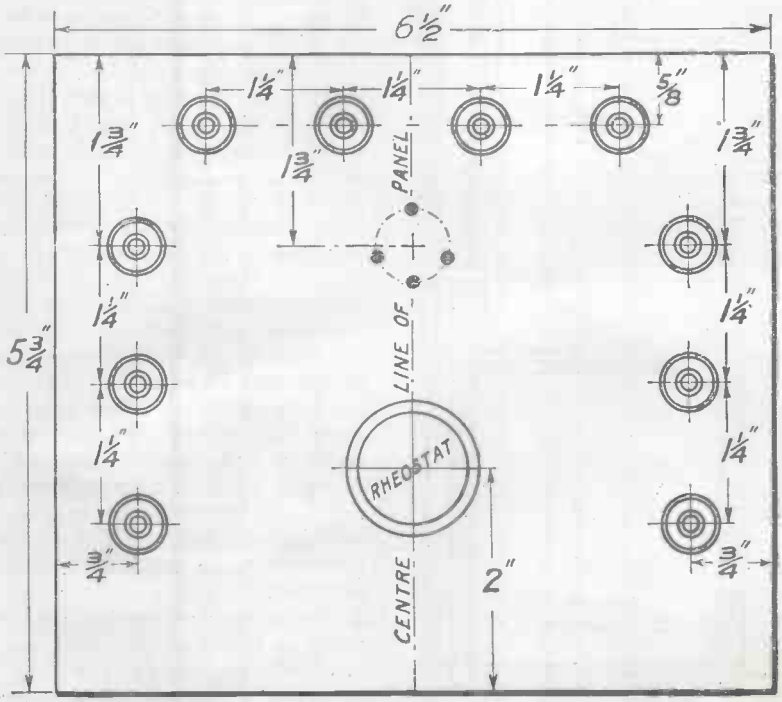


Fig. 2.—Drilling plan of the ebonite panel.

diagram, whilst more experienced experimenters will doubtless find it a useful piece of apparatus as the complete wiring of any experimental circuit can be checked with certainty and without the necessity of referring to the back of the panel.

Constructional Details

The photographs already referred to (Figs. 1 and 4) show practically all the constructional details that are necessary. The actual overall dimensions of the ebonite panel and the distances between centres of terminals are not of vital importance, but, for those who wish to make an exactly similar panel, full details are given in Fig. 2, whilst details of the containing box are given in Fig. 3.

In addition to the ebonite panel and the containing box, the following materials will be required :—

Ten terminals and backnuts.

Four valve sockets and backnuts.

One filament rheostat (that illustrated is a Burndept dual rheostat which enables a dull-emitter valve to be used if desired).

The engraving of the ebonite panel is a fairly simple matter, but takes a considerable time. In the writer's case the engraving was done with the aid of a small steel rule and the V-shaped point of a small smooth file, the groove cut in the ebonite being afterwards filled in with the white chalky material used for cleaning tennis shoes, applied on a wet cloth and smeared all over the panel. When dry, the surplus white substance is easily wiped off the panel without disturbing that in the engraved line.

All lines are first drawn lightly with a blacklead pencil, and a small indentation is made with a scriber or knife point at the end of each section of straight line. The point of the file or engraving tool is then placed in one of the indentations, the steel rule is moved into position close to it and along the line to be cut, and the ebonite is scraped away, up to the next indentation. Particular care is to be taken that the lines stop short of the valve sockets, and, before the white filling is applied, all pencil marks are to be removed by means of an indiarubber. White lead should not be used as a filling material.

The wiring at the back of the panel is fairly simple, and, as it is clearly illustrated in Fig. 4, a separate wiring diagram is considered unnecessary.

NOTE.—For commercial reasons the design of the diagram valve panel has been registered at H.M. Patent Office. There is, however, no objection to readers constructing panels to this design for use in their own experimental work.

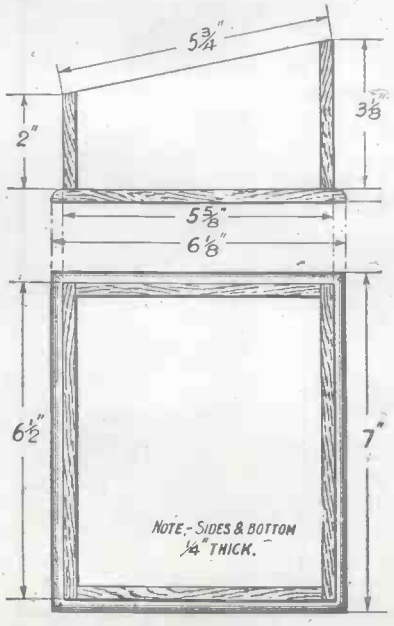


Fig. 3.—Details of the containing box.

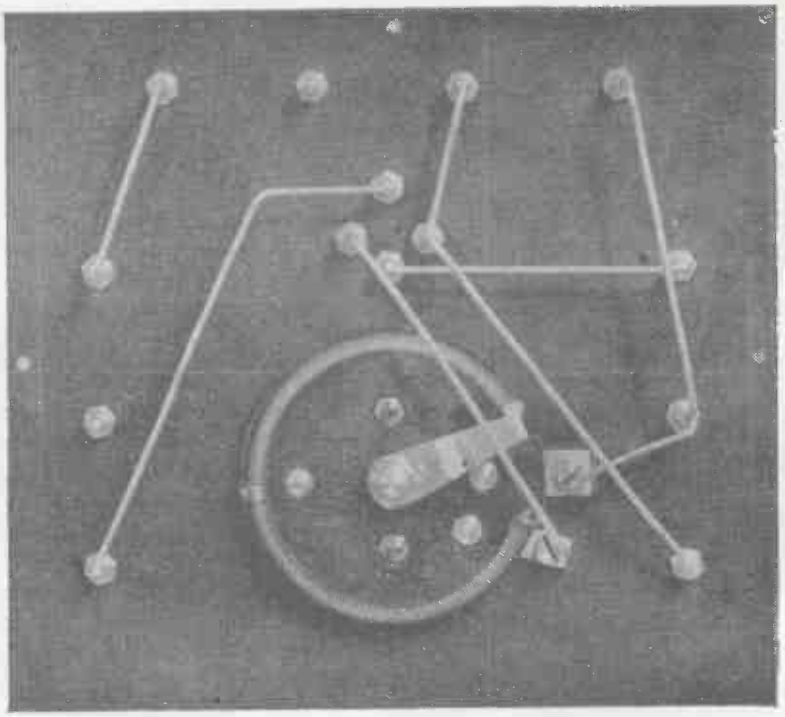


Fig. 4.—Back view of the panel, showing connections.

The Valve as a Low-Frequency Amplifier

Probably the simplest and, at the same time, most satisfactory method of adding a single valve to a crystal receiving set, is as a low-frequency amplifier.

In this connection, *low*-frequency means that the valve is to be called upon to amplify current changes which occur at a frequency below about 10,000 to 12,000 per second. That is to say, at a frequency well within the audible limits, in view of which the term *audio*-frequency is perhaps preferable to the more common term of *low*-frequency.

Fig. 5a is a theoretical circuit diagram of a simple single-circuit crystal receiver, comprising an aerial tuning variometer L, the upper end of which is connected to the aerial and the lower end to earth, and, shunted across the variometer, a crystal detector D and telephone condenser C. The telephones themselves, originally connected to opposite sides of condenser C, have been removed and the *input* terminals of the valve panel (*i.e.*, the grid and negative filament terminals) have been connected in place of the telephones.

The rectified pulses of current therefore which previously actuated the telephone diaphragm

are now applied to the grid of the valve, thus altering its potential with respect to the filament.

Bearing in mind the rule given in the preceding article, namely, that under proper working conditions, a *small* variation in grid potential causes a *large* change in anode current, it will be appreciated that the diaphragms of the telephone receivers (T), connected between the positive side of the anode or high-tension battery (B2) and the anode of the valve, will now be actuated by current impulses of a frequency corresponding to those applied to the grid, *but of greater magnitude.*

In this, and, in fact, in any method of using a valve as a low-frequency amplifier, it should be clearly understood that the incoming signals must be of sufficient strength to actuate the crystal detector (D) in a satisfactory manner. Even the most sensitive crystal detector requires a certain minimum change of potential to be applied to it before any appreciable rectified current is available, either to operate the telephone receivers direct, or to vary the grid potential of an amplifying valve.

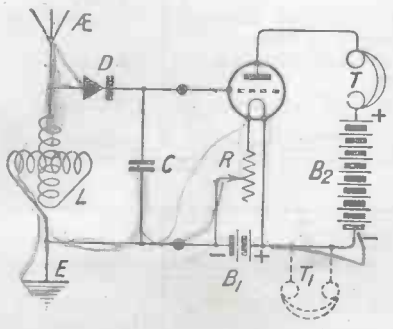


Fig. 5a.—Theoretical diagram showing a simple method of using a valve as a L-F amplifier.

Accordingly it is profitable to employ a valve in this manner only when signals (speech, music or Morse) are distinctly audible in the telephones connected direct to the detector (*i.e.*, connected across the condenser C in Fig. 5a).

Obtaining Greater Variation of Grid Potential

With the arrangement of apparatus illustrated in Figs. 5a and 5b, the variations in potential between the grid and filament of the valve cannot exceed that between the ends of the variometer L. If C is of fairly large capacity the variation of grid potential may be considerably reduced, as the energy available has to charge this condenser. The effect upon signals of reducing the value of this condenser or of removing it from the circuit entirely should be tried.

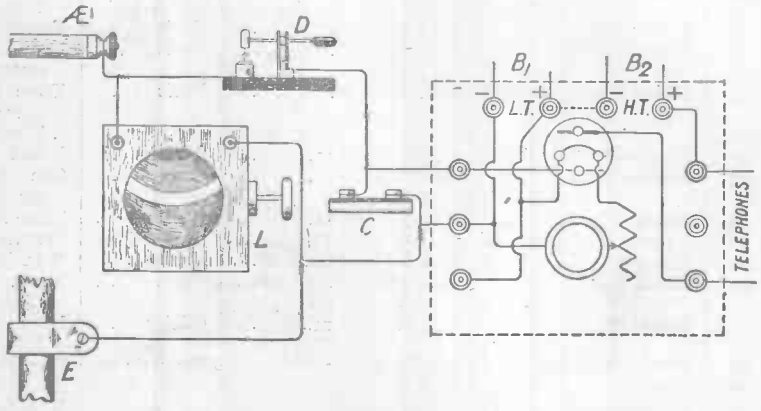


Fig. 5b.—A pictorial representation of the circuit of Fig. 5a.

With the modern type of open grid bright-emitter valve, with an applied anode voltage of from 45 to 60 volts, the initial grid potential obtained by connecting the lower end of the variometer L to the negative side of the battery B1 (*below* the rheostat R) is usually such as to maintain a steady value of anode current at a point approximately halfway up the steep part of the anode current characteristic curve.

Under this condition, the change in value of anode current will be greatest for any given variation of grid potential. The connection to the valve filament from the lower side of condenser C should be changed over to the other terminal (filament *positive*), and the effect noted.

Similarly, the filament brilliancy and the anode voltage should be varied, and the alternative position of the telephones, as indicated by dotted lines at T1, should be tried during the actual reception of signals, with a view to observing the effect produced and of determining how economically satisfactory results may be obtained.

(*To be continued.*)

Next week further arrangements for low-frequency and high-frequency amplification will be dealt with.

The Chelmsford High-Power Broadcasting Station

THE British Broadcasting Company announce that their High-powered Station at Chelmsford will open for experimental work to-day, July 9. The hours of transmission provisionally fixed are 11.30 a.m. to 12.30 p.m., 4 to 5 p.m., and 7.30 to 8.30 p.m. The morning and afternoon programmes will be mostly speech, but it is hoped that some music will be played during the evening programmes. The wavelength will be 1,600 metres. The power will be announced later; it will not be less than 15 kilowatts. The call sign is 5 XX. Listeners are invited to listen for this station and write to the British Broadcasting Company, 2, Savoy Hill, giving details of their results. It is requested that reports should be concise, and the real interest lies in the extent of the crystal range.

Daily Transmissions from leading Continental Stations.

(Telephony, except when otherwise stated.)

WEEK DAYS.

British Summer Time.	Name of Station.	Call Sign and Wave Length.	Locality where situated.	Nature of Transmission.	Closing down time or approx. duration of Transmission.
a.m.					
7.40	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Weather Forecast	5 minutes.
10.23	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Time Signal in G.M.T. (Spark) ...	3 minutes.
11.00	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Time Signal in Greenwich Siderial Time (Spark).	5 minutes.
11.44	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Time Signal in G.M.T. (Spark) ...	3 minutes.
11.55	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Fish Market quotations (Mondays excepted).	5 minutes.
11.14	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Time Signal in French Summer Time (Spoken), followed by Weather Forecast.	5 minutes.
p.m.					
12.30	Radio–Paris ...	S.F.R. 1780 m. ...	Clichy ...	Items of News	15 minutes.
12.45	Radio–Paris ...	S.F.R. 1780 m. ...	Clichy ...	Concert (Light Orchestra) followed by Exchange Opening Prices.	1.45 p.m.
12.57	Nauen	P.O.Z. 2800 m. ...	Berlin ...	Time Signal in G.M.T. (Spark) ...	3 minutes.
1.15	Geneva	H.B.1. 1100 m. ...	Switzerland	Weather Forecast	5 minutes.
2.00	Haeren	B.A.V. 1100 m. ...	Brussels	Weather Forecast	5 minutes.
3.40	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Stock Exchange Intelligence (Saturdays excepted).	8 minutes.
4.30	Radio–Paris ...	S.F.R. 1780 m. ...	Clichy ...	News, followed by Concert and late News	Until 5.45 p.m.
5.00	Radio–Belgique ...	S.B.R. 262 m. ...	Brussels ...	Concert	6. p.m.
5.00	Geneva	H.B.1. 1100 m. ...	Switzerland	Lecture	One hour.
5.50	Haeren	B.A.V. 1100 m. ...	Brussels	Weather Forecast	5 minutes.
6.15	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Concert, followed by News Bulletin	One hour.
8.00	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	General Weather Forecast ...	8 minutes.
8.00	Radio–Belgique ...	S.B.R. 262 m. ...	Brussels	Concert followed by News Bulletin	Till 10.10 p.m.
8.15	Ecole Sup. des Postes et Telegraphes.	P.T.T. 450 m. ...	Paris ...	Lecture, followed by Concert. (Usually Outside Broadcast, sometimes begins at 8 or 8.30).	Two to three hours.
8.30	Radio–Paris ...	S.F.R. 1780 m. ...	Clichy ...	General News Bulletin	One half hour.
9.00	Radio–Paris ...	S.F.R. 1780 m. ...	Clichy ...	Time Signal in French Summer Time, followed by Concert.	9.50 p.m.
11.00	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Time Signal in Greenwich Siderial Time (Spark).	5 minutes.
11.44	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Time Signal in G.M.T. (Spark) ...	3 minutes.
a.m.					
12.57	Nauen	P.O.Z. 2800 m. ...	Berlin ...	Time Signal in G.M.T. (Spark) ...	3 minutes.

SUNDAYS.

a.m.					
10.23	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Time Signal in G.M.T. (Spark) ...	3 minutes.
11.00	Eiffel Tower	F.L. 2600 m. ...	Paris ...	Time Signal in Greenwich Siderial Time (Spark).	5 minutes.
11.44	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Time Signal in G.M.T. (Spark) ...	3 minutes.
11.50	Konigswusterhauzen	L.P. 2800 m. ...	Berlin ...	Concert	Until 12.45 p.m.
11.55	Eiffel Tower	F.L. 2600 m. ...	Paris ...	Fish Market quotations	5 minutes.
12.45	Radio–Paris ...	S.F.R. 1780 m.	Clichy ...	Concert	1.45 p.m.
12.57	Nauen	P.O.Z. 2800 m. ...	Berlin ...	Time Signal in G.M.T. (Spark) ...	3 minutes.
2.40	Ned. Radio Industrie	P.C.G.G. 1050 m. ...	The Hague	Concert	Until 5.40 p.m.
4.45	Radio–Paris ...	S.F.R. 1780 m. ...	Clichy ...	Concert, followed by News ...	5.45 p.m.
5.00	Radio–Belgique ...	S.B.R. 262 m. ...	Brussels ...	Concert	6 p.m.
6.15	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Concert, followed by News Bulletin	One hour.
8.00	Eiffel Tower	F.L. 2600 m. ...	Paris ...	General Weather Forecast ...	8 minutes.
8.00	Radio–Belgique ...	S.B.R. 262 m. ...	Brussels ...	Concert, followed by News Bulletin	Until 10 p.m
8.10	Ned. Seintoestellen Fabr.	N.S.F. 1050 m. ...	Hilversum	Concert	Until 10.10 p.m.
8.30	Radio–Paris ...	S.F.R. 1780 m. ...	Clichy ...	General News Bulletin	Until 9 p.m.
8.30	Ecole Sup. des Postes et Telegraphes.	P.T.T. 450 m. ...	Paris ...	Concert or Lecture	Ends between 10.30 and 12 p.m.
9.00	Radio–Paris ...	S.F.R. 1780 m. ...	Clichy ...	Concert, followed from 10 p.m. until 10.45 p.m. by a dance lesson.	Until 10.45 p.m.
9.00	Eiffel Tower ...	F.L. 2600 m. ...	Paris ...	Concert	Two hours.
9.30	Petit Parisien ...	—— 340 m.	Paris ...	Concert (Items announced in English as well as French).	Until midnight.

SPECIAL DAYS.

British Summer Time.	Name of Station.	Call Sign and Wave Length.	Locality where Situated.	Day of Week.	Nature of Transmission.	Duration of Transmission.
p.m.						
3.00	Ecole Sup. des Postes et Telegr.	P.T.T. 450 m. ...	Paris ...	Fridays	Concert or Lecture	Two hours.
7.40	Heussen Laboratory.	P.C.U.U. 1050 m.	The Hague	Tuesdays	Concert	Until 9.40 p.m.
7.40	Smith and Hooghoudt.	P.A.5. 1050 m. ...	Amsterdam	Wednesdays	Concert	Until 9.40 p.m.
8.10	Ned. Radio Industrie.	P.C.G.G. 1050 m.	The Hague	Mondays	Concert	Until 10.10 p.m.
8.10	Ned. Vereenigen van Radio Telegraphie	P.C.G.G. 1050 m.	The Hague	Thursdays	Concert	Until 10.10 p.m.
8.10	Middleraad ...	P.C.M.M. 1050 m.	Ymuiden...	Saturdays	Concert	Until 9.40 p.m.
8.40	Ned. Seinteestellen Fabriek	N.S.F. 1050 m.	Hilversum	Fridays	Concert	Until 9.40 p.m.
9.00	Eiffel Tower	F.L. 2600 m. ...	Paris ...	Wednesdays	Concert	Until 10.55 p.m.
9.30	Petit Parisien ...	—— 340 m. ...	Paris ...	Thursdays	Concert (Items announced in English as well as French).	Midnight.
10.00	Radio-Paris ...	S.F.R. 1780 m.	Clichy	Mondays Thursdays & Fridays	Dancing Music ...	Until 10.45 p.m.
*10.15	Le Matin ...	S.F.R. 1780 m.	Paris ...	Every 2nd and 4th Saturday of the month.	Special Gala Concert with leading Parisien artists.	Till 11.30 p.m.

* This transmission will take place at 9 p.m. instead of 10.15 p.m. on Saturday, July 12.

Summer Hints.

Keep your earth moist. If you let the ground in which your earth-plate is buried become parched signal strength will show a great falling off, and where a valve receiving set is used the tendency to self oscillation will become more and more marked. A bucket of water poured over the soil once or twice a week will work wonders in hot weather.

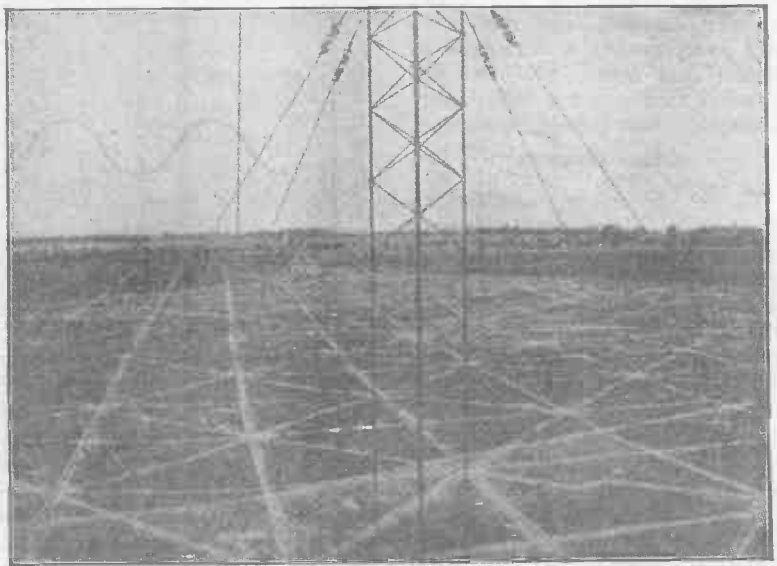
See that the acid solution in your accumulators does not fall below the tops of the plates. If this is allowed to happen the battery may be badly damaged in quite a short time. Should evaporation lower the level of the electrolyte make up the deficiency by adding plain distilled water with no acid mixed with it.

Keep your set covered up. In hot, dry weather the air is full of fine dust which is deposited everywhere. Dust is one of the worst enemies of the wireless man, for it not only collects upon his panels and reduces their insulating qualities, but it also gets between the plates of variable condensers and into the bearings of these instruments and of variometers where it causes undue wear. The best kind of cover can be made from American cloth, which is both damp proof and waterproof.

Do not leave ebonite panels exposed to strong sunlight. The heat may cause them to warp, and the light gives them a hideous greenish colour instead of their proper black. Panels that have gone green can usually be restored to their proper colour by rubbing them down with fine emery cloth and then dressing with turpentine.

□ □ □

Lastly, keep your aerial earthed when the set is not in use. In sultry weather very high potentials may be induced in the aerial, and if the lead in is connected to the set there is a considerable risk of damaging its components. Only the other day a friend of the writer's had his wireless apparatus injured by working his set when atmospherics were very strong, though there was no actual thunder about. R. W. H.



The importance of earth connections is being more and more realised in the erection of high power stations. Our photograph shows the trenches of the elaborate earth arrangements at Konigswousterhausen.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

Parasitic Oscillation

A TROUBLE which not infrequently occurs in a wireless receiver, and which is sometimes difficult to trace, is caused through parasitic oscillations being set up. These oscillations frequently have something to do with distorted reception of wireless signals. Sometimes the oscillation is of very high frequency, and sometimes of a frequency which, while not audible, is near the audible limit. Both sets of oscillation cause trouble in wireless reception, and reduce the amplification obtainable and cause distortion.

Reflex Circuits

In reflex circuits the trouble is sometimes due to the transformers forming oscillation circuits having a natural frequency just above the audible limit. If the oscillations were audible, of course, the trouble would be immediately recognised, but sometimes the oscillations are above the audible limit, and really the only symptom is a fuzziness of speech and music and the impression that not the full degree of amplification is being obtained.

Other Circuits

These parasitic oscillations occur in all kinds of circuits; they sometimes occur in power amplifiers where the high-frequency oscillations set up are formed in an oscillation circuit which consists of incidental capacities and the leads going to the transformer windings. This trouble was explained in an early issue of *Wireless Weekly,* but similar effects are obtained in other circuits.

Fig. 1 shows a common valve oscillator circuit used for transmission, yet, simple as it is, parasitic oscillations sometimes occur, and have a frequency which is largely governed by the capacity between grid and anode of the valve. The normal frequency at which the Fig. 1 circuit oscillates depends almost entirely upon the constants of the

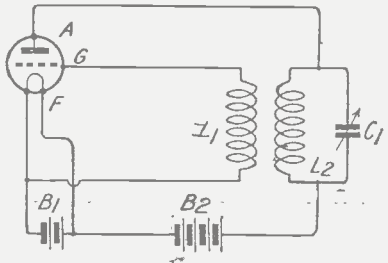


Fig. 1.—A common valve oscillator circuit used for transmission.

circuit L2 C1, but the parasitic oscillations depend for their frequency upon the value of L1, the capacity between G and A, and the value of the inductance L2. The oscillation circuit, therefore, is independent of the condenser C1, and the frequency of these

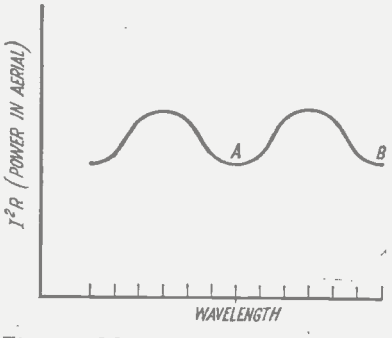


Fig. 2.—Illustrating the power output of a valve transmitter using the Fig. 1 circuit.

parasitic oscillations is consequently very high. They may occur at the same time as the main high-frequency oscillations, and when this happens the power output of the transmitter, or oscillator, drops very appreciably, but will rise again if the wavelength of L2 C1 is adjusted differently or the relation of inductance to capacity is varied.

Experimental Indications

Experiments have indicated that when the parasitic oscillation circuit, consisting of the inductance L1, the grid to anode capacity and the inductance L2, bears a certain fixed proportion to the frequency of the oscillations in L2 C1, parasitic oscillations will be set up and will reduce the power output of the oscillator.

Effect of Parasitic Oscillations

Fig. 2 is a curve showing the power output of a valve transmitter using a circuit of the kind illustrated in Fig. 1. It will be noticed at the points A and B the power output in the aerial circuit falls, and this is due to the establishment of parasitic oscillations under certain special conditions. The prevention of these oscillations on a given wavelength for the circuit L2 C1 is accomplished by proportioning L2 and C1, so that the wavelength of the circuit L2 C1 is not a multiple of the wavelength of the parasitic circuit.

Means of Prevention

The inductance L1 may be varied, or what is most convenient of all, a small variable condenser may be connected across the grid and anode of the valve, this condenser serving to tune the parasitic circuit so as to avoid the establishment of a dangerous numerical relation of the frequency of this circuit to the main oscillation circuit.

I have not heard of this kind of effect being found in a receiver, but when using valves giving high amplification it is quite possible that the effect will sometimes occur.

Some Terminal Tips

THE experimenter who does not use a boxed-in set, but prefers to employ separate components laid out upon a board, will find that some of his terminals are called upon to do a good deal of work, since they have to serve as connections for several leads. With ordinary terminals provided with only one milled nut it is not at all an easy business to connect two or three wires so that they all are making thoroughly good contact. One good method is to add another milled nut, as shown in Fig. 1, which enables two connections to be made quite easily. If a round nut is not available an ordinary large 4 B.A. nut will do quite well. Flex leads are probably the most satisfactory to use where connections are frequently changed, and quite a number of these can be attached to one terminal with perfect security if the method adopted in Fig. 1 is used. Do not try to connect each lead separately, but twist all their ends together before attaching them to the terminal. They need

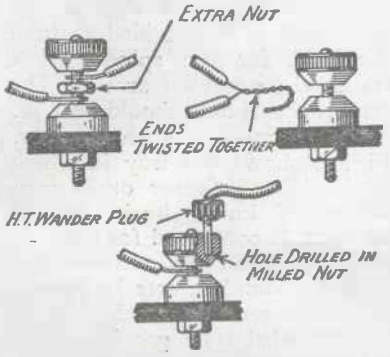


Fig. 1.—Some suggested methods of making several connections to one terminal.

not be tightly twisted; in fact, they should not be, for if they are they will probably be damaged when they are taken apart again.

A very simple way of making quick connections is shown in Fig. 1. An ordinary high-tension wander plug is used, such as can be bought very cheaply from advertisers. In the top nut of the terminal a hole is drilled to receive it. These wander plugs vary a little in size, but a No. 31 drill will usually make a hole that is a good fit for them. It is advisable to use a fairly large top nut for terminals which are treated in this way, so as to give plenty of room for making the hole. This method is particularly useful for gridleak terminals, since it enables the leak to be thrown in or out of action or to be wired in parallel or direct to low-tension positive in a moment.

When wiring is done with either square tinned rod or bare

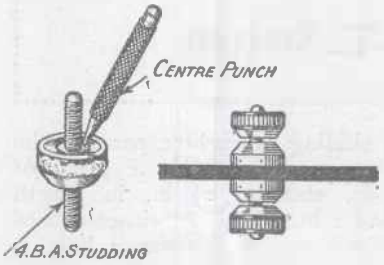


Fig. 2. Double-ended terminals.

wire of stout gauge it is convenient sometimes to have either high or low tension busbars at some height above the surface of the panel. If one uses ordinary terminals and simply takes a piece of wire vertically from the busbar to the shank of each, the busbar may be found to be rather wobbly, owing to the springiness of the wire connections. A better tip is to use terminals with very long shanks which can be made up in the home workshop. Remove the top nut from an ordinary short terminal and, if possible, get the lower nut also off the shank. This can be done sometimes, but it is usually rather a difficult business, for they are pretty firmly fixed. If the nut will not come off cut the shank short off on either side of it and drill and tap a 4 B.A. hole. Then insert a piece of 4 B.A. studding of the required length and screw through until sufficient protrudes to take the top nut. Now place the lower nut in a vice and make two or three centre punch marks, as shown in Fig. 2, just where the studding enters. These will make the lower nut absolutely secure, so that it will not work loose when the terminal has been in use. These long-shanked terminals are best inserted into tapped holes in the panel, a nut being put on on the underside of the ebonite to lock them firmly. When they are used the busbars are as rigid as can be desired.

A rather good tip for the boxed-in set is to use double terminals, as shown in Fig. 2, which enable connections on either side of the panel to be changed very quickly. With the ordinary set variations in the circuits cannot be tried without unsoldering and soldering up the connections, many of which are most difficult to get at without pulling the whole thing to pieces; but if these double terminals are used in places where changes are likely to be made, then one can try the effect of all kinds of alterations with no trouble at all. They are made in the same way as the long-shanked terminals, with top and bottom nuts and lengths of 4 B.A. studding. Only the bottom nut above the panel should be fixed to the studding by centre punching it. The terminal is then inserted into the tapped hole and the nut on the underside of the panel secures it firmly.

Another very useful device where several contacts have to be made at the same point is the multiple terminal, an example of which is shown in Fig. 3. In this way any number of connections can be made quite securely and with the least possible trouble.

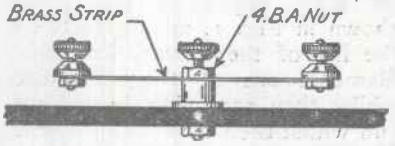


Fig. 3.—The multi-terminal.

For a triple terminal, such as that shown, a strip of sheet brass 2 in. in length and ½ in. wide is cut out, and three equally spaced 4 B.A. clearance holes are made in it. Two small terminals are then fixed tightly into the holes at either end, and the shank of any terminal to which it is desired to make a number of connections is passed through the middle hole, the strip being secured to it by means of a 4 B.A. nut. Terminals, such as these, are very useful for telephone connections, since with them as many pairs of 'phones as may be desired can be used at once.

When the multiple terminal is used for telephones the various pairs will, of course, be in parallel. To enable them to be placed in series the gadget shown

in Fig. 4 will be found most satisfactory. It consists of a strip of ebonite 1¼ in. wide, to which are fitted a pair of brass lugs spaced the same distance apart as the telephone terminals on the set. The length of the ebonite strip will depend upon the number of 'phones which it is desired to use. On it are mounted the required number of pairs of terminals spaced about an inch apart. The lugs are then connected by wires which are best placed on the lower side of the ebonite to the end terminals, and connections are made between each pair, as shown. The device shown in the drawing will take four pairs of telephones, though it can be used for one, two or three by simply short-circuiting the terminals that are not in use.

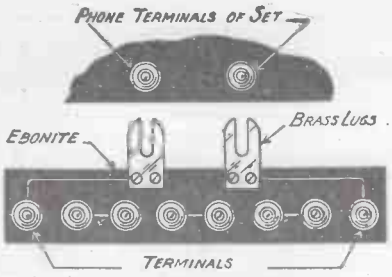


Fig. 4.—A Telephone adaptor for several pairs of phones.

R. W. H.

□ □ □

A Gradual L.T. Switch

REFERENCE was made in a previous note to a method whereby a master rheostat was used in order to obtain a gradual switching-on of low-tension current. The rheostat there described had a resistance of about 2 ohms, and a good many readers have found difficulty in obtaining one of this value with a sufficient current carrying capacity to allow it to be used in a set containing three or more valves. There can be no doubt that the effect of a switching appliance wired, as shown in Fig. 1, adds greatly to the life of the valves, for their filaments are at their weakest whilst they are being heated up and whilst they are cooling down. If they are brought suddenly under full load, or if current is suddenly cut down to zero, a heavy strain is thrown upon the fine metal and the career of the

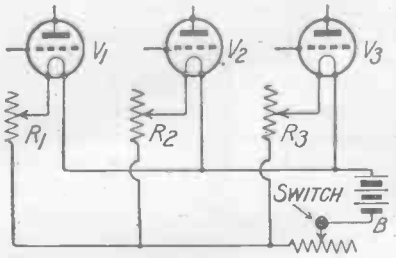


Fig. 1.—Showing the position of the L.T. switch.

valve is undoubtedly shortened by such treatment.

A very suitable "gradual switch" is quite easy to make, and the total cost of that to be described will not be more than a shilling or eighteenpence. The first requirement is a piece of ¼-in. ebonite, 2½ in. in length and 1 in. wide. At either end of this a 4 B.A. clearance hole is drilled to take the screws which will later fix the former to the underside of the panel. Close to

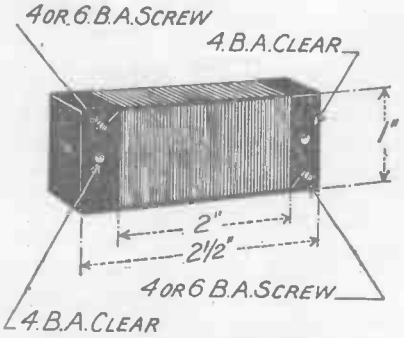


Fig. 2.—Details of the former.

these holes other 4 or 6 B.A. holes are drilled and tapped for a pair of screws which will be used to secure the ends of the windings. The former is wound for a length of 2 in. with No. 26 s.w.g. enamelled Eureka wire which has a steady current carrying capacity of three amperes. This will be amply sufficient, even for a five-valve set, since in the brief time which elapses during the turning of the switch from the off to the on position, or vice-versa, the wire will not heat up unduly, even if this load is exceeded. With a quintet of bright emitter valves the total current passed will seldom exceed 4 amperes, which will not be too much for the wire. The wire should be put on as tightly as possible with the turns lying close together. As this wire makes 26 turns to the inch if closely wound, a 2-in. length of winding will probably contain about 50 turns, which will give

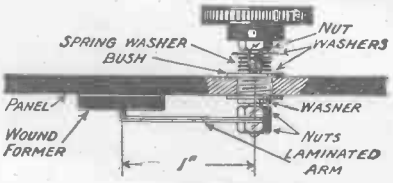


Fig. 3.—The switch.

a total resistance of nearly [illegible] ohms.

When wound, the former is mounted on the underside of the panel, as shown in Fig. 3. A ⅜-in. hole is then drilled to take the bush for the spindle of a standard selector arm. The centre of this hole should be 1 in. from the middle of the former. Fig. 3 shows the way in which an ordinary selector outfit consisting of knob, bush, spindle and arm is converted for use. By the way, when you purchase one of these complete sets be careful always to see that the bush is of the threaded type provided with a large round nut. Plain bushes are not suitable, as a rule, for the work. Move the arm across the windings two or three times until it has scratched a curved path on the enamel covering, then take a piece of sandpaper and clear off the enamel round this curve. A pair of stop pins should be inserted into the former, so arranged that the arm is quite clear of the windings in the off position whilst it rests upon the last turns in the on position. The switch is now complete and may be brought into use at once.

R. W. H.

The D-Coil Receiver

A NEW METHOD OF HIGH-FREQUENCY RECEPTION.

The circuit and particulars given below will provide the experimenter with a very fascinating new line of work.

ALMOST interesting new method of coupling stages of high-frequency amplification has recently been put forward by Mr. J. M. MacIlvain in our American contemporary, the *Wireless Age*. The main difficulty in the case of high-frequency amplifiers containing several stages is to prevent interaction between the stages, and the self-oscillation thus produced. There are several methods of reducing the effect of this interaction, perhaps the most common of which is the use of a potentiometer, the losses introduced by this piece of apparatus more than equalling the feedback between stages. However, the introduction of losses into an amplifier must obviously reduce its efficiency, and many attempts have been made by various inventors to reduce the interaction without the loss of efficiency in the method just described.

The Neutrodyne.

One of the most interesting and one which has been fully dealt with in our pages some time ago, is the "Hazeltine Neutrodyne" method. In this, special balancing arrangements are used, and when the receiver is carefully constructed excellent results may be obtained. However, the obtaining of this balance and the general adjustment of the receiver have often given difficulty, and it cannot be said to be the ideal method for the inexperienced constructor.

The D-Coil Circuit.

The circuit used by Mr. MacIlvain, in what he calls the "D-Coil Receiver," would certainly appear to be novel, and whilst we have not yet tested it ourselves, we think it should be of sufficient interest to our readers to warrant publication. The examination of the circuit diagram in Fig. 1 shows that the aerial (which is untuned) is coupled by a high-frequency transformer to the grid circuit of the first valve; this valve in turn is coupled to the next by a high-frequency transformer, the second valve passing on its energy by a third transformer to the detector valve. Stages of note magnification can, of course, be added if desired. The secondaries of the transformers are tuned, the primaries being untuned. The whole essence of the method is in the special high-frequency transformers used. An examination of the diagrams will show that both primaries and secondaries of the transformers are in two halves, the windings in the two halves being equal and opposite. It will thus be seen that the fields oppose one another, and in this way it is claimed that there is practically no external field of the transformers to cause the feedback. No mention, however, is made of the effect of the capacity coupling in the valve as a source of feeding-back energy; indeed, in our opinion, this is one of the most important causes of self-oscillation. However, the results claimed by Mr. MacIlvain are certainly good, and the transformers, which are made as illustrated in Fig. 2, are quite simple to construct. Here are the practical details:

Transformer Details.

Three tubes are taken, 3 in. long and 3 in. in diameter. A $\frac{1}{4}$-in. slot is cut down the side of each tube, starting at one end, and terminating about $\frac{3}{4}$ in. from the other. A second slot is cut on the other side of each tube, diametrically opposite, as shown in the illustration. The purpose of leaving the final $\frac{3}{4}$ in. is merely

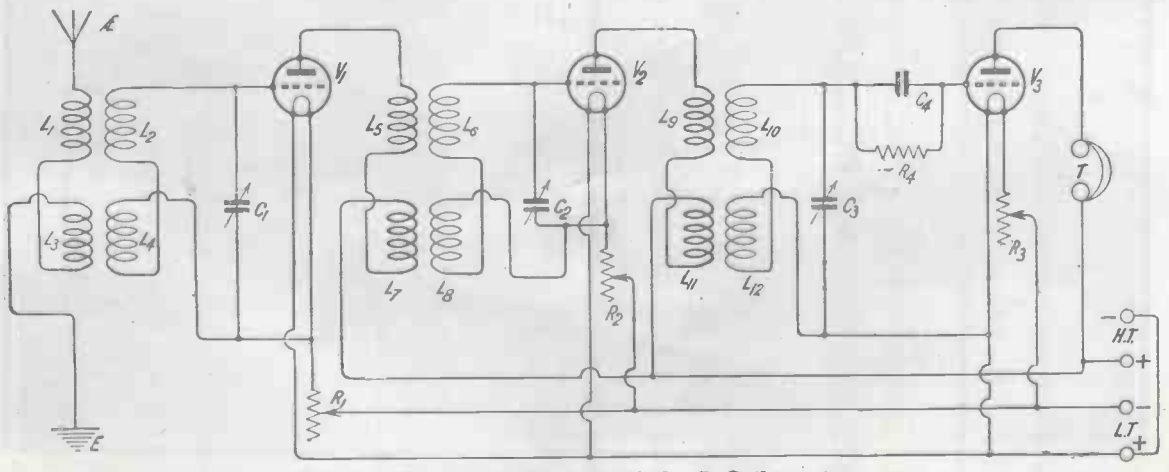
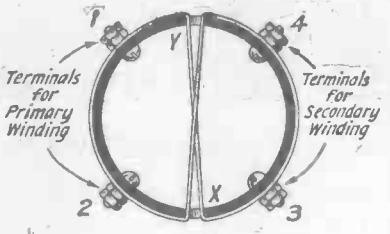


Fig. 1.—The circuit diagram of the D-Coil receiver.

to hold the two sides of the tube together. Four terminals are fitted as shown, and the winding is commenced as follows:

Take about 15 ft. of No. 24 double cotton-covered wire from the reel, and attach one end of this to the terminal marked No. 2. Connect the end of the wire still remaining on the reel to No. 3, start with the wire attached to terminal No. 2, and wind on counter clock-wise until you come to the slot X; pass the wire through the slot, and through the slot on the other side marked Y, continuing in clock-wise direction past terminal 4, and when you come to terminal 3 pick up the beginning of the secondary winding and wind it in parallel with the primary winding, both wires side by side, and continue the double winding until you come to slot X; pass the wire through this and out of the other side, proceeding with the winding in the counter clock-wise direction on this side and through the slots as before. Wind on 10 turns in this way, and then



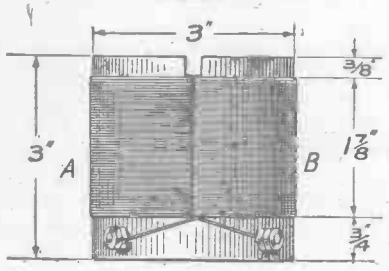


Fig 2.

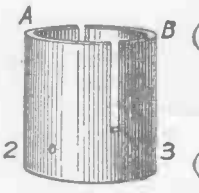


Fig 3.

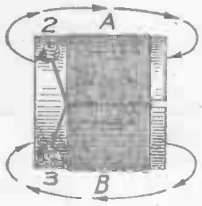


Fig 4.

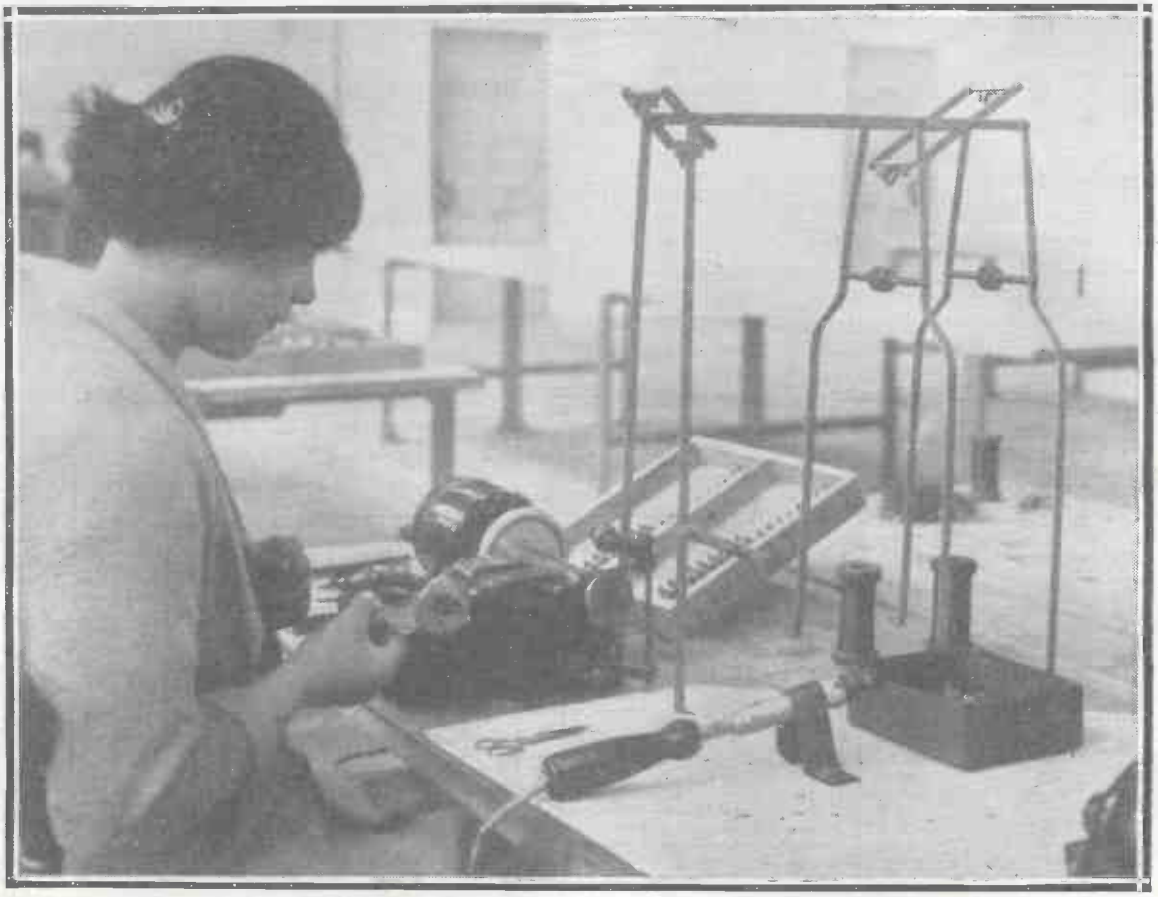
Details of transformers.

connect up the end of the 10th turn with terminal No. 1. Continue the secondary winding until 40 turns have been wound on, and connect the end of this winding to terminal No. 4. Make two more of these transformers, and you have finished the transformer part of the receiver.

Mr. MacIlvain has found that there is no appreciable coupling between the transformers when they are stood upright and separated from one another by a distance slightly more than that of the width of a valve socket with valve.

The Coil Field.

Examination of Fig. 4 shows how the fields are disposed around the two halves of the coil. It will be seen that the fields neutralise one another. Exactly the effect of the opposed fields on the coil itself, its coupling and its inductance is not explained in the article in question. We shall be pleased to hear from any readers who obtain good results from this arrangement.



An interesting operation. Winding the fine enamelled wire on to the magnets of telephone ear-pieces at the Brandes factory. A high-speed motor is used and the tension is carefully controlled by the operative.

An Important New Organisation

The Radio Press Service Dept., Ltd., and its Work.

WE have long thought that our service for the home constructor, complete as it undoubtedly is, still lacks in the final stages that which we wished to supply. In Blue Prints, Constructional Articles, Radio Press Envelopes, etc., etc., we guide the steps of the set builder in a way which is unrivalled by any other organisation, yet we have thought that something more was needed. It is therefore with great pleasure that we are now able to announce that a new organisation has been formed to carry forward the work of the various branches of the Radio Press, starting from the point where the various written descriptions and instructions supplied to the constructor leave off. The new organisation is a separate company, to be known as "Radio Press Service Dept., Ltd.," with Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., as managing director, and will concern itself chiefly with the period between the completion of any given set and the moment when the constructor feels that the set is giving satisfactory service.

The new organisation will be so equipped and constituted that it can render practically any service which the constructor may need during that period, and it will be found that its scope is so comprehensive that we are in a position positively to guarantee that if anyone chooses to make up a set from one of the Radio Press descriptions, with due heed to the necessity for following such descriptions exactly, he will, with any necessary aid from the Service Dept., finally possess a set giving results equal to those of the original. In the majority of cases, of course, no aid is needed once the set has been finished, but we are considering now the small minority where something goes wrong.

Special Staff

A special staff has been engaged, and new offices have been opened in Grecian Chambers, Devereux Court, Strand, W.C.2 (opposite the Law Courts). An important part of the new organisation is a properly equipped test department, where constructors may bring faulty sets for examination and test, a full detailed report being furnished in each case. It is not intended that the Service Dept. shall be a profit-yielding concern, but may be regarded rather, as its name implies, as an organisation for the *service* of our readers. Charges have therefore been fixed for the various tests, which our readers will find purely nominal, since they are merely intended to cover expenses. Those who desire to avail themselves of the set-testing service are invited to apply for particulars, when they will be informed of the necessary fee in their particular case. This fee covers a thorough examination and test of the set and all its components, and the furnishing of a detailed report upon its condition, any faults being, of course, pointed out.

Alterations to Sets

It is expected that the usual form of procedure will be to leave the owner of the set to make the necessary alterations to the receiver, and if in any case it is found that making the alterations which we suggest does not remove the fault, a further test will, of course, be carried out free of charge. In special cases where readers desire us to make the necessary alterations, we shall be able to do so, an estimate being given in such cases.

Carriage Arrangements

The Service Dept. will be mainly to the benefit of the London area, at any rate at first, and it is therefore expected that owners of sets will be able to bring them to its offices (up to 8 p.m.) themselves, but in cases where they have to be sent by post or otherwise, a warning must be issued as to the desirability of registering or otherwise insuring the parcel. The Service Dept. will, of course, take similar precautions in returning the receiver, but it cannot take any responsibility for loss or damage incurred in transit or while in its hands, although every possible care will be taken.

Special Cases

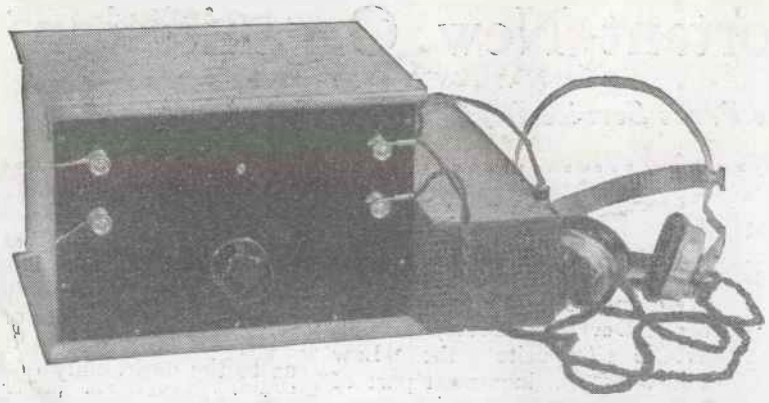
In special cases a qualified member of the Test Dept. staff can be sent to the reader's address, so long as this is within the London area, and tests or any other investigation carried out upon the spot. A special fee will, of course, be necessary in such cases, in addition to travelling expenses.

Postal Queries

The old Postal Queries Dept. of Radio Press, known as the Information Dept., is being merged in the new organisation, and will carry on its work as before. The old regulations concerning postal queries are therefore still in force, and readers will remember that a fee of 2s. 6d. is charged for a reply to a query, a stamped addressed envelope being required from the reader in each case.

Exhibition of Sets

Finally, it will be noted that part of the premises of the Service Dept. are allotted to the exhibition for a limited period of the various *Modern Wireless*, *Wireless Weekly*, and *Radio Press Envelope* Receivers, and these may be inspected by anyone interested. Readers taking advantage of this offer, however, are requested not to interrupt the work of the testing staff going on in the same room, and to limit their visit to an inspection only.



Simplicity is the keynote of this instrument. The L.T. battery and valve are enclosed.

A Single Valve Dull E

By PERCY W. HARR

A useful addition

MANY crystal users are anxious to attach valve amplifiers to their sets, but fear that complicated apparatus will be necessary, and that its cost and the cost of the accumulator to run the valve will put the idea out of court. The advent of the latest dull-emitters which can satisfactorily be run from dry cells has removed the necessity of the accumulator, and for that reason has considerably reduced the cost of an amplifier attachment. Indeed, it is surprising how compact and simple a valve amplifier may be when built up along the lines about to be described.

I have just finished a single valve amplifier for attachment to

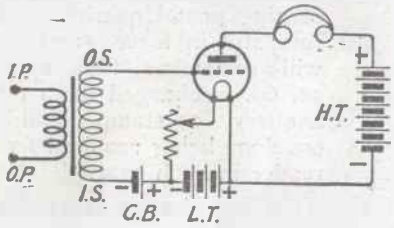


Fig. 1.—The simple circuit.

a crystal set, which I think will prove attractive to some readers. As will be seen from the photographs, the apparatus (including the valve) is enclosed in a neat polished mahogany cabinet, with but four terminals on the panel and a single knob to control the filament resistance. A pair of flexible leads terminating in plugs are taken from the side of the cabinet so that the H.T. voltage required may be conveniently applied, but otherwise everything is contained within the box, well protected from dust and damage.

Simplicity of construction and operation have both been aimed at in the design, which has several novel features. The circuit which is given in Fig. 1 is quite conventional, and any good make of intervalve transformer can be used. This is not intended to be an experimental amplifier. It is made up for use with an .06 ampere valve (D.E.3, B.5, A.R. .06, or Mullard .06 valve) with a plate voltage of 60 to 80 and a grid bias of about 3 volts. This latter is obtained by a voltage drop of about 1½ volts in the filament resistance (due to the fact that a 4½ volt battery is used through a resistance which cuts the voltage down to 3, a volt plus 1½ volts obtainable from a single dry cell. As will be seen from the characteristic curve reproproduced herewith (the actual curve is that of a D.E.3 valve, the curve being issued by the makers and confirmed by myself) a grid bias of minus 3 volts brings the working point on to a suitable portion of the characteristic curve. The set will work just as well with a bright-emitter, but, of course, this latter would require an accumulator, which would mean that leads must be taken out of the box for the L.T. supply. Although primarily designed for use with a crystal set, it can be applied to an existing valve receiver.

Special Features of Design

A particular advantage of the present design is that although in appearance it is at least as handsome as most commercial amplifiers, there are remarkably few holes to drill in the panel. For example, the usual rather irritating job of drilling the panel accurately to take the valve pins is entirely dispensed with, as a special form of low capacity valve socket, requiring but a single screw for its attachment, is used. In fact, with the exception of the holes drilled to take wood screws for securing the

This picture shows the valve and

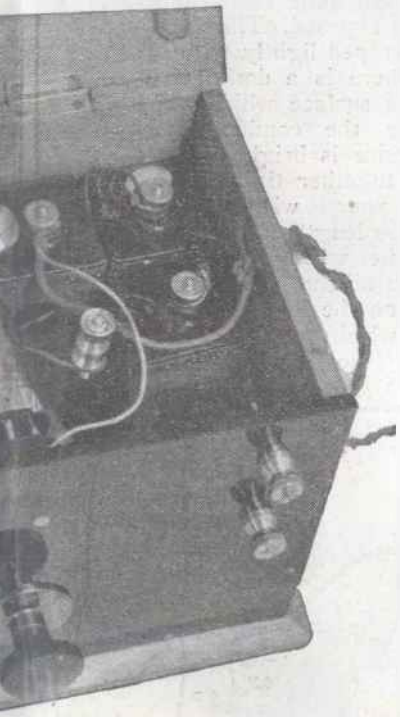
Amplifier for mitters

S, Assistant Editor.

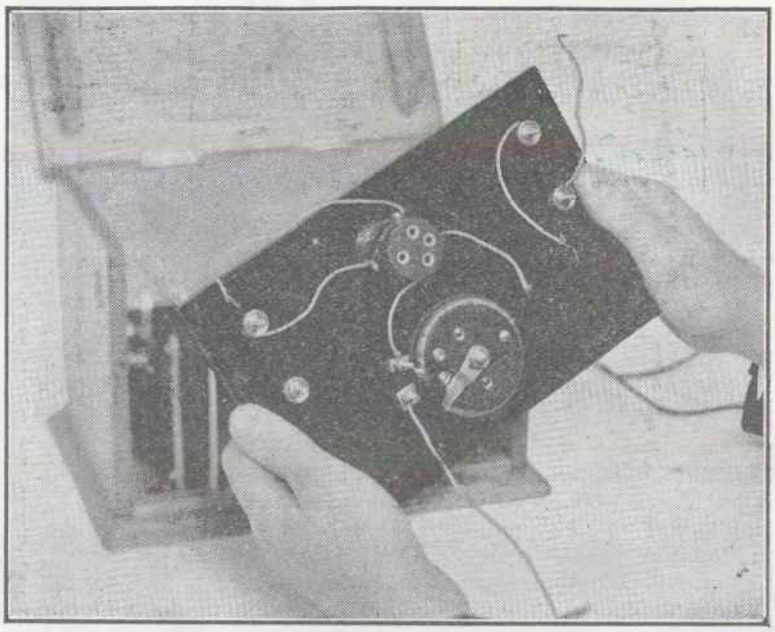
o a crystal set.

panel to the box, there are but eight holes in all, seven being drilled with a number No. 26 drill for 4 B.A. clearance, the eighth being a 3/8th hole to take the spindle of the filament resistance. If a "one-hole" mounted resistance is used, there would be only six in all.

Another feature is that not a single soldered connection is needed, a good sound contact being obtained in other ways. I am introducing in this receiver what may be termed the "double terminal" arrangement—a method which is not new, but so simple and practical that one wonders it has not been used before. The method is illustrated in Fig. 2, and consists simply of using an extra terminal top at the back of the panel after the terminal shank has been secured in place with a nut. Obviously if a grip connection is good enough on the front of the panel, it should be just as good on the back, and if everything is made tight there will be little loss of efficiency by adoption of the method. At present no doubt it will be necessary to buy two terminals in order to obtain the two tops, but if the demand is sufficient the terminal makers will no doubt supply each with two tops at a slightly increased cost.



filament lighting battery in place.



Wiring is carried out with ordinary flex and soldering is avoided by the use of screw connections.

An examination of the illustrations of the interior will show that a transformer is used with good strong terminal connections, while the dry batteries themselves have such terminals already fitted. The negative end of the L.T. battery is, however, a wire, and in order that connection may be sound here, this wire is attached to one end of a double terminal, the other being connected to the filament resistance and grid bias battery. The negative wire of this latter call is screwed under the I.S. terminal of the intervalve transformer, whilst connections to the valve socket are made by wires secured under the screws which project from the side. The particular form of valve socket used is made by the Goswell Engineering Co., whilst the transformer fitted is a Woodhall. The filament is a Burndept dual, which unlike most filament resistances is fitted with screws and nuts for making connections to both the moving arm and the end of the resistor. For filament lighting, Siemens square dry cells (type R.) are used, whilst for the grid bias a single cell (type S.) is needed. Any good intervalve transformer can be used in this set, and, of course, you are not limited to the particular filament resistance indicated. Any filament resistance suitable for dull-emitters can be used. It should have a resistance of about 30 ohms.

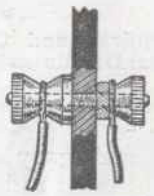


Fig. 2.—The double terminal method.

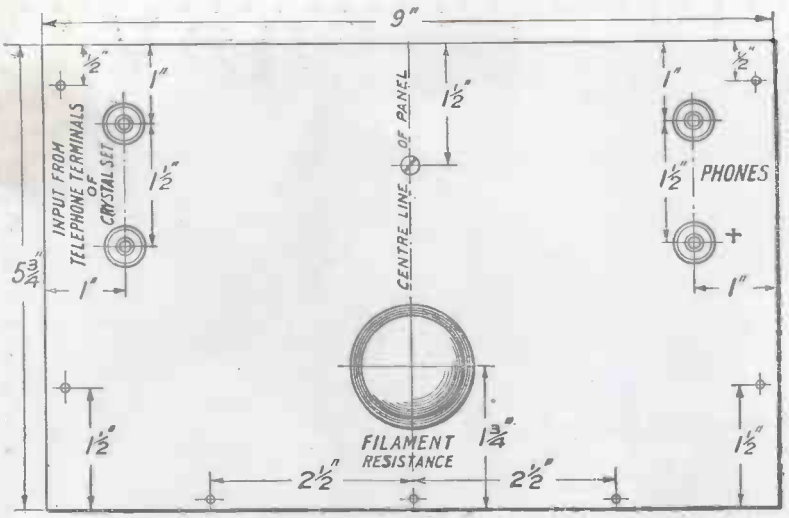


Fig. 3.—The front of panel arrangement.

If you look at the circuit diagram, you will see that the H.T. battery is connected on one side (the positive) to one of the telephone terminals, the other side being connected with the positive of the L.T. battery. We now drill two holes in the side of the cabinet and through these holes pass the flexible wires (ordinary electric light flex serve admirably here), on the other end of which are fixed two Clix terminals, one red and one black. These terminals are such a size that they make good plugs for the ordinary variable H.T. battery. Inside the box we connect the positive lead to the lower telephone terminal, and the negative lead is screwed underneath the positive terminal of the L.T. battery.

Components Required and Constructional Details

A complete list of components is as follows :—

One polished mahogany box with ebonite front panel and lift-up lid (that used is a standard Bowyer-Lowe box). (See dimensional drawing.)

One ebonite panel 9 x 5¾. If the ebonite is not guaranteed leakage free, remove the surface skin on both sides with fine emery.

One legless valve socket.

Five 4 B.A. terminals each with an extra milled head.

One intervalve transformer.

One dull-emitter resistance.

Three Siemens dry cells (R. type).

One Siemens dry cell (S. type).

One .06 valve.

One H.T. battery, 60 to 80 volts (a standard 66 volt unit will serve excellently).

A few yards of electric light flex.

Two Clix terminals, one red, one black.

Four 6 B.A. metal screws with nuts.

Six or 7 small wood screws for attaching panel to box.

The first step is to drill the holes for the terminals, securing screw of the valve socket, and the filament resistance respectively. The valve socket and filament resistance can then be mounted on the panel and the additional terminal tops should also be put in place. The next step is to stand the intervalve transformer in its position on the bottom of the box and, with a pencil, mark the position of the holes which are to take the screws to hold the intervalve transformer in place. Remove the transformer, drill four clearance holes through the wood of the bottom of the box to take the 6 B.A. metal screws, and then make small recesses on the underside of the box to take the heads of these screws, which are pushed through from the underside so that their shanks project through the floor of the box. Now stand the intervalve transformer over these screws and run four nuts over the shanks and tighten. This is a much more satisfactory method of holding the intervalve transformer than that of turning wood screws from the top, as it is most difficult to get the screw-driver where you want it.

Wiring up is carried out with ordinary electric lighting flex. Take a suitable length and unwind it so as to get two single strands, slide off the cotton or silk covering from the rubber covered wire and remove the rubber from the end of one piece of wire for about half an inch. You will find underneath the rubber a cotton covering. This can be removed quite easily and the bare wire exposed. This wire should be scraped lightly with a knife, for there is a dark substance on its surface which will not improve the conductivity. When the wire is bright, twist the strands together tightly and commence your wiring up, cutting off the length suitably as you go. The wiring diagram will give you all the information you require on the joining up.

The wire which goes from the negative of the L.T. battery

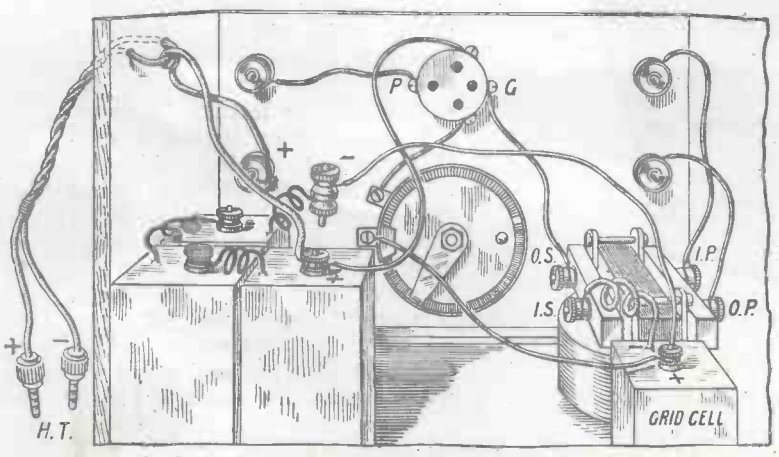


Fig. 4.—A practical guide to wiring.

passes first to the positive of the grid bias cell and then to one terminal of the filament resistance. To enable proper connections to be made, a small portion of the rubber covering should be removed a part of the way along this length and the wire twisted under the terminal and carried on the filament resistance. This saves the trouble of using two wires and twisting them together. Notice that there is no fixed condenser across the primary of the transformer. With a crystal receiver it is really unnecessary, and, in any case, is often fitted to the crystal receiver itself, while in a valve receiver it is almost always found that a condenser is fitted across the output terminals. If the particular receiver with which this set is used happens to be a single valve receiver with reaction and no fixed condenser is provided across the telephone terminals, a condenser .001 or .002 should be joined across them before they are joined to the amplifier.

The four dry cells simply stand inside the box in convenient positions. The three cells are joined in series by screwing the negative wire of the first cell under the positive terminal of the next, and so on, the negative wire of the final cell, as previously explained, being screwed underneath the double terminal, so that connection from it may be taken with ease. The negative wire of the single grid bias cell is screwed underneath the I.S. terminal of the intervalve transformer and thus no double terminal is required on this particular wire. The positive from the H.T. battery is screwed underneath the positive L.T. terminal (which must have two wires from it, one going to the H.T. battery and the other to the valve socket), whilst the positive wire from the H.T. battery goes to the lower telephone terminal, the upper wire of which is joined to the plate terminal of the valve socket.

Tests Report

As soon as the instrument was finished the H.T. plugs were connected to a 66 volt H.T. unit, the filament resistance turned just on and the input terminals connected to a standard crystal receiver. The output terminals were then joined to a pair of 4,000 ohms telephones. The amplification was found to be quite as good as could be expected with a single valve applied to a crystal set, and with the particular transformer used, the purity was just as great as with the crystal detector itself. The wires from the crystal detector to the input terminals were then reversed to see whether an

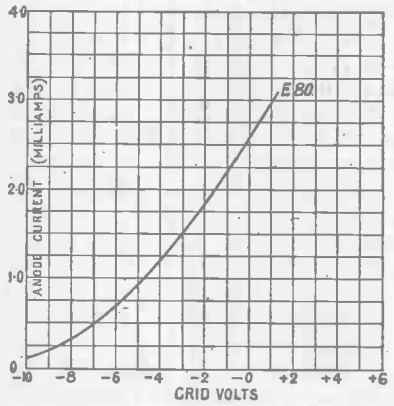


Fig. 5.—The valve characteristic.

improved effect could be found, but either way worked just as well. Various values of grid bias were tried up to 6 volts in all and various H.T. voltages applied during the test. It was

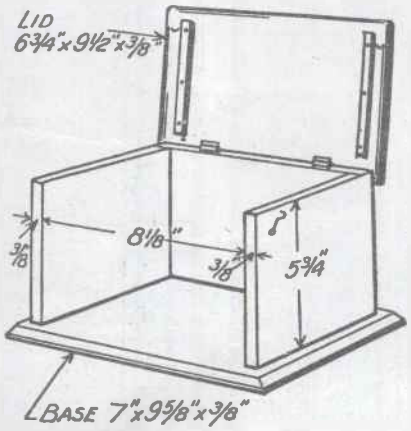


Fig. 6.—Box details.

found that best all-round results were obtained with from 60 to 80 volts H.T. and about 3 volts grid bias, which may be obtained, as previously explained, by the drop of voltage in the filament resistance plus the voltage of the single dry cell. The trials of voltage were tried with D.E.3, B.5 and A.R. .06 valves, all of which worked excellently.

Voltage measurements were taken of the filament voltage of the three valves, and it was found that all three worked quite well on about 2.6 volts, practically no increase of signal strength being gained by raising the voltage to 3. The nominal voltage of the dry cells is, of course, 1.5 volts, but when under load the voltage drops. The filament current taken from these valves is so small, however, that the voltage drop on test was almost negligible, accurate measurement showing that on load the 3-cell battery showed 4.3 volts altogether, after about half an hour's run. With a 30-ohm filament resistance it will be found that the valve should be turned just on to get about 2.6 volts on the filament. After perhaps an hour's run a slight variation of filament resistance may be required.

Test with a milli-ammeter in the plate circuit showed that with the grid bias indicated and the voltage at 66, the steady plate current was .7 of an ampere with 2.6 volts on the filament.

The next test was to attach the amplifier to the end of my Transatlantic Receiver (2 H.F. and a detector). It was then found that on a small indoor aerial, about 7 miles from 2LO, full loud-speaker strength was obtained in this way.

POPULAR PRICE REDUCTIONS

We note with interest the enterprise displayed by Messrs. Alfred Graham & Co. in placing certain of their loud-speaker products on the market at reduced prices.

The low figures at which the Amplion Junior and Amplion Junior de Luxe are now obtainable will, no doubt, do much to popularise loud-speakers, and in consequence stimulate the wireless trade in general during the summer months.

We understand that these models incorporate the latest developments in loud-speaker construction, including the floating diaphragm.

Faithful Reproduction by Broadcast

By P. P. ECKERSLEY, M.I.E.E.

The discussion following upon the paper recently read before the Radio Society of Great Britain.

(Concluded from page 287.)

Mr. G. G. Blake

At one part of his lecture Captain Eckersley spoke of the microphone being treated with some weird kind of surgical dressings. It would be interesting to know if any other ingredients were used in addition to vaseline and cotton wool, and how they were applied.

Speaking of the acoustic properties of a room, the author said that very little is known on the subject. When the architect is designing a room or hall he understands so little abouf acoustics that it is really greatly a matter of chance as to what properties it will possess when the building is completed.

I remember a lecture about a year ago, at the Royal Society of Arts, by Major Tucker, when he showed his hot wire microphone, and told us that by its aid he had been able to explore the interiors of buildings for their acoustic properties. He was able to go about a hall and detect nodes and loops of sound. In fact, the instrument was so sensitive that he could locate certain places in a hall where no sound could be heard.

We have therefore, I suppose, to take it that it is possible for a member of an audience to be just so located that one of his ears coincides with one of these dead spots. In such a position he would hear with one ear and not with the other.

If this instrument of Major Tucker's is made use of it seems to me that it should certainly be possible in the future to design rooms with better acoustic properties, or at any rate to know something of the sort of effects that are likely to be produced after the room is built.

One of the speakers has referred to the Simon's speaking arc as a loud-speaker. About a year ago I carried out some experiments myself with a speaking arc as a loud-speaker, and reproduced music and speech from 2LO moderately well. It seemed to me at the time that as the arc has no diaphragm and the speech reproduction is due to variations of the expansion of the air being

The portable station at Batchford Heath on the occasion of the field day, held by the Western Metropolitan Association of Affiliated Societies.

heated by the arc there should be no undue resonance, and this might prove a very valuable way of obtaining good reproduction. My own results were not altogether satisfactory. I could hear quite well right across the room, but the speech sounded very woolly. I attributed this to the fact that I was using some old apparatus I had employed some years previously at the time Simon's arc was first introduced. Probably the apparatus was wrongly designed, and this may have accounted for the trouble. I certainly think that further experiments should be carried out with this arc in the hope of finding a solution in this way.

Captain Eckersley

Admiral Jackson said that the loud-speaker was much better a year ago than now. I consider that a serious reflection upon 2LO. I do not think so. It may be that distortion balanced distortion when we used the carbon microphone. I have heard of receiving apparatus giving better results with faulty microphones when distortion is balancing another. For instance, the transformer amplifier and the loud-speaker may balance distortions, and some manufacturers will not sell their loud-speakers without their amplifier, because they have balanced one distortion against another.

Relative Merits of Loud-Speaker Principles

Mr. Coursey raised an interesting question when he asked me about the relative merits of various principles for loud-speakers. That is unfortunately a leading question, and, owing to my official position, I am sorry to say I dare not, if I could, answer it. I should be treading on too dangerous ground. It seems to me that it does not matter which way it is done. So long as you get the result, the principle does not matter.

Mr. Reeves referred to sloppy construction of loud-speakers, and he has there raised a fundamentally important point. We have found, for instance, in relation to microphone construction, how important it is to leave no slackness in any intendedly rigid part.

Inter-Valve Couplings

As to the question put by Mr. Fogarty as to which is the best, resistance capacity, reactance capacity or transformer, I hold no brief for the resistance capacity, but like it because it is the fool's method, and therefore my own—(Laughter)—and as being the method which cannot go wrong, provided always, of course, that you use the right values. With a 50,000 ohm anode resistance and 0.2 or .0.3 μF intervalve condensers there should be no serious distortion.

With regard to transformers one must be very wary. There are certain ones in highly polished brass cases which look lovely, but they may not be so good as that dirty-looking thing thrown away on the dust heap. This transformer question is an extraordinarily interesting one, because the transformers have got to be efficient from down to 30 a second —which we do not give you (laughter) — up to 10,000 a second. Most transformers are resonant and only amplify just those frequencies which are reamplified by 'phones or loud-speaker.

Shunting Condensers

By heavily shunting transformers you may cut out their resonance, but you may equally reduce their sensitivity to our equality with resistance capacity amplification.

Finally you do get down to a fairly effective device, and the important point is that you must use your transformer in the proper way. Again, it is no use

A DELICATE OPERATION

Grinding the faces of telephone pole-pieces in the Brandes factory.

taking *a* transformer and *a* valve. You must have *the* transformer and *the* valve. When a trader shows you a perfect curve, certified by a dozen people, ask him how they got the curve and with what valve, and how much they gave the certifier. (Loud laughter.) Reactance capacity is very good, but make the impedance of the inductance large.

Deep Waters

The question of detection raised by Mr. Carpenter takes us into very deep waters, and frankly, how does a valve rectify? I think the general theory is quite simple, but a great many factors complicate the situation. In certain cases a valve may introduce more damping for greater amplitudes, as does the crystal.

I find some difficulty in following Mr. Voigt, because he approaches the subject from a different angle than I do. Unfortunately I have complicated this discussion by foolishly making the mistake of using the term equal amplitude when I meant equal audibility. I must apologise to all who were present at the lecture. The mistake has been corrected in the text printed here.

I wonder if one can neglect the higher frequencies, and again I would like to tackle this subject like a fool, and it may be a most foolish idea, but I think it may be that one can neglect the higher frequencies. I have been taken seriously about the one valve per mile, and I had better not say anything more about that. (Loud laughter.)

Horns

With regard to horns, raised by Mr. Cudden, a great many people have dealt with horns. I still am an exponent of the horn, because I do not think that you ought to do all your work by low frequency magnification, and then have an inefficient system. I do not agree, simply because it is not practicable. Our houses are wrecked fairly adequately now; my drawing-room does not look very much like a drawing-room. It is a chaos of valves, condensers, wires, charging apparatus and so on, in the middle of which I sit whilst my wife complains. We must realise that the really efficient set must have a good low frequency amplifier and a really efficient loud-speaker, rather than having a glut of valves and an inefficient loud-speaker. Without the horn a loud-speaker is usually inefficient; the horn increases efficiency.

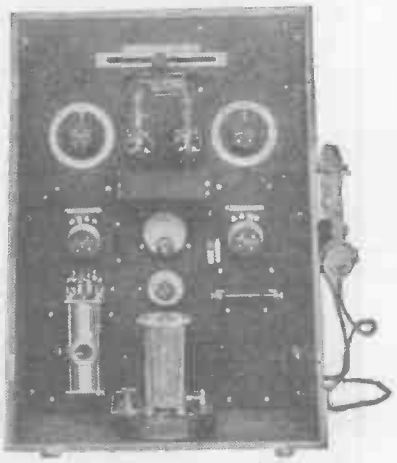
Metal or Wood Horns

As to the material of which horns are made, I do not think it matters in the least. I think that as long as you have a horn which is not influenced too much by the vibrations of the moving parts, then you are on the right road.

Somebody mentioned that he was not using an earth. Very many sets work much better without an earth because they tend to oscillate easier, and so give apparently louder signals. Be very wary of doing without an earth, however.

Push-Pull Amplifiers

Mr. Robinson raised the question of push-pull magnification.



Marconi call signal apparatus, showing relay.

This is an extraordinarily efficient method of magnification, and has all sorts of valuable qualities. The Western Electric system with double buttons uses that method. The test of a microphone, however—and this is a point which has not been mentioned—is the ratio of its sensitivity to its spurious noise. The double button does not help here.

Freak Microphones

Mr. Robinson also mentioned freak microphones, and asked if we could use some other method. Of course, one dreams about things like that. One dreams about microphones which have no moving parts whatever; one dreams of heat engines which have an efficiency of 100 per cent.; one dreams of all sorts of things like that (loud laughter), but after all, the principle does not matter if you can get something which is practically perfect.

Captain Plugge asked why such a high pitched note is used by the B.B.C. for tuning. That is because the same apparatus is used for the time signal. That is why the high pitched biting note is used instead of something which is rather more mellow, and therefore difficult for purposes of the time signal.

I thoroughly agree with Captain Turner on the question of the last valve on the loud-speaker amplifier. That valve has got to do work. It has got to push the diaphragm up and down, and in consequence it has got to have a certain number of watts coming into it, and these watts have got to be dissipated in the plate. Therefore you will, in my opinion, require a valve which has at least 20 volts sweep on the grid without affecting the straightness of the curve, and without running into grid current. I did not quite understand his point about bright and dull valves, but the dull emitter valve gives *me* exactly what the bright valve has given me and at much less cost. Therefore, I take off my hat to the dull emitter valve.

Mr. Lawes said he was shown round the 2LO studio, and was told by one of the staff there that the pedal notes of the organ were present, whereas my curves show a lamentable falling off in the bass. That gentleman will get the sack to-morrow. (Laughter.) My curves show that the pedal notes are present, but I admit not in their full ratio. The loud-speaker, however, must do better before the lack is apparent.

Dr. Eccles spoke about our work, and I think he realises that we are aiming at perfection without fake.

Mr. Harris talked about condensers across loud-speakers. I said I did not advise their use, as they may not give perfect integration as theory indicates.

That finishes my talk, and if it has been as interesting an evening to you as it has been to me, I am more than satisfied.

The Radio Society of Great Britain

THE daylight relay test carried out by the Transmitter and Relay Section of the Radio Society of Great Britain on Sunday, June 15, although not all that could have been desired, proved exceedingly useful in many respects.

The weather was the most important factor in preventing the test from being carried to an entirely successful conclusion. Bright and sunny conditions prevailed throughout the country.

The following notes from various stations operating at the time have been forwarded, and are now published:—

2UV London

Unable to get 2TO through heavy 'phone jamming from powerful stations in London. There was a practically continuous jamming throughout the test period. 2TO is generally good strength at 2UV, but not heard at all on this occasion. 5KO at Bristol was heard but did not answer the call. Reception of distant stations seemed very much worse than usual. W/L variable from 150 up to 200 Rad. .6.

2TO Ipswich

Heard 2UV, but very QRZ. Unable to get into touch owing to weather and jamming in London. No other control stations heard. W/L 200 metres. Rad. .8.

5MO Newcastle-on-Tyne

Could not get into communication with 2TO, but could hear 5DN, whom he called without receiving an answer. Heard, and was heard, by 5SI during test. Was unable to get into touch with anyone, despite radiation of 1.4. W/L 155 metres.

5DN Sheffield

Reports very bright weather. Heard 5SI calling him on 145 metres, and replied, but received no further QSL. Heard other stations calling and apparently working 5SI. 2XY told him he was getting 5SI and 5MO, but no other control station heard. W/L 160 metres.

5SI Shrewsbury

Reports good weather during test. Heard 2UV at commencement, but very QRZ, only just readable on 175 metres. Heard 5DN fading badly. Got QSL from 5DN, but no further contact. Reception of 5DN much more QSS than usual, and unable to establish contact over 150 metres. Heard 5MO and 5JX, but nothing further.

6TD Wales

Heard 5SI, 5DN, and 5KO. Reports heavy jamming from 'phones and tonic train sets, but no news of any message.

2DX Camberley

No report.

2OF Lowestoft

Reports hearing 2TO, and that 6NO reported to him that 5MO called 2OF during test.

5RW Goodmayes

Heard 2TO and 2UV calling, but no other stations.

Summary

The test was of special value to the Traffic Section, inasmuch as it proved that the line of relay, although excellent for normal conditions, is very weak on particularly bright days. A further circular will be issued later, more closely connecting each control station.

The failure on the part of the control stations to establish communication was undoubtedly due to three causes:—

1. The heavy QRM from amateur 'phone sets on 200 metres.

2. The long distance between 2TO and 5MO.

3. The particularly bright weather conditions, which undoubtedly cut down ranges very considerably, rendering usually readable stations very QRZ, and thus harder to receive through QRM.

It is to be regretted that a great deal of the QRM was caused by the station of a member of the Section, and it is sincerely hoped that in future tests all members will stand by and be ready to assist.

SIGNAL MEASUREMENTS

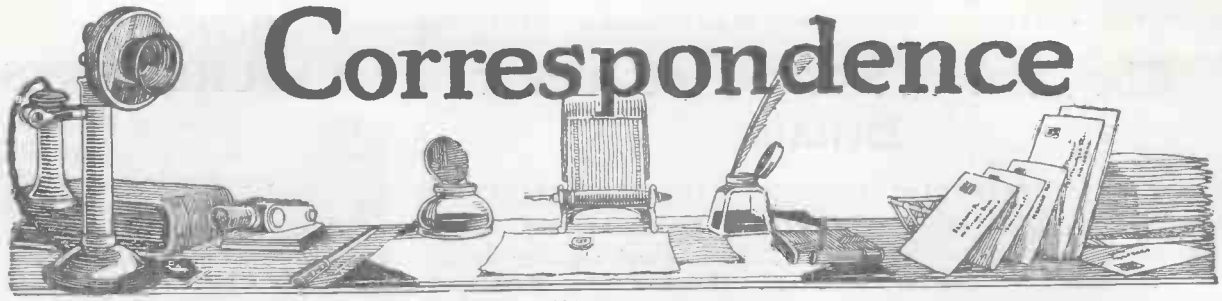
Lecturing before the Society at the Institution of Electrical Engineers on June 25, under the title of "A Résumé of Modern Methods for the Measurement of Radio Signal Strength," Mr. Hollingsworth dealt ably and comprehensively with the theory and practice of radio measurements as carried out to-day. The lecturer made no claims for the present stage of development, for he confessed that we are still in a state of abysmal ignorance concerning the law of the propagation of waves through space. What is wanted is information regarding the relation between the power at the transmitter and the power at the receiver, and at present no adequate method exists for such a measurement.

Mr. Hollingsworth touched briefly on early attempts at signal measurement, including the thermo-galvanometer of Duddell. With the arrival of the thermionic valve, however, the scope of investigation enormously increased. In dealing with modern methods of measurements, Mr. Hollingsworth stated that in each case an amplifier was employed. The amplifier of the present day cannot, however, be regarded as an instrument of precision, and therefore all kinds of precautions have to be taken. The principle embodied in present-day measuring instruments is the use of a local E.M.F. of known value, which is compared with the E.M.F. received, and the lecturer described several systems now in use.

One of the major difficulties encountered is the unreliability of the human ear in comparing the relative strength of different sounds, and in the subsequent discussion Captain St. Clair Finlay drew attention to an interesting method by means of which comparative measurements could be recorded on a meter.

Dr. Smith-Rose emphasised the present need for research in radio measurements. Other participants in a profitable discussion were Messrs. E. H. Robinson, G. G. Blake, R. E. H. Carpenter and Captain Plugge.

Correspondence



2HF

SIR,—I am enclosing two photographs of one of my stations which might be of interest to your readers. The aerial is a three-wire single strand 14 S.W.G. enamelled copper on 12-foot spreaders, suspended at the free end on an 83-foot mast and at the other on a 50-foot one. The receiver and transmitter are contained in the rough cabinet seen in the photograph. The transmitting valves are 150 watt each, not shown in photos as they are at rear of panel. In conclusion I might mention that I have worked England, Ireland, Scotland, France, Switzerland, Holland, Denmark, and was the first British amateur to work direct with the Italian IMT.

Trusting the above may be of some interest.—I remain, yours truly,

W. G. GOLD.
Operating Stations 2HF, 5OF,
Four Oaks.

COWPER H.T.-LESS CIRCUIT

SIR,—With reference to Mr. Cowper's H.T. less set, as described in *Wireless Weekly* and *Modern Wireless*, I hurriedly connected up the circuit with quite good results. Cardiff, 3½ miles, came in hardly loud enough for loud-speaker, but much stronger than on a crystal. Bournemouth (85 miles) was a comfortable head-'phone strength, although Cardiff could be faintly heard in the background. The tuning was critical, as was also the filament current (Lissenstat being used). A radio choke of 400, instead of 250 turns, seemed to improve matters. A variable .0005 mfd. condenser was used in the aerial, no fixed condenser being available. Capacity effects, touching 'phones, etc., were evident.

Comparing, I should say results were very little below ordinary single valve with reaction strength, on Cardiff and Bournemouth alone.

Wishing you every success.—Yours, etc.,

Penarth. J. F. HUDSON.

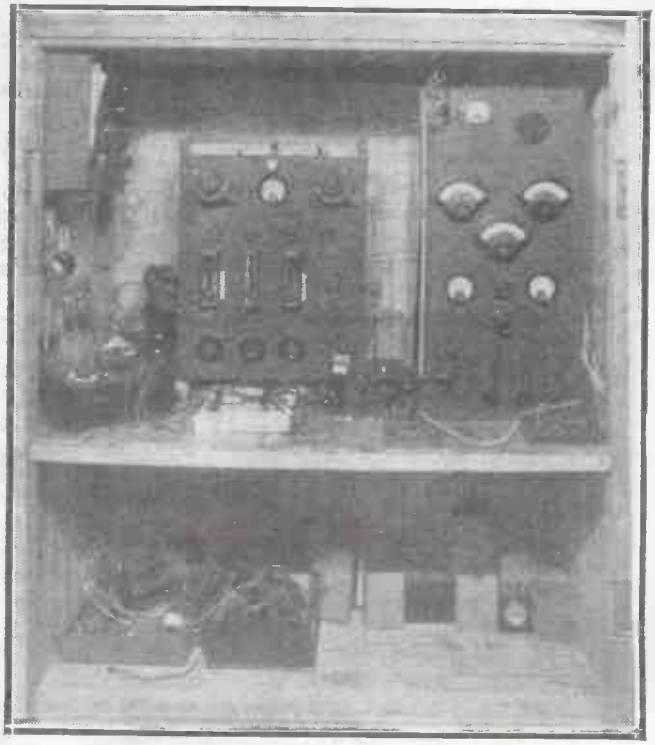
DRILLING TEMPLATES

SIR,—I have read in the correspondence columns of your excellent journal that several people have a job to drill holes for separate valve-holders. Here is a little tip which might interest them:—

On the tips of the valve pins place a little blob of red paint or any other conspicuous colour. Then press the valve gently but firmly in the place desired to fix the valve-holder. Then make a small impression with a centre punch or a nail in order to get a starting-place for the bit. Then proceed as usual.—Yours faithfully,

W. W. LLEWELLYN.

London, S.W.11.



The left-hand photograph shows the aerial arrangement of the station 2HF, owned by Mr. W. F. Gold, whilst the right-hand photograph shows the interior of the station.

ST136

SIR,—You will find enclosed a photograph of a set I have built incorporating your circuit ST136,

Both H.F. transformer primaries are tuned by 0.0003 μF condensers. The potentiometer gives excellent control. The H.T. battery is inside the first cabinet and the two switches at the bottom of the panel are connected to the different tappings. The right-hand switch regulates the detector H.T., the other is for both H.F. stages.

The large H.T. battery for the magnifier is contained in a box below the table.

The valves in the receiver are M.O.5v., while those in the magnifier are B.4. The first valve has 84 volts H.T., while the second has 126.

The L.F. transformers are Lissen T.1 for the first stage and R.I. for the second. The loud-speaker is shunted by a 0.05 μF condenser which gives it an exceptionally good tone quite free of distortion with 4.5 volts and 7.5 volts grid bias.

As the house has its own lighting battery the filaments are heated by this battery, a little panel on the wall being used to regulate the voltage.

Either head-phones or magnifier may be connected with the aid of the Minicap D.P.D.T. switch shown.

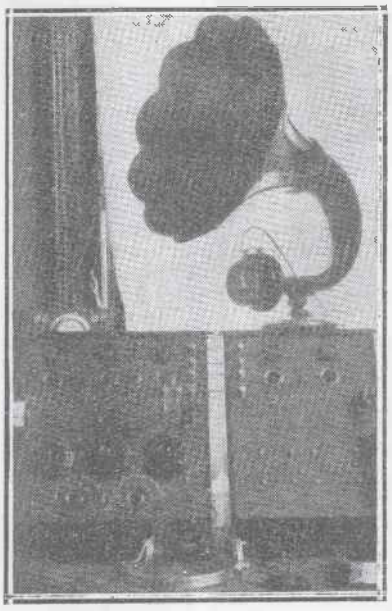
Since the house lighting negative is earthed, a 0.002 μF fixed condenser is placed in the earth lead.

I have, of course, no trouble in picking up every B.B.C. station of full loud-speaker strength. I have not yet attempted to get America, but I do not expect any trouble with this when the nights are longer.

Wishing your two excellent periodicals every success.—I am, yours truly,

W. R. MURDOCK.

Bootle, Lancs.



A neat arrangement of ST136 made by Mr. W. R. Murdock.

FROTHING IN ACCUMULATORS

SIR,—We read with interest in the issue of *Wireless Weekly* for June 25 your comments on the above subject.

This is the first time we have seen any mention made regarding the use of Hudson's soap to remedy the above trouble. It was used by us many years ago, and found to be satisfactory, but at the same time it is hardly a remedy that can be referred to in a pamphlet. Frothing in the cells appears to take place only in those cases where the containing box is celluloid. Celluloid at its best is not a particularly stable compound owing to the fact that one of its principal constituents, camphor, is extremely volatile.

Frothing in celluloid-cased accumulators is probably caused by action on the celluloid case or separator, especially the latter, when the material is not of first-class quality. In some cases frothing has its origin in the use of impure water containing lime salts, which are deposted on the plates and interfere

with the process of charging. It is generally noticed that frothing trouble begins almost at the commencement of the charge, and no amount of extra charging will remove it.

The remedy is to empty out the acid, fill the cell with water (distilled for preference) and let it stand for two hours, repeating this two or three times, after which fill up with 1.225 s.g. acid in the ordinary way. The addition of Hudson's soap to the water may assist in making this a perfect cure.

As a general rule accumulator cells should never be filled with water and allowed to stand for a long period, as sulphating on the plates would result. Care should be taken, therefore, to refill with acid directly after the cleaning process.

The people who should enlighten the public on this matter are the manufacturers of celluloid, who, with an intimate knowledge of the materials contained in their product, should be able to make chemical and electrolytic tests which may elucidate the cause of this trouble.—Yours faithfully,

PETO & RADFORD.
WM. PETO.

Grosvenor Gardens,
London, S.W.1.

INDOOR AERIAL RESULTS

SIR,—Perhaps it may interest your readers to hear of my rather unusual experience with an indoor aerial.

This consists of a length of copper tape about ½ in. wide, slung between two points, one the top of a two-storey building staircase and the bottom under the ceiling of the room in which the set is. The tape is simply continued from the bottom point to the instrument.

Although the tape is perfectly bare, it touches walls, furniture, etc., on most of its length.

On my first experience I tried a simple crystal set, using only a variometer, one of the new "Kupee" crystal detectors with micrometer adjustment and a pair of 'phones. This was at about ten miles from 2ZY, and results were equal to many single-valve sets I have heard on an outdoor aerial.

I then tried in turn a single valve, using also a "Kupee" valve panel and a single valve with reaction. In the latter case signals are too loud to be comfortable.

I am now about to try ST100, using both the above detector and the two valve panels, which are ideal for such experiments.—Yours faithfully,

H. E. TAYLOR.

Ashton-under-Lyne.

A NEW CIRCUIT

SIR,—I have noticed in *Wireless Weekly* of June 25 a letter, together with a "One-Valve Circuit," over the name of F. Harold Webber.

The heading of the letter as given above is hardly applicable, as I have for the past two years been working with a similar circuit with one exception, *i.e.*, the inclusion of a small fixed condenser interposed between the aerial and plate circuit—this condenser being fitted merely for the purposes of protection in the event of the aerial tuning condenser breaking down.

Further, this circuit has previously been published in the technical Press in association with my name.—Yours faithfully,

C. HART COLLINS.
5NY & 5NZ.

Westminster, S.W.1.

□ □ □

Erratum.

In connection with the report upon the "Formo-Densor," which appeared in our last issue, the maximum value of this condenser should read 0.000756 μF, instead of 0.00756 μF, and the minimum value 0.000025 μF, instead of 0.00025 μF.

Information Department

Readers will facilitate the work of this department if STAMPED ADDRESSED ENVELOPE is enclosed in their letter.

Apparatus we have tested

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

"Simplaerial" Indoor Aerial

Messrs. The Radio Transformer Co. have submitted for test a sample of their portable indoor aerial equipment, consisting of a hammock-like mat of zigzag wire about 5 ft. 6 in. long by 1 ft. wide, with small wooden spreaders at each end provided with bridle and insulator, the wire being kept in position by interwoven string. Twenty-one feet of heavily insulated cable with terminals are also supplied and ceiling hooks. The idea is to hang this just below the ceiling of the room in which the receiver is situated, or as an impromptu aerial elsewhere.

A test was carried out by comparing the signal-strength, measured in three ways on valve and crystal, with that obtained on an indoor aerial of exactly the same effective area, but of two strands of the customary aerial cable of 7/22's stranded copper, in identical position to that occupied alternately by the Simplaerial; with a single-strand aerial of the same length, with a 2-ft. square frame aerial (in valve reception), and on the full outside P.M.G. aerial. The station was thirteen miles from 2LO, and an excellent low-resistance earth was used, the receiver being on the first floor and a direct vertical wire of 7/22's going down to a large water-pipe. Extremely low-resistance inductances were also used, and an efficient and finely-controlled one-valve (or two-valve) reaction set to give the optimum signal-strength. An inefficient receiver might easily mask small differences in the aerial.

As compared with the normal average of 18-21 microamperes with the crystal on the outside aerial, both Simplaerial and two-wire of the same outside dimensions gave but one microampere—too small to distinguish the better of the two. If anything, with the Simplaerial the faint aural signals were a trifle more distinct, but not loud enough to judge accurately. The distance was rather too much for such a small aerial.

With single-valve and critical

reaction below the point at which distortion is evident, by the method of the Moullin voltmeter this aerial gave .7 volts effective signal-strength, the two-wire of 7/22's gave approximately 1 volt. The single wire 3 ft. lower down gave about .6 volts, and the 2-ft. frame, with centre-tapping earthed, so as to give the optimum effect, gave about .3 volts. Under similar circumstances the large outside aerial generally registers around 2 volts.

With an audio-amplification stage beyond, and measuring the actual signal-voltage across 4,000 ohm 'phones, on the Savoy band music, and taking a time average in fairly uniform passages, the Simplaerial gave an average of around .7 volts audio signal-strength; 7/22's, .8 volts; the single wire, .6 to .7; and the frame aerial, .5. The outside aerial gives 2-2.5 usually. In each case moderate loud-speaking was obtained, sufficient for a small room, with the inside aerials.

Evidently the great length of wire in this zigzag arrangement offers an H.F. resistance, which more than compensates for any extra pick-up. The capacity of both the Simplaerial and the two-wire of the same area was below 100 micro-microfarads, that of the Simplaerial being about 5 micro-microfarads greater.

For valve reception, where extra amplification can be employed, or for head-'phone crystal reception at short distances, this self-contained and compact aerial offers considerable advantages; it would be quicker to erect and would offer less æsthetic objections than an improvised two- or three-wire indoor aerial of the usual type.

A Plug-In Variable Transformer

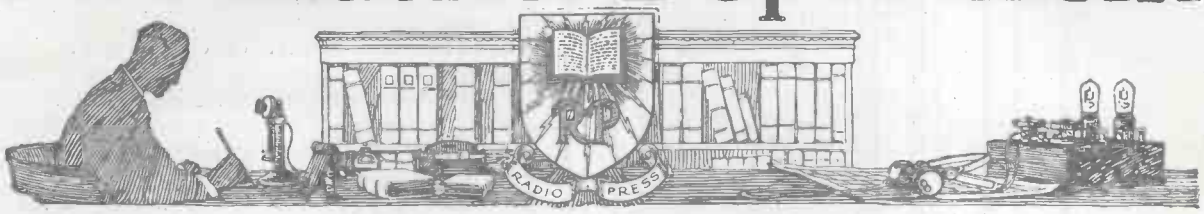
Mr. Eric J. Lever has sent an example of the "Trix" H.F. intervalve transformer, of the variable or tapped type, and with plug-in fitting of the usual arrangement, covering, however, the wide range from 230 to about 2,800 metres (nominally from 300 to 3,200 m.), with a low-minimum variable condenser of .0003 μF actual maximum capacity in parallel with the primary.

The device takes the form of a cylinder 2½ in. in diameter and about 1 in. high, with the four pins in the base as usual. A small switch-handle on the top gives choice of 5 switch-points, the ranges determined by measurement being 230-550, 340-570, 360-740, 530-1,020, and 1,300—about 2,800 metres wavelength respectively.

With direct-coupled primary tuning in a two-valve circuit, with good R valves and correct H.T., reaction being critically applied, London at 13 miles came in loudly, Paris (Ecole) was just audible (on 450 m.) through 2LO; Birmingham was readable in the phones, and a whisper of Aberdeen was obtained. On actual measurement of the amplification attained, compared with single-valve with critical reaction, the figure was not high, but came out just below that with tuned anode coupling and critical reaction.

The unit is strongly made and well finished, the switch operating smoothly and effectively. The actual insulation resistance, measured between windings with 500 volts D.C. by means of a "Meg" tester, was over 100 megohms.

Information Department



SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

S. T. H. (BATTERSEA) states that he has been very much puzzled by the fact that he can pull out the positive plug from his H.T. battery and continue to receive signals with his single valve set for some time (as much as one minute) after the disconnection. He reports that the signals gradually die down and finally become inaudible. He thinks that his set must be functioning in some way resembling that of the various H.T.-less receivers and asks our opinion.

Your circuit diagram shows a condenser of 1 μF across the H.T. battery, which is acting as a reservoir, and is alone responsible for the effect which you have noticed. Such phenomena are quite common with sets employing a reservoir condenser and requiring only a small H.T. supply. The fact that your particular set continues to give audible signals for as much as a minute after disconnection is quite a good testimonial to your reservoir condenser.

S. W. T. (KING'S LYNN) states that he is very much puzzled by the fact that amateurs are succeeding in setting up wonderful long-distance records by means of exceedingly short waves, and yet he observes that all the principal high-power stations which carry out long distance services employ extremely long waves, and he asks us to explain the matter.

Short waves of the order of 100 or 200 metres appear to possess remarkable carrying power under favourable conditions, but they are extremely erratic and variable, and seem to be very readily absorbed by certain types of obstacles. Long waves, on the other hand, only vary very slightly in the ranges which they will cover

from day to day, are not easily absorbed, and do not exhibit nearly so much variation between night and day. It has therefore become the standard practice to use very long wavelengths, and the necessary high power to compensate for their relatively poor carrying power.

I. O. H. (NORTHAMPTON) states that he is very much troubled with severe overlap, for whose removal he has tried all the usual remedies, such as variation of high and low tension voltage, variation of grid leak resistance, etc. He submits the diagram of his receiver and asks whether we can see anything fundamentally wrong with the circuit.

The diagram in question shows that the grid-leak is connected between the grid of the rectifying valve and L.T. negative terminal, the filament resistance being in the negative lead to the filament of the valve, and a 6-volt battery being in use. This position for the grid-leak is quite sufficient to cause trouble in many cases, and probably all that is needed is to alter it to the more conventional one between grid and filament positive.

A. N. C. (BERKHAMSTED) states that he has just finished a three-valve set (his first long-distance receiver) and although he finds he can receive a number of the more distant broadcasting stations, upon many occasions he notes that their signal strength appears to vary from one minute to another, and asks whether this indicates any fault in his receiver.

This is the well-known effect called "Fading," whose cause is a matter of controversy. The balance of opinion seems to favour an explanation based upon absorption and reflection of the waves by irregular masses of ionised gases in the upper atmosphere, the effect changing as the atmospheric conditions vary.

T. P. C. (CLAPHAM) states that he thinks that there is a break in the plate circuit of his high-frequency amplfying valve, and asks how he can settle the matter.

The simplest method is to connect the telephones in series between the high-tension positive terminal upon the set and the high-tension positive socket of the H.T. battery, and turn on the filament supply of the high-frequency valve. Fairly strong clicks should then be heard upon making and breaking the high-tension supply circuit, which become faint when the valve filament is switched off. No clicks indicate a break. Alternatively, you might carry out the test with a pair of telephones and a dry cell by connecting these two in series and applying the free terminal of the dry cell to the high-tension positive terminal upon the set, and the free tag of the telephones to the plate socket of the valve-holder. Clicks should be heard if the anode circuit is complete, care being, of course, taken to see that there is a coil in the anode circuit coil-holder.

Wireless Weekly, 6d. Net. Wednesday July 16th, 1924.

Wireless Weekly

and the Wireless Constructor.

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No. 11.

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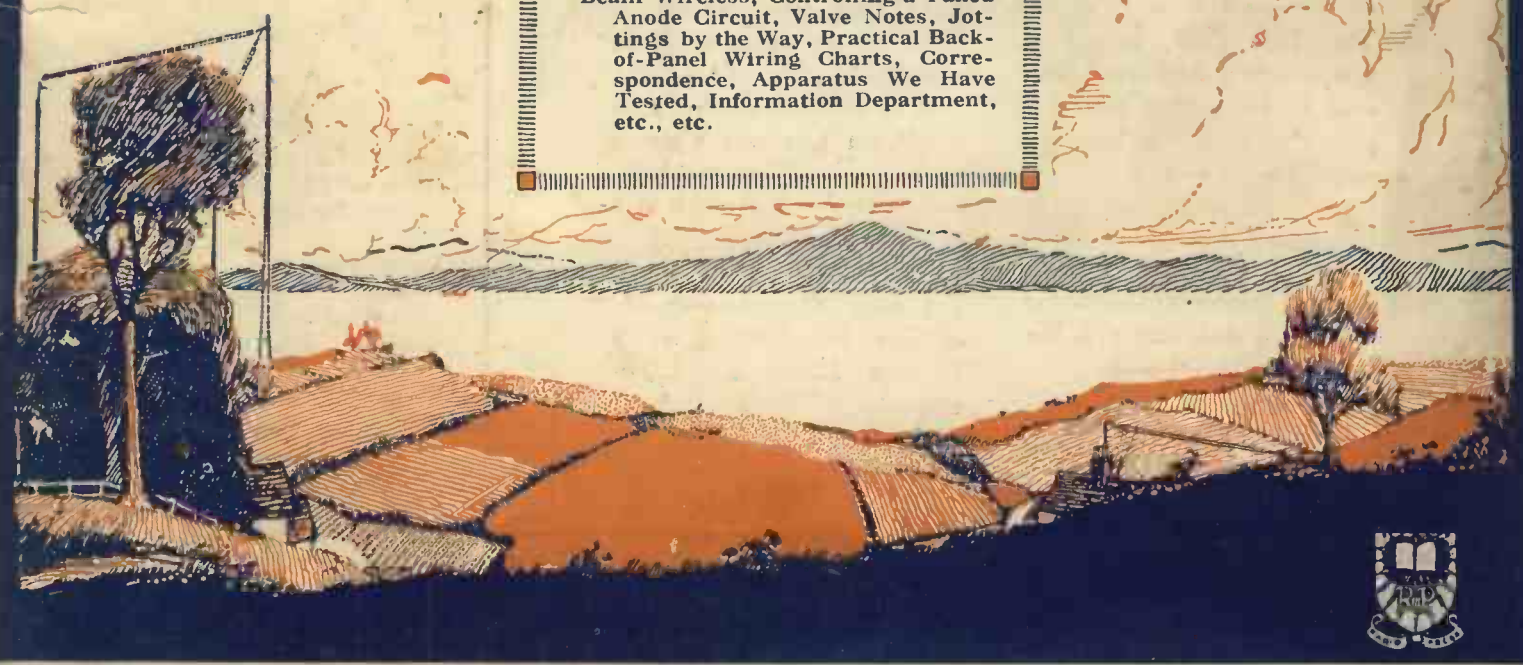
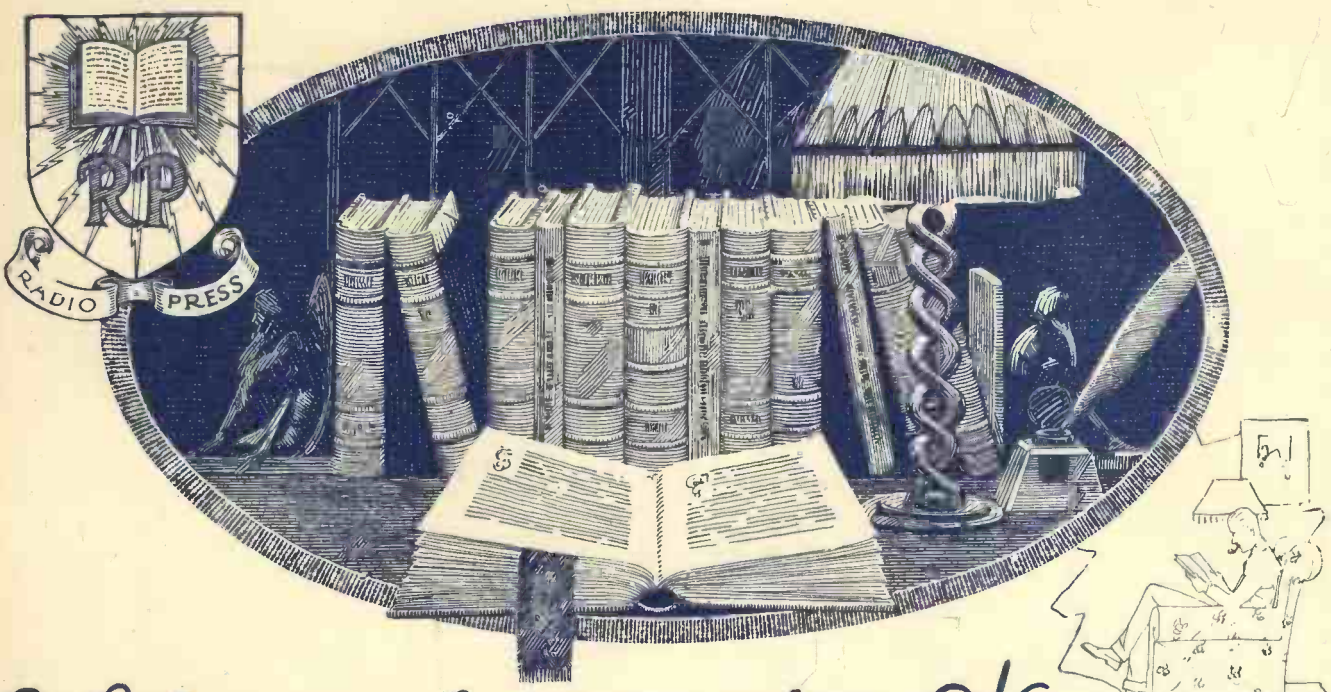


How to obtain Loud Signals

By Capt. H. J. ROUND



A Reference Library for 2/6.

WITH the large number of really good Books on Wireless published by Radio Press Ltd., it is a little difficult for an enthusiast to pick out the most useful of them. The Book ***500 Wireless Questions Answered***, however, by its immense sales, has already proved itself as being the most popular — two editions having been exhausted since last November.

Its wide scope—coupled to the fact that it deals only with live and useful information—is rendering it indispensable to every Broadcast listener and experimenter.

Certainly, previous to its publication it would not have been possible to have obtained one half of the information contained within its two covers under an expenditure of several pounds. And even then the information would not have been given in such a concise and compact form, well indexed, and available at a moment's notice.

Such a Book as this will save its cost many times over—it can certainly be described as a *Reference Library for half-a-crown.*

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By G.P. Kendall & E Redpath.

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RADIO PRESS SERIES No. 13.

Wireless Weekly

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All correspondence relating to contributions is to be addressed to the Editor of "Wireless Weekly."

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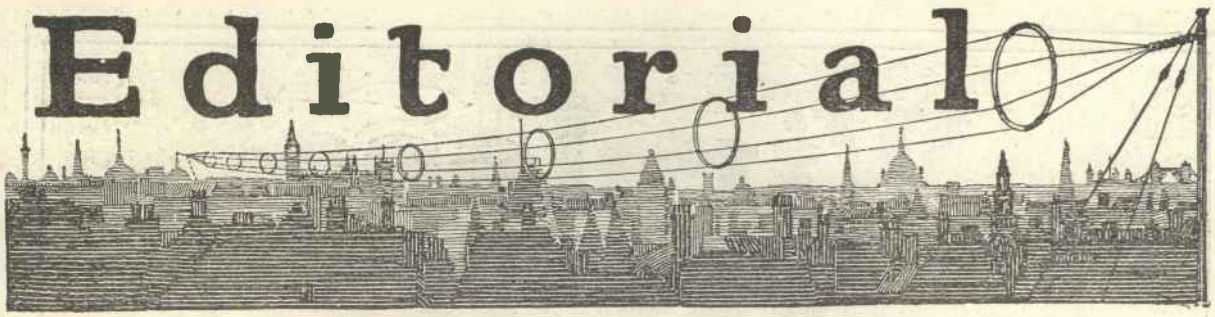
Editorial



Further Aid for Experimenters

FROM the date of its inception it has been the aim and ideal of Radio Press to render the fullest possible service, not only to the wireless experimenter who has already learned the fundamentals of the art, but also to the beginner, whether he is aiming to become a serious experimenter or merely at obtaining the best results from apparatus he has purchased. Furthermore, Radio Press has always realised the fundamental importance in giving the clearest possible photographs, diagrams and wiring guides for the construction of sets at home, a branch of the art the importance of which is now fully realised by all parties.

The unique editorial facilities possessed by the Radio Press organisation, and the full sympathy between its members and the great wireless public, has accounted more than anything else for the success they have attained. The policy of seeing that every set described really works, and works *well*, and is made from parts readily obtainable in good quality, has been abundantly justified, and we are naturally proud of the reputation we have gained for reliability in this regard.

A Missing Link

For some months, however, we have felt there is still one branch of wireless in regard to which the experimenter and home constructor cannot be said to be fully catered for. It is known that in the best regulated of wireless workshops, sets are occasionally made which fail to function, although everything seems to have been made in the proper way and all connections appear correct. Only experts, and frequently only a few of the experts, are able to place their finger on the real fault, which may prove of a particularly elusive nature. A well designed three or four valve set, if good components are used, is not a cheap piece of apparatus to build, and it is most disheartening to find, after the best possible work has been put into a set, that it still fails to give the results required.

Having actually tested the sets we describe we are of course in a position to say definitely that every one will work just in the way described, and it might be thought that the possession of this knowledge would prevent our taking further interest in the matter. We feel, however, that the interests of the readers are ours in every way; we have therefore made arrangements which will add still further to the service we render.

Firstly, the actual sets described in *Wireless Weekly* and *Modern Wireless* can now be seen and examined by any interested reader who cares to call at Radio Press offices. Naturally this service is limited in time, for with the number of sets produced in these two publications the office would soon be full. We have made a rule that the set described shall be on exhibition for three weeks after the date of publication of the paper in which the set is described, after which they will be withdrawn.

The Service Department

The second important addition is that we have now established a Service Department, where, for a nominal fee, readers' sets made according to our designs can be examined, tested and reported upon and defects remedied in those cases where they have failed to work. Readers of our publications are thus in the highly favourable position of knowing that the articles of a constructional nature are accurate and reliable, that they can see the sets themselves, and that, if necessary, on those few occasions when they fail to work properly the Radio Press Service Department will tell them what is wrong.

It should be unnecessary to point out that if any defects can be shown to be due to any fault on the part of our publications no charge will be made for the tests referred to.

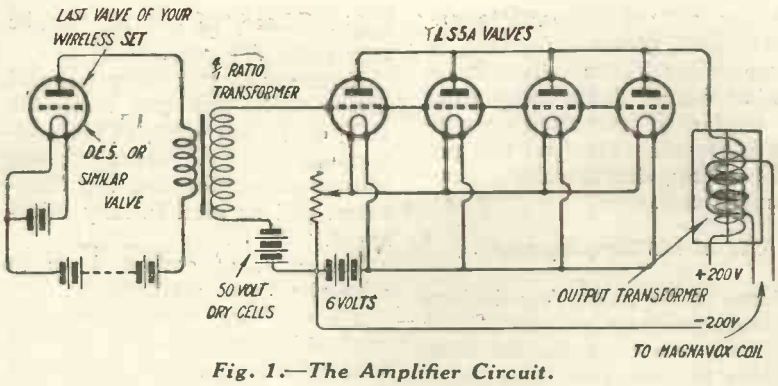


Fig. 1.—The Amplifier Circuit.

How to obtain Loud Signals.

By H. J. ROUND.

An article by one of the greatest British receiving experts giving practical details of a real power amplifier

CAPT. ECKERSLEY is always preaching quality first, but a lot of people still want a noise, and I propose to show you how to make quite a loud noise without much more distortion than you get at present.

Your wireless receiver wants to be moderately distortionless—resistance amplifiers with no reflex arrangements are usually pretty good. The loud-speaker I propose to work with is the Magnavox, and the quality out of doors will be very fair. The Magnavox principle is probably better for very loud sounds than that in use in the Amplion, as the forces and the reactions can be made more linear over a wide amplitude. This remark only applies to the principles involved, not particularly to the instruments named here.

A Curious Fact.

It is rather curious that the Magnavox principle seems to have been first conceived by Sir Oliver Lodge; that is, it is an English invention, whereas the Amplion principle is the original Bell telephone, an American invention, and yet the use in the two countries has been inverted.

Both the large and the small Magnavox will be suitable for the experiment.

The valves I propose to use are a kind I have designed particularly for the purpose. This valve is, in all particulars except the grid, a copy of the M.O. L.S.5, but this grid I have opened up until the impedance has fallen to 2,000 ohms and the "m" value to 2. The valve is called the "L.S.5.A."

A Fine Small Power Valve.

This type of valve (I mean both L.S.5 and L.S.5.A) for small power purposes is probably the finest tube in existence. Its filament is of a specially treated thoriated tungsten, apparently capable of any amount of ill-treatment, and the vacuum is extraordinary. Originally rated by the manufacturers at about 120 volts, and 4.5 volts on filament, I constantly run these valves at 500 volts with 25 watts loss at

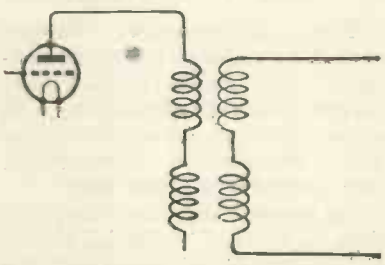


Fig. 2.—The Equivalent Circuit when using Valves in Parallel.

the plate, and the only damage seems to be bulb blackening from the nickel anode. Although the filament is rated at 4½ volts, I have run for long intervals at 7 volts on banks of the valves, and so far have not damaged a single tube.

The L.S.5 itself is an ideal valve in an amateur transmitter, and the L.S.5.A is ideal as the modulator with the L.S.5 as oscillator. These valves, after considerable use, should be handled carefully, as the filaments tend to become brittle.

The Step-up Transformer.

The one serious fault about these valves is the price. Whether this can be reduced I have no knowledge.

If the last valve of your wireless set is of the 201 A variety (M.O.D.E.5—B.T.H.B.4), then you will want a good 4/1 step-up transformer. Any valve of more impedance than this will require either less transformation ratio or some element of transformer damping. It would be much nicer if two transformers were obtainable here instead of the one. That is, a step down then step up again. The intermediate circuit then permits one to put the loud-speaker amplifier away from the wireless set. I do not think any such transformers are on the market, however.

I will now give the circuit to be used (Fig. 1), and details of the one or two parts which must be built up.

How to Make the Output Transformer.

The iron core output transformer will have to be made up, and a rough indication of the method of design will be given here.

In general the power valve system should have connected to it an effective absorbing resistance from two to three times the resistance of these valves, providing undistorted volts to the grids of the power valves are unlimited.

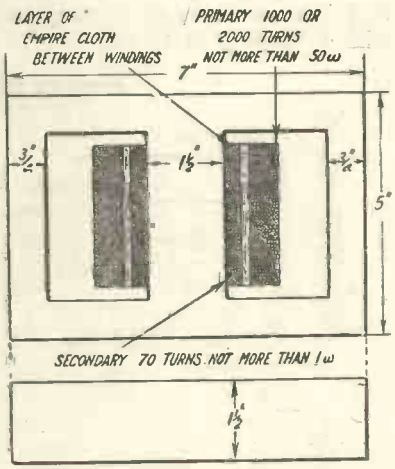


Fig. 3.—Details of the Output Transformer.

If we choose four valves in parallel, the resistance will be 500 ohms and our equivalent circuit will be Fig. 2.

It is fairly obvious that the choke should be higher in impedance at any important frequency than an assumed 1,200 ohms output resistance, otherwise it will short-circuit the lower frequencies.

Let us say at 300 cycles $2\pi nL$ should be 3,600 ohms. This gives

$$6 \times 300 \times L = 3{,}600$$
$$L = 2 \text{ Henries.}$$

If we take a stalloy core of the dimensions shown here, 1,000 turns on the central core will give about 2 Henries. These can be wound layer winding or section wound on the middle line, just as you like, and will constitute the primary of our transformer. The ohmic resistance should be kept low so as not to lose D.C. voltage.

The Magnavox Winding.

Now as to the secondary. A Magnavox winding is about 6 ohms, so that our secondary winding should be $1{,}000 \times \sqrt{\frac{6}{1200}}$ =70 turns. The resistance of the wire in this case should be less than 1 ohm. Incidentally I forgot to say that the Magnavox transforme- should be removed and leads taken directly to the moving coil terminals. These leads should be kept under 1 ohm in resistance.

In case you only want to use one-power valve, it is advisable to put 2,000 turns of primary on with a tapping at 1,000.

A lay out of a complete receiver and power amplifier is shown, but keep the loudspeaker out of doors away from the receiver if its polarising current is on, otherwise you will get bad howling, due to valve microphonic action.

Use of Milliamperemeter.

Some of the correcting devices I have previously written about* will help you to make the tone suitable to your ear.

A milliamperemeter reading up to 200 milliamperes will be very useful to watch blasting—*i.e.*, the needle should not move too much when working—and a low-resistance hot wire meter in the moving coil circuit will be handy to watch for overload of the coil —half an ampere should be the limit.

High Tension Supply.

The high-tension battery should be either a good accumulator—say, Exide 24 A.Y.G.1, 50-volt units—or the mains, with a low-resistance smoothing choke and Mansbridge condensers. Dry batteries will not last.

To prevent reaction, the negatives of the L.T. batteries should be connected, or, if using the mains for the power valves, connected through a Mansbridge condenser to prevent earthing of the mains.

The value of grid negative in general is about $\frac{H.T.}{4}$ for these valves, or for any valve about $\frac{H.T.}{2m}$ These, of course, can be very small dry cells.

If the power you can get is still not enough, you can raise the H.T. up to 400 volts, suitably increasing the grid negative; but beware of burning out the Magnavox coil or mechanically injuring it.

You will, of course, have to raise the input strength.

The milliamperemeter will also be useful for watching blasting in your amplifier, which should not distort until distortion shows in the power bank.

If you wish to connect two or three Magnavox instruments to the same set, the secondary turns will have to be altered to get the best effect. You can work them out in the same way as for one Magnavox.

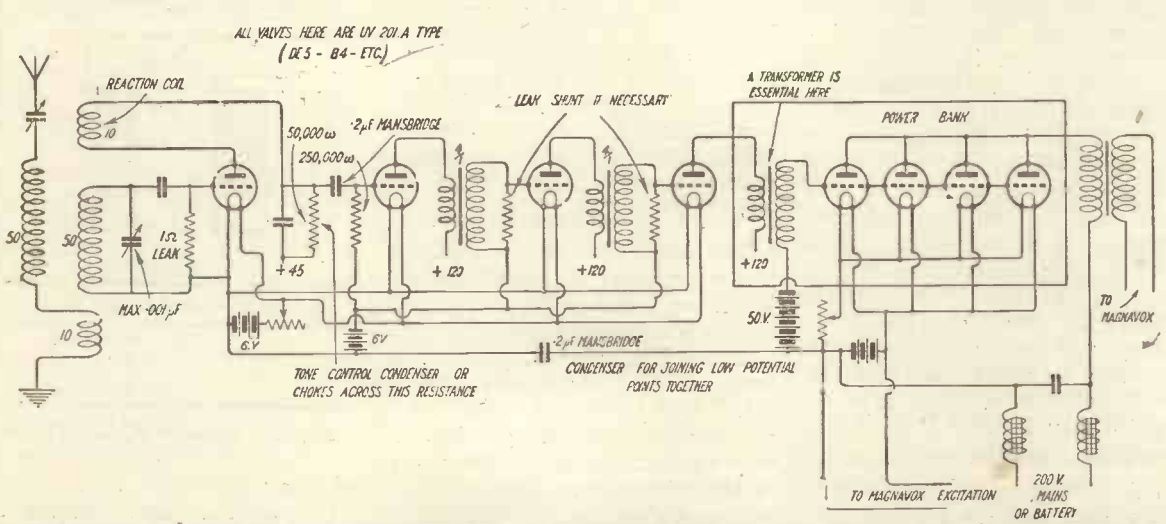
Connections for Several Loud-Speakers.

If instead of raising the voltage you wish to double the power, you can increase the number of valves to eight, decreasing the transformer primary to 700 turns.

Care should be taken in use to disconnect the Magnavox before making any changes in the set, as the loud bangs made by disconnection in the amplifier may damage the loud speaker.

A long, straight, wooden horn, say 4 or 5 ft. long and about 18 in. at the big end, will increase the volume of low tones. This can be made as a square cone with good effect. It should taper down to the Magnavox orifice in diameter internally.

**Modern Wireless*, April, 1924, issue.



Connections and details of a complete receiver. All valves should be mounted on rubber, antimicrophonically. Those who prefer may use resistance-capacity connections instead of four-to-one transformers.

GOOP-WAYFARER No. 761

Synopsis of Previous Chapters

New Readers Can Begin Now

(Professor Goop and Wireless Wayfarer, having invented the most wonderful circuit that the world has ever seen, are giving it to readers of *Wireless Weekly* in serial form. The talented authors have dealt so far with the aerial tuning inductance, the condenser which gingers it up and the leads which connect it to the set. If you have not started to construct, pull up your socks and get down to it. If you are a new reader start your career well and

BEGIN THIS THRILLING SERIAL NOW)

Vital Components

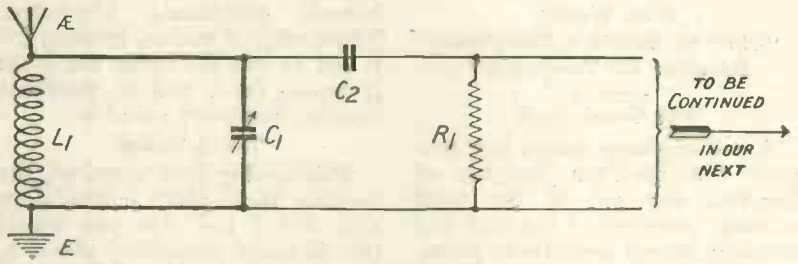
We come this week to two of the most important parts of the new Goop-Wayfarer circuit. These are the grid condenser and grid leak. A condenser is called a condenser because it does not condense; a leak, on the other hand, gets its name from the fact that it does leak. You will thus see that there is good reason for the names which we give to all our wireless parts. What would happen if a condenser did condense and the leak did not leak I cannot think, but Professor Goop is studying this problem deeply and I hope before long to tell you something of the results that he has achieved in this direction. And now the probability is you want to know something about the work done by the grid condenser. It is a hot day, and, as I have explained before, summer is not a time when a man should really be called upon to work. Still I will do my best to help you. Possibly it will save both of us trouble if I quote the explanation given by Professor Popoff in his little book "Wireless Without Tears." As the Professor has acquired by correspondence no less than seven degrees from the Postal University of Saskachumbo, Conn., U.S.A., it goes without saying that he is a man of considerable erudition, and that his words must carry weight.

And There You Are

"The grid condenser," writes Professor Popoff, "is the most important component of the wireless set (I said that, too). The way in which it functions is difficult to understand and still harder to explain. I notice that most writers of books upon wireless skate over this part in an airy way and leave the reader no wiser. Others produce bewildering masses of figures and any number of weirdly-shaped curves. But they again quite fail to make clear the purpose served by the grid condenser. I do not propose to imitate either of these types of author, and will endeavour to make the function of the grid condenser perfectly clear to all who have patience to read my little book." This is the end of the chapter on the grid condenser, and as there is no further mention of it in the book I take it that the Professor expected that very few would have the patience to peruse his immortal work. Anyhow I have quoted one of the most lucid explanations of the grid condenser's working to you, and that should be enough. If you do not now understand fully just what the thing does it might possibly be better for you to give up wireless as a hobby and to take instead to the making of wool mats or to the rearing of silkworms. Alternatively you may write to me about it, enclosing three cigarette pictures and a block of ice, and I will answer you fully when my working season comes round.

Now for the Grid Leak

Now that we have arrived at a pefect understanding on the part played by the grid condenser I can go on to explain with equal clearness precisely what the grid leak does. Its chief function is to produce atmospherics so as to give the sorely-tried amateur a good excuse for closing down when his set refuses to work. If you must buy grid leaks never purchase those of good quality, for these are apt to do their leaking in comparative silence. Go to some small shop in a by-street which displays "guaranteed 2-megohm grid leaks" at sixpence a time. A perfectly silent grid leak is most unsatisfactory, for you never know whether it is working or not. If, however, you fit a real ear-rattler there will be never any doubts on that score.



The Goop-Wayfarer No. 761 circuit as revealed to date. Addition of the grid leak R1 is described herein.

Constructional Details

It was my firm intention to tell you exactly how to make both the grid condenser and the grid leak, but, as I have remarked before, the weather is hot and I feel sure that if I did so you would be far too lazy to make them up for yourself. If, therefore, you will kindly purchase them from the little shop round the corner you will save both of us a great deal of trouble. One little difficulty seems to arise here, which is that with your natural love of truth you may find it hard to claim that these things are genuinely home made. A knotty point, I admit, for those who are not the possessors of thoroughly well-trained consciences which speak only when they are spoken to. A simple solution of the difficulty is to enclose both of them in small home-made boxes provided with terminals. Then, if you are asked the question "Is this your own make?" you may lay your finger on the box and say, with a slight shrug of the shoulders, "Oh, great Scot, yes, I made that!" If your questioner thinks you are referring to the contents of the boxes, that is his look out.

Next Week:

"How to Obtain a Telephone Receiver for Twopence"

The Great Trek

A pall of gloom hangs just now over the northern heights of London, for one of the most eminent members of the staff has recently moved from those parts, flitting, as the swallows do when they have had enough of our climate, towards the milder south. When it was rumoured that he had the intention of leaving, a deputation, headed by the Mayor wearing his chain of office and the latest thing in civic millinery, waited upon him to beg him to change his mind. They pointed out that his aerial had long been a local landmark, and that if he went the prosperous and residential area would soon become deserted. He explained, with a choke in his voice, that though his heart was in Hampstead he yet must bid them adieu. His last touching words, "I don't want to leave you, but I feel I've got to go," brought tears to every eye; but in spite of these manifestations of grief he remained adamant. Lest there should be any misunderstanding, I think that I had better tell you first of all why the move became necessary. The house which he occupied had been selected, of course, because of the admirable position which it offered for the erection of an aerial. Towering steel masts were erected and between these was slung a glorious sausage which was the envy of all beholders. Unfortunately, the garden beyond was owned by one who had a rooted dislike to aerials. To him it was an eyesore, and he resolved to blot it out from his line of vision.

Deinodendron Togoense

He purchased a sapling of the Togoland Shooter (Deinodendron Togoense) which he planted on his side of the wall quite close to the mast. The main feature about the Togoland Shooter is that it shoots. It has been known to grow at the rate of more than a foot a day under suitable conditions. The early shoots of the Shooter produced little effect, but as it more and more nearly approached the height of the mast, the wireless man's signal strength began to fall off, and there came a time when he found himself completely blanketed. There was, of course, nothing for it but to sell the house for what it would fetch and to purchase another one more suitable.

The Advance

This having been acquired, the moving took place a few days ago, and I feel that you would like to know something about it, in case you should ever be called upon to change your abode. The procession across London consisted of four pantechnicons marching in column of route with precisely the correct intervals between radiator and tailboard. The first contained the household furniture, the other three what we may call the effects. In one were packed thirty-seven wireless sets, fourteen accumulators, the steel mast, the sausage and sundry small components. The next was devoted chiefly to valves, whilst the last was stuffed to overflowing with condensers, wire and other miscellaneous bits and pieces. All went well until Westminster Bridge was reached, but here a sudden cry of anguish was heard from the owner, who was riding at the head of the procession in a Tin Lizzie. Being one of those who are always willing to help (provided that the work is not too hard), I had gone down to give a hand, and was enacting the part of rearguard mounted upon a motor scooter. Hearing the cry, I hastened to the front, brushing aside a motor bus and overturning two or three taxis as I did so.

A Terrible Moment

"What is it?" I asked, as soon as I had reached his side. "Tell me, tell me everything and keep nothing back." His sobs were so violent that I could make nothing of what he said, but at last, when I had stroked his hand for a time, he calmed down sufficiently to gasp out, "What shall I do? I have left Philip behind." "Philip?" I asked, "Philip?" "Yes, yes," he sobbed, "Philip. The light of my eyes, the joy of my heart, the most faithful grid-leak that ever man possessed." This was indeed a tragedy, and I joined him in his weeping. There was, of course, nothing for it but to go back again to rescue Philip, for goodness only knew what might happen to him if he fell into bad hands.

Back Once More

With the help of half a dozen policemen, mounted and dismounted, and amidst the cheers of the onlookers we executed the manœuvre known as right reverse—no easy business this with a column of pantechnicons on Westminster Bridge; and cheered by M.P.s who had assembled upon the Terrace to watch our progress, we made our way slowly back to the grim north in search of the missing Philip. You may imagine the emotion which racked us both as we went. I am glad to say that we found him nestling in cotton wool in his little box which had been left behind on the mantelpiece. The meeting between him and his owner was one of the most touching scenes that I have ever witnessed. Thereafter all went well. Our progress from north to south went off without a hitch. The only thing that is worrying me is that I have rashly promised to go round next Saturday to help to stick up the aerial mast. As I have remarked before, it is hot just now. . . . .

WIRELESS WAYFARER

RADIO PRESS SERVICE DEPT., LTD.

Experience having shown that many of our readers who wish to have their sets tested by the Service Dept. find it impossible to bring them during ordinary office hours, it has been arranged that the Test Dept. shall remain open until 8 p.m., and it is hoped also to remain open on Saturday afternoons when the necessary arrangements have been made. An announcement regarding this last will be made at a later date.

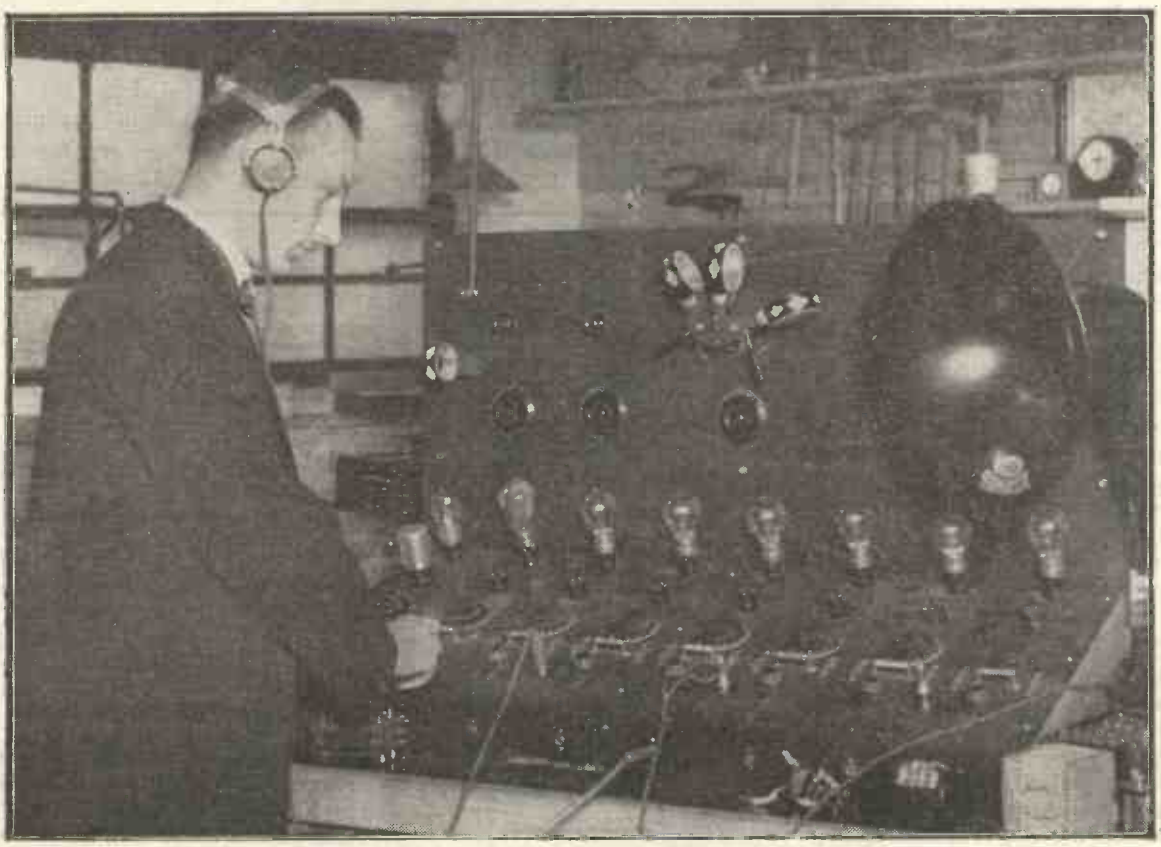
The address of the Service Dept. is Grecian Chambers, Devereux Court, Strand, W.C.2, and readers can easily locate it by looking for the entrance to Devereux Court in the Strand; it is almost opposite to the Law Courts.

The scale of charges for the testing of sets has been fixed, provisionally only, at 2s. 6d. per valve in the case of multi-valve sets, "dual" valves to be counted as two. Thus, the fee for a complete test and report upon an ST100 receiver would be 7s. 6d. For information regarding any special cases ring up Central 1497.

Radio Tests on a Train

Experiments in wireless transmission and reception carried out by the Radio Society of Great Britain on Friday, the 4th inst., on a special coach attached to a train running from King's Cross to Newcastle gave very satisfactory results. Calls from the Radio Society's station were received until broadcasting began, and at 8 p.m., when the train was travelling between Potters' Bar and Hatfield, at 60 miles an hour, the chimes of Big Ben were heard. An amateur station at Bedford was called, and when the train was near St. Neots, Bedford replied that they had heard well the train calling during the earlier part of the journey. A four-valve receiving set for broadcast had to be closed down for a time, as it was interfering with a special three-valve receiver for short-wave reception on 185 metres, but later broadcast programmes from London and Birmingham were enjoyed. The aerial used was a double length of wire 40 ft. long fixed about 18 in. below the roof of the coach. Our photograph on another page shows the interior of the experimental coach.

AN EXPERIMENTAL EIGHT-VALVE RECEIVER.



This photograph shows Mr. Bertram G. Calver of Hurlingham, with a special multi-valve set he has built. Such an instrument as this obviously requires highly skilled handling.

A Useful H.F.-Detector Receiver

By
STANLEY G. RATTEE,
Member I.R.E., Staff Editor.

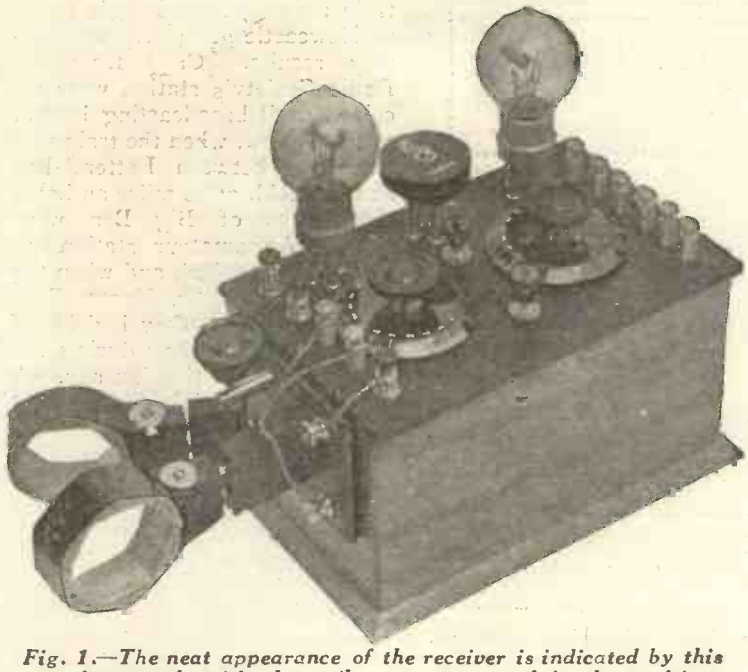


Fig. 1.—The neat appearance of the receiver is indicated by this photograph with the coils, etc., mounted in the positions as used.

OF the three possible arrangements of coupling high-frequency valves, this receiver uses the well-known transformer method, but as a departure from the more usual practice, the secondary or grid circuit is tuned in preference to the primary winding.

The circuit employed is one given by Mr. John Scott-Taggart in his "Valve Notes," Fig. 1, in the July 2 issue of *Wireless Weekly*, with the addition of constant aerial tuning.

The results obtained in S.E. London with this circuit indicate that with ordinary, careful tuning Cardiff, Bournemouth and Birmingham may be received with sufficient strength to give comfortable telephone reception, whilst with more careful manipulation Manchester and Aberdeen may also be received. With the receiver tuned to London signals are of sufficient strength to work a small loud-speaker with ample volume for a small room.

Comparative Results

Compared with the more usual two-valve circuit in which the first valve is coupled to the detector by means of a high-frequency transformer with tuned primary and the reaction coil is in series with the telephones and plate of the detector valve, the results obtained are somewhat in favour of the receiver described in this article, though the instrument calls for more skill in its operation than does the more usual arrangement.

Experimental Observations

It may be observed, in the course of experiments, that the receiver has a tendency towards self-oscillation, but with careful adjustment of the H.T. voltage and the use of a small coil for reaction, this tendency will be no more pronounced than in other circuits in which reaction is incorporated; provision for the use of a small reaction coil is obtained by means of constant aerial tuning as advocated in the "Valve Notes" referred to above.

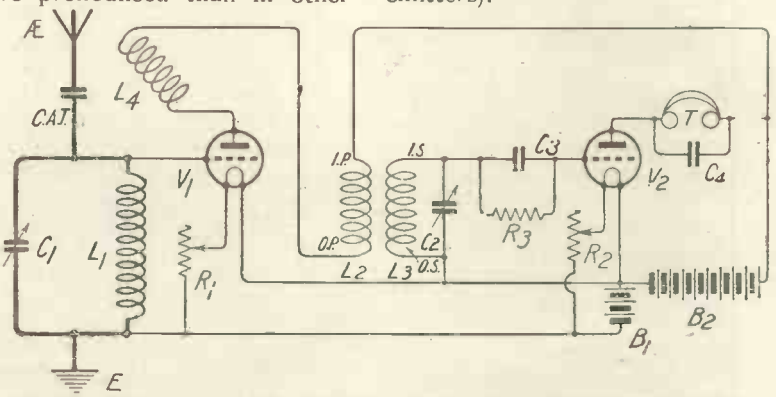


Fig. 2.—The circuit of the receiver. Note that constant aerial tuning is employed.

Components

The receiver as illustrated is made up of the following components, and though no special manufacture of these is advocated, the values must be strictly adhered to:—

1 ebonite panel measuring 9 in. by 5¾ in. by ¼ in.
1 0.0005 μF variable condenser.
1 0.0003 μF variable condenser.
1 0.0001 μF fixed condenser.
1 0.0003 μF grid condenser.
1 0.002 μF fixed condenser.
1 2 megohms grid leak.
2 Lissenstat minors.
3 valve-holders or, alternatively, 12 valve-socket pins.
11 terminals.
1 H.F. plug-in transformer to cover the wavelengths desired.
Set of plug-in coils for the wavelengths desired.
1 two-coil holder.
1 60v. H.T. battery.
1 accumulator (6v. for bright emitter valves or 4v. for dull emitters).
Quantity of tinned copper for connecting purposes.

The Circuit

The circuit arrangement of the receiver is the same as that given in Fig. 1 of "Valve Notes" in the July 2 issue of this journal, with the exception that constant aerial tuning is added, and for

A Broadcast Receiver in which reaction is obtained by the little-used method recently described in "Valve Notes."

the guidance of new readers the modified circuit is given in Fig. 2.

The reader who has little experience of sensitive circuits would do well to first lay out his components upon the table and then roughly connect them up as shown, and so assure himself that he understands the circuit before making positive connections with solder.

This method will, in the event of a misunderstanding of what is required, make itself manifest before time in careful workmanship has been expended. Further, this rough lay-out of components will make the finding of any fault an easier and less tedious occupation.

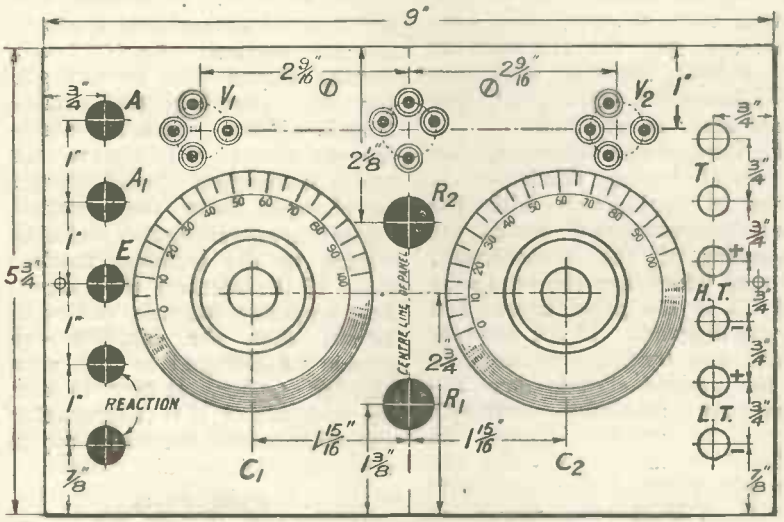


Fig. 3.—The layout of the panel, showing dimensions and purposes served by the various terminals.

The Panel

This is made from the ebonite appearing first in the list of components and is drilled in accordance with the instructions given in Fig. 3.

There are now on the market certain makes of ebonite which, besides having a glossy finish, are guaranteed to be free from surface leakage, and readers when buying ebonite should assure themselves whether or not the material purchased bears that guarantee. In cases where this specially prepared ebonite is not supplied, then the panel must be subjected, after the drill holes have been made, to a thorough rubbing on both sides with fine emery cloth in order to remove any impurities which may be embedded in the surface as a result of the tinfoil treatment which constitutes a part of the manufacture of most ebonite.

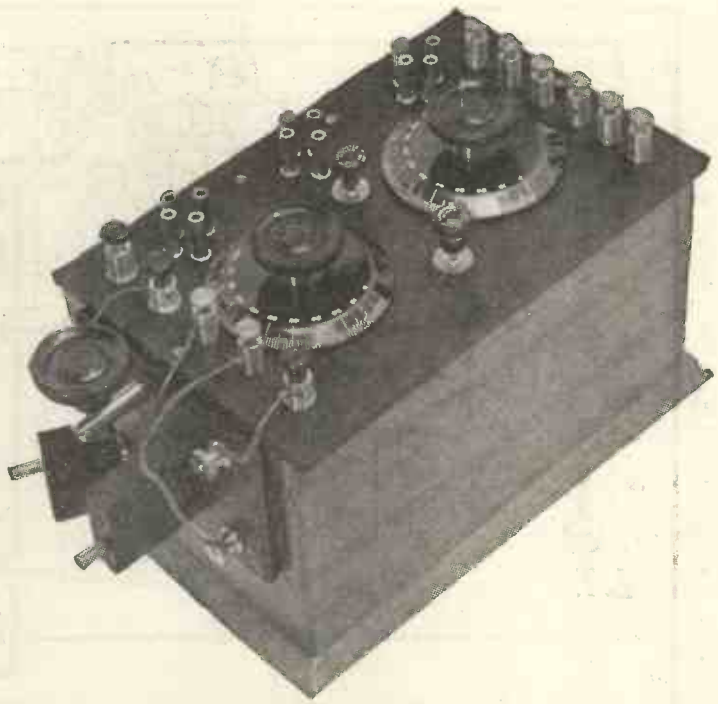


Fig. 4.—Illustrating the disposition of the parts upon the panel, the coils, valves, etc., having been removed for clearness.

Wiring Up

The wiring of the receiver may be seen in the photograph, showing the underside of the panel, and may be more clearly followed in the practical wiring diagram given in Fig. 5. It will be observed that stiff wire is used for connecting purposes, but in cases where readers prefer to use the somewhat easier method of soft wire and insulating sleeving there is no reason why this latter method should not be used so long as all leads are kept as short as possible and are well spaced.

H.F. Transformer Connections

The connections to the H.F. transformer are given in the wiring diagram to give satisfactory results with the transformers tried, namely, a McMichael, Ediswan and Formo, but it may be found that with other makes of transformers these connections may vary, and in any case before finally connecting the receiver the practice of changing over the connections should be tried, meaning IP or OP to plate IS or OS to grid.

Whilst on the subject of transformers, it is interesting to note that I was recently informed by Mr. Percy W. Harris that even with a given make of transformer one could not be sure of

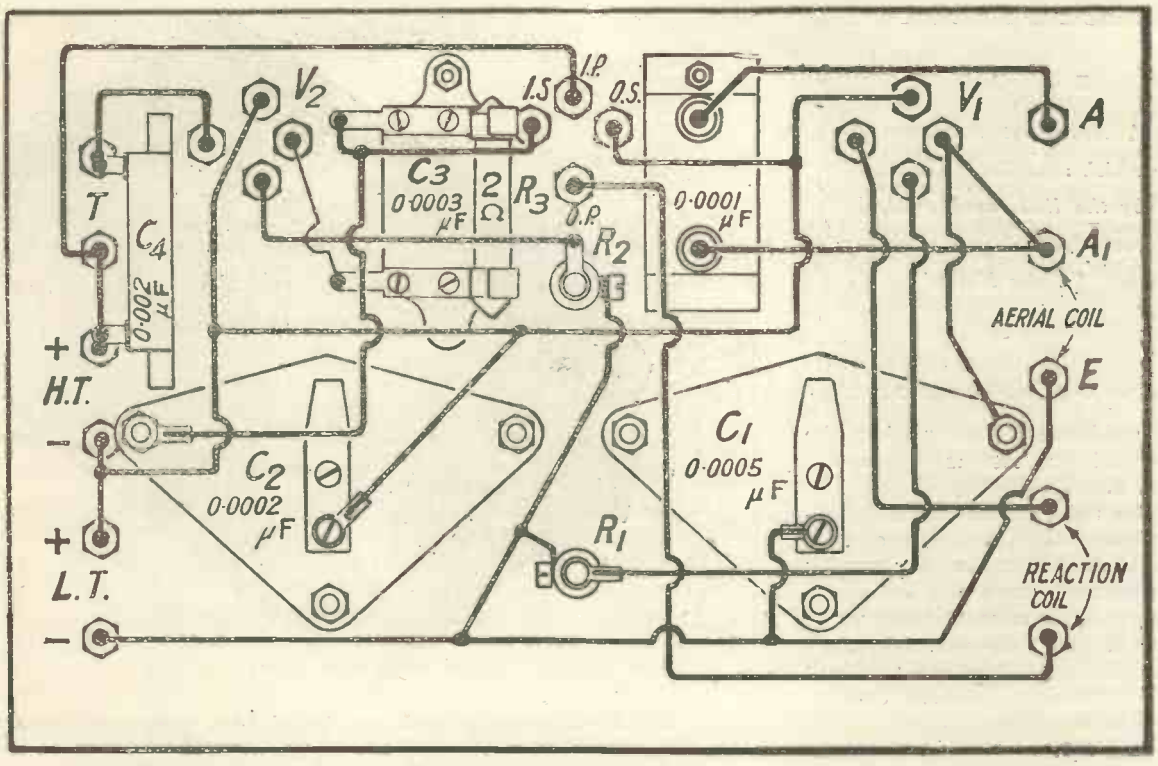


Fig. 5.—Practical wiring diagram, the values of the condensers, etc., being shown.

one transformer being the same as another, and, as an illustration of this fact, he pointed out that with two transformers of the same make one was wound clockwise whilst the other was wound in the opposite direction!

Coils for B.B.C. Wavelengths

The operating of this instrument is much the same as when using any other H.F. detector combination, with the exception that with this receiver a little more careful manipulation is called for to obtain the best results.

For the reception of the B.B.C. stations using wavelengths up to 420 metres the aerial should be connected for constant aerial tuning—that is, to the terminal marked A in Fig. 3, and the earth should be connected to the terminal marked E. A No. 50 plug-in coil should be inserted in the aerial coil socket and a No. 25 coil in the reaction coil socket.

Operating the Receiver

The aerial and reaction coils should be turned to a right angle position and the H.T. battery connected. Plug a suitable H.F. transformer into the middle valve holder, and light the valves to a suitable degree of brilliance; it should be noted that the average H.F. transformer for broadcasting is wound to cover wavelengths from 300 to 600 metres with a .0003 µF condenser, so for the reception of the B.B.C. stations excluding the 1,600-metre station only one transformer is required.

To tune to the desired station the aerial tuning condenser is varied in conjunction with the condenser connected across the secondary of the transformer, both of which are shown as C1 and C2 in the panel layout and wiring diagram. If the receiver shows any tendency to oscillate as the desired signals are approaching maximum strength the H.T. voltage should be reduced to about 50 volts and the set retuned for the best results. With the maximum signal strength obtained in this way the moving coil should be brought nearer to the fixed coil, taking care that the set is not made to oscillate, and slight adjustments made on the condensers C1 and C2.

For the reception of the B.B.C. stations with wavelengths above 420 metres the operation is precisely the same, but using in the aerial socket coil No. 50 or 75 and coil No. 25 for reaction.

The 1,600 m. Station

For the new B.B.C. station on 1,600 metres the aerial coil should be a No. 150 (without constant aerial tuning) and a 100 or 150 for reaction whilst the transformer should also be changed for one covering that wavelength. When receiving wavelengths above 600 metres the aerial connection should always be changed from the constant aerial tuning terminal A and connected to the terminal marked A1. If the receiver then shows any tendency towards self-oscillation, then the reaction coil should be changed to an even smaller number. It may, in fact, be understood that the smaller the reaction coil the less likely is self-oscillation to take place.

Radio Paris

For the reception of Radio Paris the same transformer and coils are used as in the reception of the 1,600-metre station. On indoor aerials, however, one size larger aerial coil may be needed for these longer waves.

Valves

It may be taken that any general-purpose receiving valve may be used with this receiver, and since suitable filament resistances are fitted these remarks

also cover the range of dull-emitting valves. Care must be taken when using this receiver that no excess of H.T. voltage is applied to the plates of the valves, otherwise the operator will experience considerable difficulty in obtaining that fine adjustment of reaction which is so desirable in the reception of distant stations.

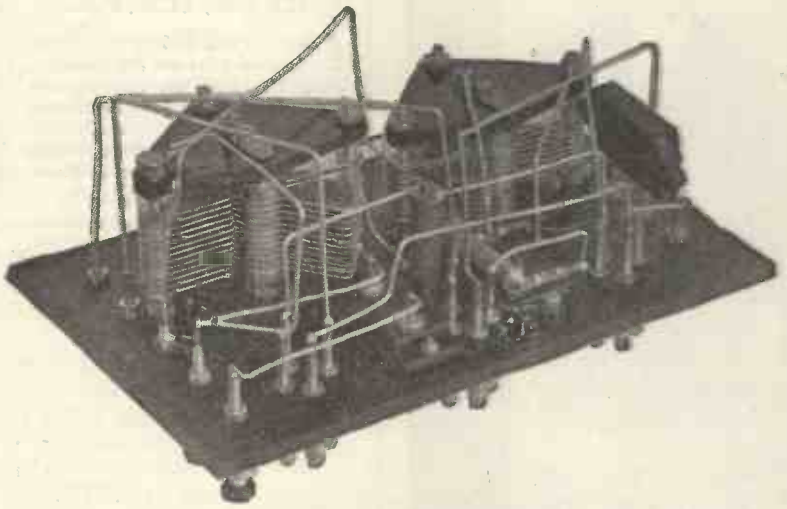


Fig. 6.—The underside of the panel, the terminals on the left being A, A1, E and Reaction.

Test Report

It is interesting to note that when first testing this receiver after completion, using a No. 50 coil in the aerial, with a No. 25 for reaction, 50 volts H.T., and constant aerial tuning, the first station picked up was Cardiff. After a careful searching the stations mentioned in the beginning of this article were also received the same evening. Tested on a different aerial in S.W. London, the same results were obtained, the tuning being much the same in its operation as when using the first aerial.

As an interesting two-valve receiver for the man who is careful in his operation, the set described is worthy of construction.

Full-sized Drawings

For the guidance of those readers, who, desirous of making this receiver, prefer to work from full-sized drawings, blueprints of the practical wiring diagram may be obtained.

When applying for these blueprints application should be made to the offices of Radio Press, Ltd., quoting Blueprint No. 55, and enclosing 1s. 6d.

□ □ □

How to Hear 5XX

The following is taken from a leading evening newspaper:—

"With the majority of crystal sets a variable condenser used in series—that is, in line between the aerial and the set—will enable the owners to tune in Chelmsford without any great trouble.

"In any event the use of a variable condenser should bring in the powerful broadcasting from this station with almost the strength of a one-valve set."

In case any readers should have tried this and failed, it should be pointed out that the condenser should be in *parallel* and not in series as suggested in our contemporary. In any case some crystal sets will not have enough inductance to reach the wavelength even with a condenser.

□ □ □

A Useful Tool for the Amateur

ONE of the handiest little tools that the amateur can obtain is the automatic centre punch, which saves an immense amount of time in marking out panels and also makes for great accuracy in centring. It consists of a holder within which is a spring-and-striker mechanism not unlike that contained within the bolt of a rifle. The holder contains also a steel rod, at whose outer end is a fine punch point. The tool is extremely easy to use. One simply places the punch point upon the mark where it is desired subsequently to drill a hole, and presses the handle downwards. During the movement of the handle under pressure the striker is carried upwards, compressing the spring. The compression continues until a tripping piece is reached, which releases the spring and causes the striker to be driven hard down upon the head of the pointed rod. In use, one, of course, sees nothing of its action, all that happens is that the handle is pushed downwards until a sharp click is heard. The tool is then lifted and a punch mark appears upon the panel. With one of these little tools one can punch-mark a large panel with the utmost accuracy in two or three minutes. R. W. H.

LATE NEWS

In connection with the article entitled "The Fascination of Continental Broadcasting," we learn as we go to press that the wavelength of the Ecole Superieure des Postes et Telegraphes has now been changed to 385 metres approximately.

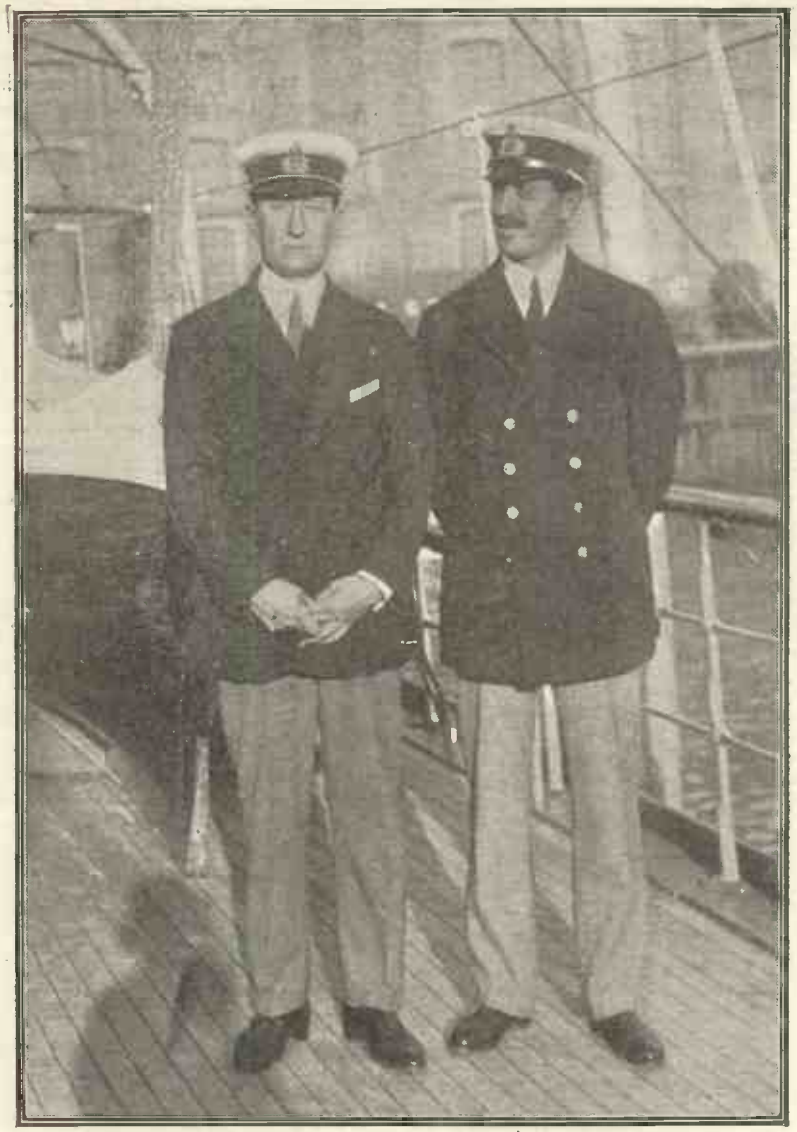
This change is probably temporary.

Beam Wireless

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

A Paper read before the Royal Society of Arts on Wednesday, July 2, 1924, on results obtained over very long distances by short wave directional wireless telegraphy, more generally referred to as the beam system.

(Continued from page 298.)



Senatore Marconi, on left, on board his yacht "Elettra," on which these famous experiments were carried out.

THE great value of the reflectors was demonstrated by average measurements made, which showed that the value of the energy received when both reflectors were used was 200 times that of the energy that could be received without reflectors.

In April, May and June of last year a series of long-distance tests were carried out under my direction between a small experimental transmitting station at Poldhu in Cornwall and a receiver installed on the S.Y. "Elettra."

The Arrangements at Poldhu

Mr. C. S. Franklin was responsible for most of the design and operation of the transmitting arrangements at Poldhu, and Mr. G. A. Mathieu was in charge of the receiving apparatus on the yacht, where I also was present during the whole of these tests. Mr. Mathieu was able to make some valuable calculations based on the observed results, especially in regard to the absorption or attenuation of the waves brought about by sunlight.

The principal objectives of these tests were :—

(1) To ascertain the reliability of signals transmitted on approximately a 100 metre wave over considerable distances with or without making use of a transmitting reflector.

(2) To investigate the conditions which affect the propagation of short waves, and to ascertain the maximum reliable ranges obtainable by day and by night in respect to the power and wavelength employed at the sending station.

(3) To investigate and determine the angle or spread of the beam of radiation when employing a transmitting reflector, especially with regard to the possibility of establishing long-distance directional wireless services.

During the tests carried out on the S.Y. "Elettra" no receiving reflector could, of course, be employed, and it will therefore appear obvious that the strength of the received signals and the ranges covered must have been considerably less than could have been obtained had it been possible to use a fixed receiving station equipped with a suitable reflector.

Present Impressions

Up to the present time the general impression prevailing amongst most technical experts in regard to the behaviour of short waves is, I believe :—

(1) That their range during day time is variable and short.

(2) That the night ranges are exceedingly variable and freaky, with a great deal of fading, and altogether too unreliable to allow of the carrying out of commercial work.

(3) That any considerable amount of intervening land or mountains very seriously reduces the distance at which it is possible to communicate.

The tests carried out between Poldhu and the "Elettra" proved by the definite results obtained that the above impressions or

assumptions must be erroneous, at least in so far as they may concern waves of about 100 metres long, for we observed :—

(1) That the day ranges proved to be reliable and not inconsiderable.

(2) That the night ranges were much greater than anyone, myself included, had anticipated, and no doubt very considerably exceeded the maximum distance to which I was able to proceed on the yacht.

(3) That intervening land and large portions of continents do not present any serious obstacle to the propagation of these waves.

In carrying out these tests we discovered that it is by no means correct in dealing with these waves to refer to distances covered during daylight as day-ranges, as the strength of the signals which can be received during the hours of daylight varies definitely and regularly in accordance with the mean altitude of the sun over the space or region intervening between the two stations.

Daylight Effects

This discovery, based on the observed results, makes it safe to infer that our tests, which took place mainly during the months of May and June, and partly within the tropics, were carried out at the most unfavourable time of the year for daylight transmission (as the sun reaches its maximum altitudes during June in the Northern Hemisphere) and over what is a most difficult region on the West Coast of Africa.

The Austin Formula

Perhaps one of the most remarkable scientific results of the experimental work carried out on my yacht was to ascertain quite definitively that the coefficient of the well-known Austin Formula for the propagation of the waves was defective when applied to short wave phenomena.

It will be remembered that this absorption factor is an exponential of the form $e-x$, where x the negative index is given by Austin as the product of a Constant multiplied by the ratio of the distance between the stations and the square root of the wavelength used.

Slightly modified values for that constant have been suggested by several scientists during recent years, and a different value has also been suggested for daylight and night communication.*

The results of our measurements and observations are that for short waves of the order of 100 metres this constant must be replaced by a variable, which is a a linear function of the mean altitude of the sun calculated on the great circle track between the two stations.

In other words, the coefficient of absorption is a function of the time, the seasons and the relative geographical situation of the stations, and can now easily be ascertained for wavelengths of the order of 100 metres.

Our tests obviously showed that short waves behave quite differently in their propagation from long waves, and that the weak period at sunset and sunrise followed by a recovery in signal intensity observed with the long waves over great distances, is not true in the case of short waves.

Short and Long Waves

It is also obvious that there is probably no sharp limit between short and long waves, and that the change in the behaviour of short waves, of say 100 metres, and that of the long waves of, say 10,000 metres, may follow a slow process of transformation.

Very likely over very long distances as the wavelength increases there may be a tendency for the signals to recover progressively during the period of no signal, for short waves, and this may form the object of further very interesting investigation.

In regard to the x's (or atmospheric disturbances) these usually appeared to be, during day-time, less severe than those experienced when working with the longer waves up to now employed for practical radio telegraphy.

Night-time Reception

During night-time, even when receiving at St. Vincent, which is situated at 2,230 nautical miles from Poldhu, and well within the tropics, the strength of received signals was so great that absolutely none of the x's or atmospherics which we there experienced ever approached being able to interfere in any way with the reception of signals or messages from England.

During the tests to the "Elettra" on 97 metres wave the Poldhu transmitter consisted of 8 glass valves (standard M.T.2) worked in parallel, the input to the valves being 12 kws. The radiation from the aerial was approximately 9 kws. The parabolic reflector concentrated the energy towards Cape Verde and gave a strength of field in that direction which would have required a radiation of approximately 120 kws. from the aerial without a reflector to produce the same effect.

S.Y. "Elettra"

For the purpose of the experiment a special receiver with independent aerial was installed and added to the wireless gear of the "Elettra."

The receiving aerial was a vertical wire, the top of which was at a height of 20 metres above sea-level.

The receiver consisted of an aerial circuit, a closed condenser intermediate circuit, a frequency changer, two high-frequency tuned amplifications, and an autoheterodyne detecting valve to which could be added two stages of low-frequency amplification.

After carrying out a few preliminary tests in Falmouth Harbour on April 11, the "Elettra" sailed for Cape Finisterre (Spain).

(To be continued)

* Based on the so-called night effect which I discovered early in 1902. (See *Proceedings of the Royal Society*, Vol. LXX, by G. Marconi, June 12, 1902.)

KING'S SPEECH TO BE BROADCAST

The opening of Liverpool Cathedral on July 19 will be exceptional in that the ceremony is to be broadcast, and thus listeners-in will again have an opportunity of hearing their Sovereign's voice. Commencing at 11.50 a.m., there will be an organ solo, followed at 12 noon by the reception of the King and the clergy. Next comes the King's reply. This will last until 12.20. At three o'clock the consecration service will take place, when an address will be delivered by the Archbishop of York. This will be followed by the dedication.

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

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

WITH reference to my notes in the previous issue, I am glad to say Messrs. Peto & Radford, the well-known accumulator makers, have now written to me regarding the use of Hudson's soap as a preventative of frothing. Their letter was reproduced in last week's issue, so I need not quote it here. It is interesting to note that, according to Messrs. Peto & Radford's opinion, no ill-effects will occur by the application of this soap, and they themselves have used it. I still continue to receive appreciative remarks from readers on this subject, and in every case so far the application of this soap powder has proved a cure.

* * *

I have just been carrying out a most interesting series of experiments which I am sure will surprise the great majority of our readers, particularly those who do not believe the theory which I have preached so consistently for many months, that the actual physical dispositions of the parts of a receiver has a good deal to do with its efficiency. Perhaps the simplest way to tell the story will be to describe just how I stumbled across the effect I am about to describe.

* * *

I have, I suppose, in my study about twenty different makes of intervalve transformers, ranging from some very cheap specimens up to the most expensive on the market. In getting together data for a book, I recently tested a number of transformers in a particular circuit, the apparatus being so arranged that the rapid change from one transformer to another could be made. As the experiment involved changes in both primary and secondary connections, the transformers were not wired up to a switch.

I was testing on loud Morse signals, and had already disconnected the secondary of one transformer and connected the leads to another (the primary leads of the first transformer still being in place), when I found that signals were still coming through! A glance at the apparatus showed that the detector valve was connected to the primary of one transformer, while the note-magnifying valve was connected to the secondary of another, the two transformers being several inches apart. A few minutes thought showed that the coupling which existed between the two valves could only be in a few places, *i.e.*, in the stray field upon the first transformer to the second, coupling due to the use of a common high tension battery or coupling due to long straying leads. Signals were still audible, although weak, when the transformers were separated as much as eighteen inches. I could not pursue the experiments at the moment, so put them by for a few days.

* * *

The need of preparing these notes for the present issue led me to think that I might spend an hour or so on further tests in this direction, and I have just completed them. Summarised, the results are as follows:—

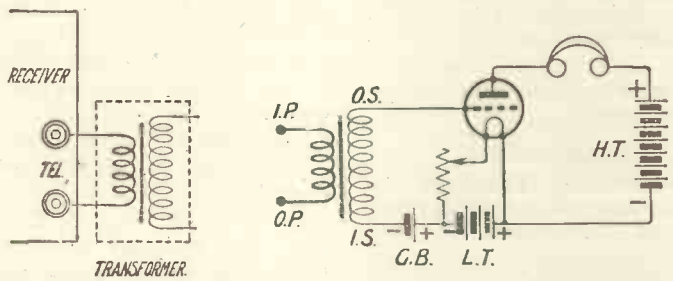
(1) The field of an intervalve transformer and its leads is sufficiently strong to influence another at a distance of 15 to 18 inches, even when the shortest possible leads are used for both pieces of apparatus and when *separate L.T. and H.T.* are used.

(2) Whilst there is a difference in degree of coupling when we change the angular relations of the two transformers, there is still enough coupling at a distance of a foot or so to give signals at any angle.

(3) I could distinguish very little difference in coupling between transformers which have no shielding and those which are claimed to be perfectly shielded.

(4) That transformers vary in the sharpness of the minimum which can be found, the shielded types seeming to have more uniform distribution of field and far less difference between minimum and maximum than is the case with any unshielded type.

(5) That connecting the two cores together and to earth does not in any way reduce the effect referred to.



Showing the relative positions of the two sets and their connections to the transformers.

With these few facts to consider, readers should have something to think about. Those kind friends who imagine that I am suffering from the results of overwork are invited to try the experiments for themselves. Any set which normally will give moderate loud-speaker effects on the local broadcasting station, with its output terminals connected to the I.P. and O.P. of one transformer and the I.S. and O.S. of the second transformer connected to a note-magnifying valve in the usual way, will quickly show you that a pair of "shielded" transformers, 10 in. apart, will pass just enough energy for you to hear the speech or music in an amplifier. You will find the effect, whether you use separate H.T. and L.T. or common H.T. and L.T.

N.P.L. Calibration Waves

A PROGRAMME of standard waves is now being transmitted from the National Physical Laboratory W/T Station, Teddington. These transmissions are of accurately known radio frequencies covering the range between 60 kc/s and 360 kc/s (kilocycles per second).

The transmitting system consists of a master valve oscillator operated entirely on batteries and arranged to permit of fine smooth adjustment of the frequency of the oscillations generated.

This master oscillator serves to feed the grid-filament circuit of a power valve set operating on an anode potential of 2,500 volts. The aerial and an adjustable aerial inductance coil, together with an open scale small condenser, form an oscillatory circuit in the anode circuit of the power valve.

By this arrangement the variations in the aerial capacity or other conditions in the power valve circuit are rendered of almost negligible effect on the frequency of the waves transmitted.

The adjustment of the frequency of the transmitted waves is made as follows :—

The waves are received into the amplifier of the standard multivibrator wavemeter, and produce an interference tone with the selected harmonic of the multivibrator representing the frequency under transmission. This interference tone is conveyed by telephone wires to the transmitting hut. The master oscillator frequency is then adjusted—with a power circuit also in operation—until the interference tone is reduced to beats of one or two per second. The minute changes in frequency during the transmission of a dash are continuously corrected by adjustment of the small variable condenser shunting the aerial. This method of adjustment forms a very sensitive means of holding the frequency constant.

The steadiness of frequency normally attained is of the order of ± 3 cycles per second at a frequency of 360 kc/s, and at a frequency of 60 kc/s it is of the order of 0.5 cycles per second.

The absolute accuracy of the frequencies is determined entirely and only by the tuning fork controlling the standard multivibrator wavemeter. The average frequency of the tuning fork is within 2 parts in a hundred thousand of its nominal value of 1,000 cycles per second. The variations of frequency of the fork are comprised within a belt of ± 2 parts in a hundred thousand.

The maximum probable error in the frequency of the transmitted wave is therefore about ± 5 parts in a hundred thousand. and the mean probable error is of the order ± 2 parts in a hundred thousand.

The present programme of transmissions is as follows—

Time, G.M.T.	Frequency kc/s.	Approximate Wavelength.	Indicating Group.
15.00–15.03	360	833	N1
15.08–15.11	280	1,072	N2
15.16–15.19	200	1,500	N3
15.24–15.27	180	1,667	N4
15.32–15.35	120	2,500	N5
15.40–15.43	100	3,000	N6
15.48–15.51	75	4,000	N7
15.56–15.59	60	5,000	N8

The programme will be transmitted in the following form :—

At 14.58 G.M.T. CQ, CQ, CQ de5HW 5HW 5HW repeated for 2 minutes at a frequency of 360 kc/s.

From 15.00 to 15.03 { N1 N1 N1———20 sec. dash———transmitted 6 times altogether. The aerial current will then immediately be transmitted on the same frequency and will be given twice. The wait signal.—.—. will then be given.

Five minutes interval.

From 15.08 to 15.11 { N2 N2 N2———20 sec. dash ———transmitted 6 times. The aerial current. . .

During the five minutes interval short dashes will be heard whilst exact adjustment of the next frequency is being made, but they are not to be considered as part of the programme.

The effective height of the aerial is of the order of 25 metres, and the aerial current varies from about 5 amperes at 360 kc/s to about 2 amperes at 60 kc/s.

Transmissions take place on alternate Tuesday afternoons.

The Radio Society of Great Britain

THE Society has received a communication from the Swedish Radio Exhibition, Gothenburg, inviting British Amateurs to take part in the Exhibition, to be held in Gothenburg during the period of the Swedish Fair, August 4 to 10, 1924. The promoters are particularly anxious to enlist the support of British experimenters, some of whom, they hope, will be disposed to send radio apparatus, circuit diagrams, photographs or other articles of interest connected with the science of radio.

In an endeavour to encourage amateurs to send apparatus, the exhibition authorities are offering several trophies, which can be competed for by foreign amateurs, including, of course, British. They further offer to insure all apparatus exhibited, and state that the only charges which exhibitors are asked to meet, will be the freightage costs to and from the exhibition.

Any members of the Radio Society of Great Britain who desire further information on the matter are invited to communicate with the Honorary Secretary of the Society, 53, Victoria Street, S.W.1, or, if they wish, direct with Mr. Bertil Lind, 14, Garlinge Road, West Hampstead, N.W.2, who is the London representative of the Swedish Exhibition Authorities.

A Cancelled Meeting

The ordinary meeting of the Radio Society of Great Britain intended for Wednesday, July 23, 1924, at the Institution of Electrical Engineers is cancelled.

ADDRESSES WANTED.

Will Messrs. P. Saunders and James Baker please advise our Sales Dept. of their respective addresses?

Valve Notes

By

JOHN SCOTT-TAGGART,

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

Fine Adjustment of Reaction

FAR more depends upon the fine adjustment of reaction for long-distance reception than most people imagine. In the case of many sets the adjustment is crude in the extreme, and the only real method of adjusting the degree of reaction is by detuning after the circuit has been made to oscillate, and this, of course, is a most undesirable procedure.

An idea which may be very simply carried out is that illustrated in Fig. 1.

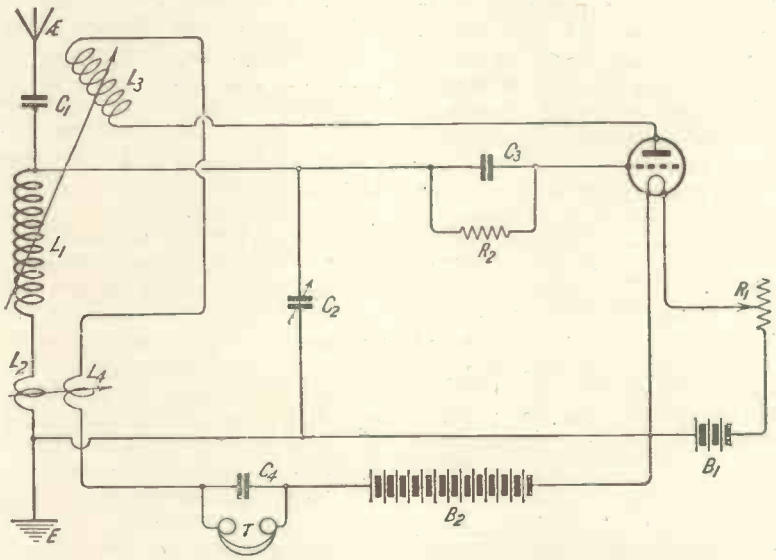


Fig. 1.—An arrangement of reaction control by which a very fine adjustment is obtained; a vernier effect being given by varying the coupling between L2 and L4.

Vernier Control

In this circuit the main inductance L1 has coupled to it the main reaction coil L3, but in addition we have two small inductance coils L2 and L4. The adjustment between L2 and L4 is normally kept medium, so that by increasing or decreasing the coupling between L2 and L4 a so-called vernier adjustment of the reaction is possible. The coupling between L1 and L3 should be such as to produce a reaction effect, but the coupling between L2 and L4 may be arranged to give either a reaction or a reverse reaction effect.

The coils L2 and L4 should, of course, be very small, and should preferably be smaller coils than the No. 25 plug-in type. The new coils now on the market for 100-metre work would do quite well when the wavelengths to be received are between 300 and 500 metres.

A Modified Arrangement

A modification of the Fig. 1 scheme is illustrated in Fig. 2. This simpler arrangement may be used with a three-coil holder, and it will be seen that the small reaction, or reverse reaction, coil L4 is now coupled to the main inductance L1. Various modifications and combinations are possible using this idea.

A Different System

A different system for controlling reaction is that illustrated in

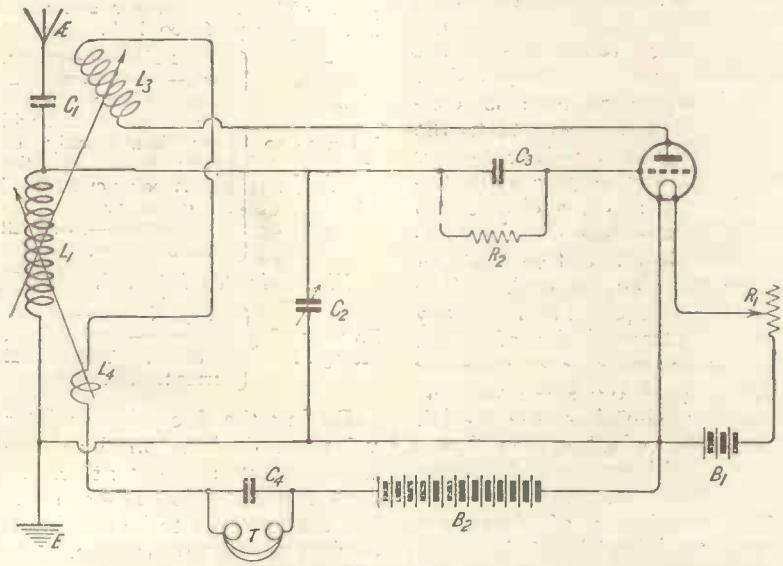


Fig. 2.—Another arrangement in which a similar control may be obtained using a three-coil holder.

Fig. 3. The degree of reaction is now varied by inserting a resistance R_3 in the grid circuit of the valve, shunted by a variable condenser C_3 of very small capacity. The resistance L_3 may have a value of almost anything above 100 ohms—a gridleak will do. The use of a variable condenser here will make very little difference to the tuning of the main circuit, which is always one of the troubles when varying the reaction. A disadvantage of this arrangement is that it is liable to be affected by small incidental capacities, such as hand capacities.

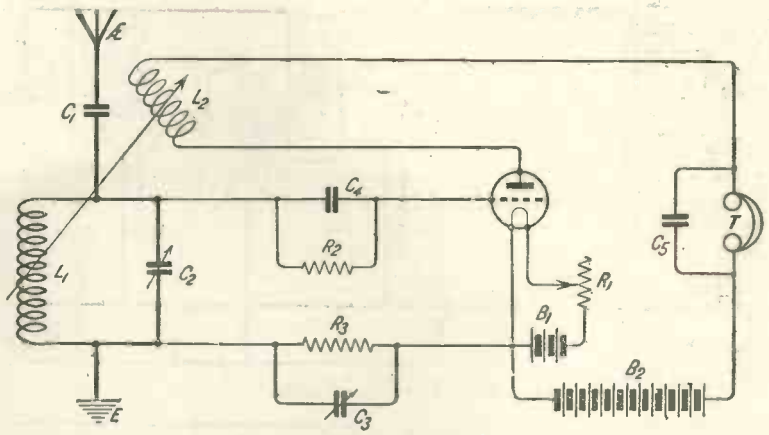


Fig. 3.—The inclusion of R3 and C3 in the grid circuit will give a fine adjustment, but is liable to be affected by hand capacities.

Ebonite Making at Siemens' Works

Ebonite is made of pure rubber and ebonite dust worked together between rollers. After this it is calendered into sheets and wound upon wooden mandrils between calico (as shown on the right of the illustration). The plastic sheet from the mandril is then plied up to the required thickness and cut into sheets of standard length, after which a sheet of metal foil is placed on either side, and it is rolled down (shown in the background) so as to exclude all possibility of air bubbles. In this form the sheets are stacked in the vulcanisers, where they remain for several hours. After vulcanisation the sheets are allowed to cool and the metal foils are stripped off. It sometimes happens that sheets so made have a conductive surface, and this manufacturing surface, or foil surface as it is called, should always be removed on ebonite used for electrical work. Sheets can be supplied with the foil surface removed on a machine specially installed for the purpose, pumice powder being the abrasive used, with water.

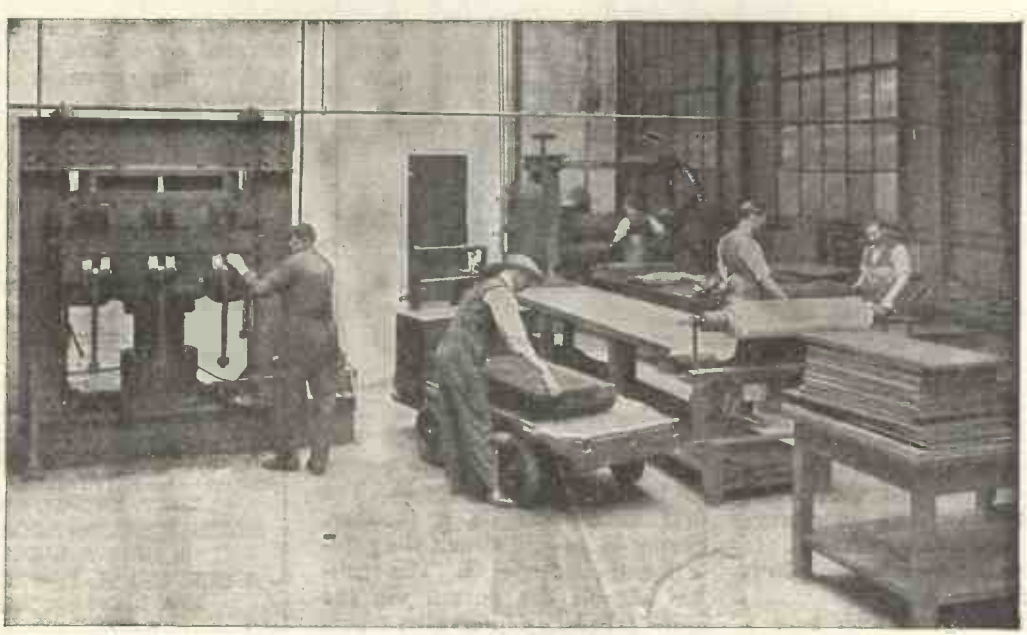
WHO WILL HELP THIS READER?

SIR,—I wonder if you would be kind enough to find me amongst your readers someone to correspond with who is interested in radio. I spent several years in England, and should very much like to hear from someone in "The Old Country." At present I am a radio operator in the Army, but at the same time am a keen amateur.

Yours faithfully,

H. M. BOUCHIER.

Headquarters Company,
34th Infantry,
Camp Meade,
Maryland, U.S.A.



Our photograph shows the rolling of ebonite between calico.

Practical Back-of-Panel Wiring Charts

By OSWALD J. RANKIN

A Detector and Note Magnifier Circuit.

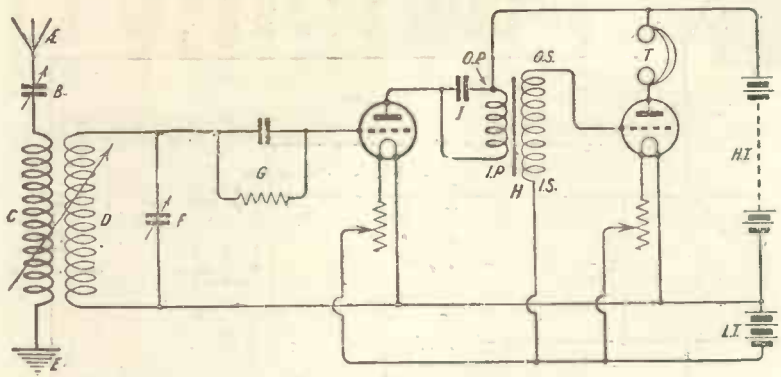


Fig. 1.—The circuit.

The aerial circuit is tuned by the coil C and variable condenser B, which is in series with the coil. The coil D, which is shunted by the variable condenser F, forms the closed or secondary circuit, the two coils C and D being coupled together. Greater selectivity is obtainable by this method than by the more usual single coil aerial circuit.

Owing to the fact that both the aerial and secondary circuits must be exactly in tune to the incoming signal, in order that the latter may be heard, careful tuning is necessary on both the variable condensers if the best results are to be obtained. Close coupling between the two coils will give the loudest signals from any given station, but when the coils are slightly separated the selective property of the circuit will be observed, as interfering stations can be reduced in strength without seriously affecting the desired signals.

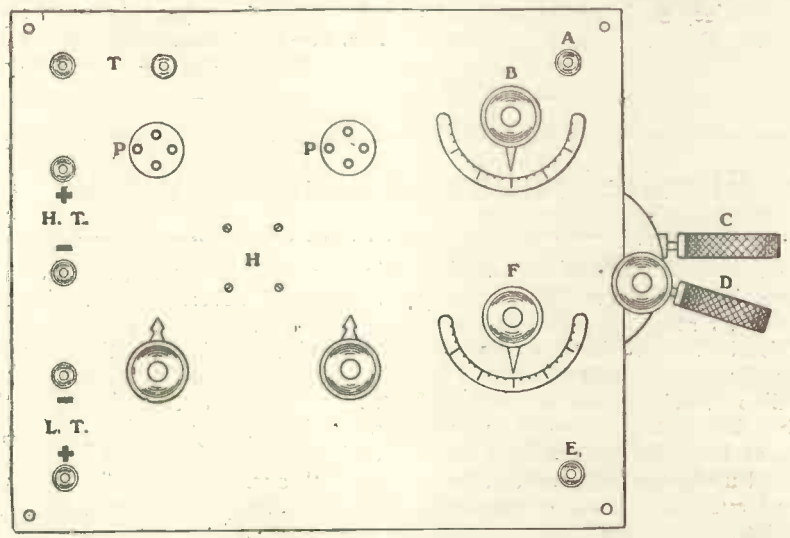


Fig. 2.—The lay-out of the panel.

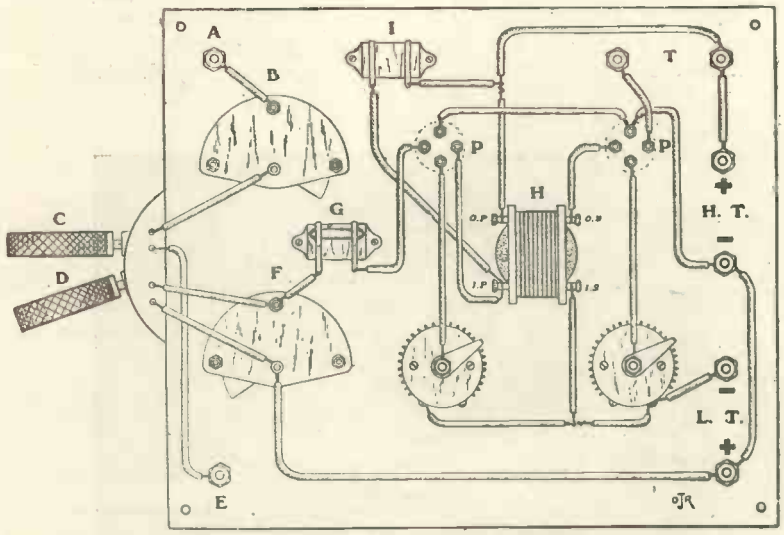


Fig. 3.—The practical wiring diagram.

The condenser B may have a value of 0.001 μF, while 0.0005 μF is a suitable value for F. The first valve acts as a rectifier, having in its grid circuit the grid-leak and condenser G. The rectified signals are passed via the low - frequency intervalve transformer to the second valve, which thus acts as a note magnifier, the telephones being included in the anode circuit of this valve.

The primary winding of the low - frequency transformer is shunted by a fixed condenser I, which may have a value of 0.001 μF.

In the circuit diagram, Fig. 1, the IP of the transformer H is shown connected to the anode of the first valve, and in general it will be found that this form of connection gives the greatest satisfaction, but before permanently connecting up, a reversal of these connections may be tried.

OUR NEXT ISSUE

A WAVETRAP FOR 1600 M. CRYSTAL SETS
By G. P. KENDALL, B.Sc.

SIMPLE WIRELESS RECORDING
By PERCY W. HARRIS.

A NEW 1600 M. TUNING COIL
By A. D. COWPER, M.Sc

The Fascination of Continental Reception

By Captain L. F. PLUGGE, B.Sc., F.R.A.E.S., F.R.Met.S.

Readers who have satisfied themselves in the reception of British Broadcasting should "try their hands" at tuning in the continental transmissions. This article gives many useful hints.

Clocks at the Eiffel Tower station, controlling the time signal emission.

IF your sole object in wireless is purity of signals, and your aim entirely directed towards getting perfect reproductions at loud-speaker strength without distortion, then do not attempt to listen to distant stations, for it is impossible to do so without losing purity of tone by reason of the interference to which one is subject, and which it is practically impossible to eliminate entirely in the present state of wireless.

If you do not mind putting up with a few atmospherics, or now and again with a little interference from some coastal station transmitting on spark or C.W. using a similar wave, and are prepared to overlook an occasional distorted note, or one which is not quite as clear as Big Ben sounds when in sight of the 2 LO aerial, then to you the lure of foreign lands will no doubt have some attractions.

Travelling by Wireless

If you are a traveller, in imagination or fact, have visited the Continent, or intend doing so, if you are interested in languages, the thoughts and methods of other countries, their customs and literature, then Foreign Station reception will have its fascination to you—the fascination of listening to someone speaking to you across the sea that makes us an island, speaking from the other side of the water, hundreds of miles away. Many such people are at your disposal for the turning of a dial, and if you are an enthusiast you will not be discouraged by failures and difficulties, but by perseverance will endeavour to achieve better results each time.

It will be a good idea for beginners to log down their receptions, and to draw up a chart giving the readings of their condensers and tuning keys, noting also the size of the coils employed and amount of reaction, etc. One important thing in Continental reception is to be able to obtain any definite station as quickly as possible, and this with certainty.

First Attempts

The first time a new station is received it will be possible to identify it without doubt when the name of the station is given out, but for several Continental stations this only occurs at the beginning or at the end of the transmission — sometimes both, but not always. For later reference, it is necessary that the station may be identified by the position of the tuning dials of the instrument, as there will be no other means of knowing to which station you are listening.

By consulting the time-table of Continental stations given on the next page, it will also, by this means, be possible to tune in the station you require before the actual transmission begins. This procedure is a very useful one, as a good deal of the usual information regarding the programmes and other interesting news is given at the beginning of the transmission.

It is also satisfactory to be able to give your friends any station that may be mentioned, and this in a few moments. When very conversant with the various Continental stations it will be found possible in some cases to switch over from one to another in as easy a manner as a telephone operator switches over from one subscriber to another.

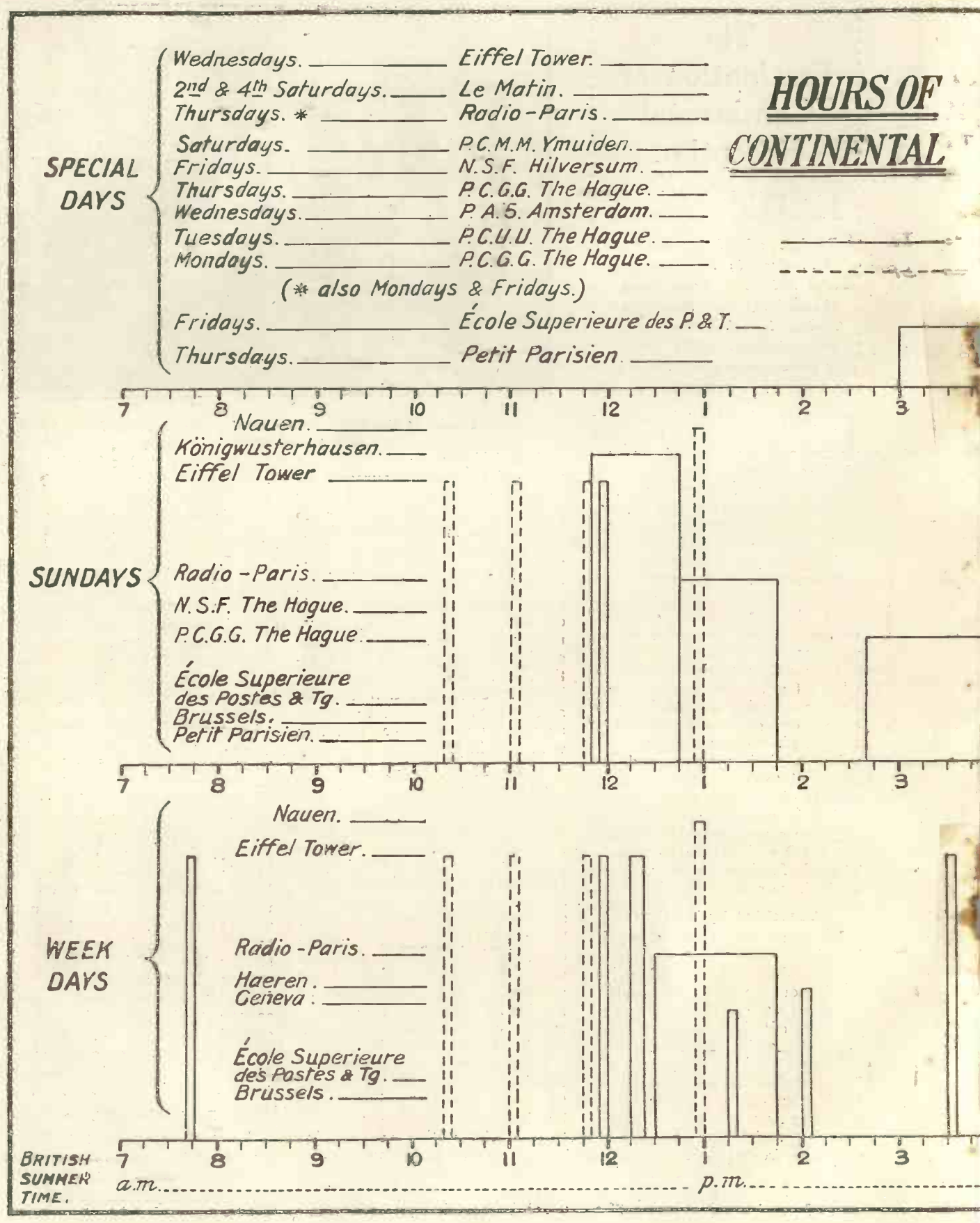
Standard Expressions

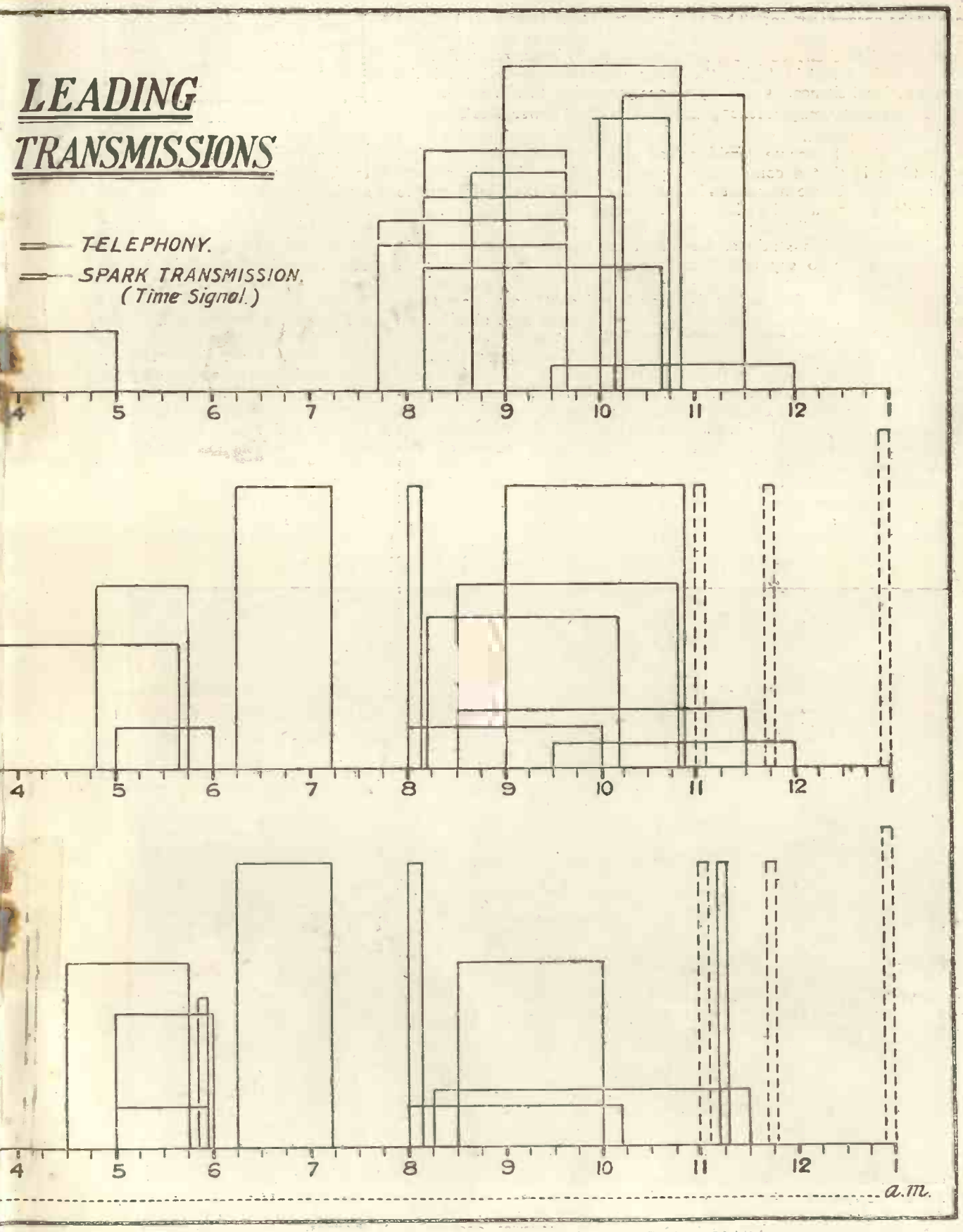
The enthusiast should endeavour to get familiar with the various expressions which the announcer of each particular station uses. It will be found that this is not difficult, even if only little of the language is known. It is our intention at a later date to give some of the standard expressions used with their translations in order to help the beginner to understand what is taking place.

Several stations, alive to the fact that they are heard in other countries, give out their items in several languages—English in particular — also occasionally sending out special announcements for their British listeners.

Programme Times

A great many of the Continental transmissions take place at the same time as the B.B.C., but there are several intervals in the course of the day during


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


LEADING TRANSMISSIONS
TELEPHONY.
SPARK TRANSMISSION.
(Time Signal.)
4
5
6
7
8
9
10
11
12
1
a.m.

which the only stations working are those across the sea. This is an additional incentive to getting accustomed to their reception, so they may be tuned in during the hours of local silence.

Interesting Comparisons

Another reason why the amateur should become familiar with them is that a comparison is available between what is being done abroad and at home. Being a regular listener to a good many foreign stations, we do not hesitate to say that the B.B.C. service is in many respects well ahead of most Continental stations. The latter, on the other hand, are not so tied down to regulations, and in this way are able to include in their programmes items which the B.B.C., under present contracts, is apparently not able to give its licensees. Among these I might mention news in the early part of the day. Certain Continental stations have also provided their hearers with a description of sporting events—such as Rugby, Football Associations, cycle racing, etc., transmitted direct from the stadium whilst the play was actually in progress, furnishing their listeners with all the accompanying thrills.

High Power Work

Some Continental stations are at present broadcasting on high power, and are in this respect ahead of the B.B.C. in regard to its new Chelmsford station.

Such high-power stations can be received on crystal sets in some cases and comfortably on one valve. In many parts of the south and south-east coast these stations are easier to obtain than the B.B.C. stations, and come in with greater signal strength.

We shall in our subsequent articles deal with various stations, giving all possible information and advice. We hope that this will enable many of our readers to receive the distant Continental stations, and thus provide them with an additional wireless attraction—regular Continental reception.

How to use the "Wireless Weekly" Key Chart of Continental Broadcasting

The key chart on pages 348 and 349 forms not only a rapid means of ascertaining what broadcasting stations are working at any particular hour, but also acts as a guide to which station it is advisable to listen to first. The time line is divided into quarter - hour intervals. The spaces between vertical lines indicate the time occupied by the particular transmissions. Different stations are indicated by different heights, as shown by the names on the left. Thus at 5.30 p.m. (bottom line) Brussels, Geneva and Radio Paris are all working, and Radio Paris will be the first to finish (at 5.45 p.m.). Brussels and Geneva will carry on until 6 p.m., while between 5.45 p.m. and 6 p.m. Haeren will come on for a few minutes.

RADIO SOCIETY'S TRAIN EXPERIMENT

Inside the special radio coach during the experiments conducted by the Radio Society of Great Britain. The members present, reading from left to right, are: Mr. Philip R. Coursey, B.Sc., Mr. L. McMichael, Mr. Maurice Child, Mr. Andrewes, and Mr. F. H. Haynes.

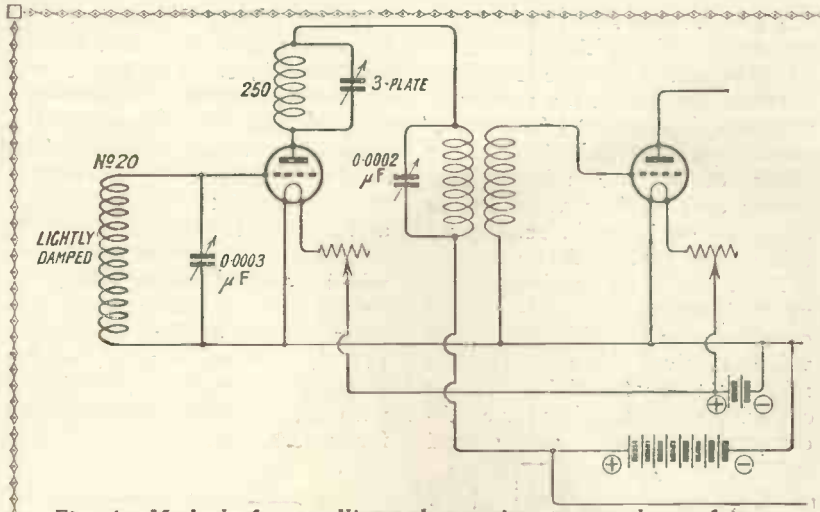


Fig. 4.—Method of controlling a low-resistance tuned transformer H.F. coupling.

Controlling a Tuned Anode Circuit

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

A valuable contribution to the discussion on how to obtain the best high-frequency amplification

(*Concluded from page* 300.)

A two-plate condenser, with the plates well separated, will often suffice on the shorter waves, with a loose-coupled grid-circuit on the first valve. In the second an ordinary "vernier" or three-plate condenser suffices, or even a low-minimum one of .0001 nominal capacity. It will surprise many experimenters to find by actual trial how small a capacity is needed to pass enough to produce self-oscillation here. By placing this condenser at minimum, both the H.F. amplification and the reaction effect are at a minimum, and the circuit is perfectly stable. If the minimum of this condenser is small enough, with critically-tuned anode of low H.F. resistance, by slowly increasing the capacity of this variable condenser both H.F. amplification and reaction increase, until the circuit passes almost imperceptibly and quite smoothly into quiet oscillation. With care it can be held at a point where strong C.W. Morse is heard heterodyned, but without actual continuous oscillation. Naturally a radio-choke must be provided to bye-pass the D.C. component of the plate-current whilst effectively isolating the plate for H.F.; this is the usual coil of around 250 turns and of low distributed capacity. If two stages are used, the chokes used should be of different values, but of adequate size in each case, i.e., not under 150 turns for the broadcast band, and proportionally for longer waves.

The effect of this small series condenser is to necessitate a large P.D. or drop across it, when introduced into the complex oscillating circuit which makes up the "tuned-anode" circuit, thus cutting down at once the available tuned impulses which set this circuit into sympathetic oscillation when signals are received on the grid of the first valve, and also the P.D. across the anode and grid of the first valve, resulting from the oscillations thus built up in the tuned anode, which would normally produce self-oscillation.

Practical Experiment

Practical trial of this simple device will assuredly convince careful experimenters of its value, the maximum available H.F. amplification being reached with remarkable selectivity, and an exceedingly smooth control over reaction at the same time. The effect on the tuning of the tuned anode by adjustment of this small series condenser will be found to be very small, and is compensated for automatically with a little experience.

An interesting modification of the Hazeltine Neutrodyne circuit, recently published in an American journal, which approaches very closely in principle the "Bridge" method of control described by Mr. Scott-Taggart in *Wireless Weekly*, Vol. I, Nos. 12 (p. 720) and 13 (p. 741), also lends itself to an adaptation for use in tuned-anode circuits.

As in the "bridge" circuits described in the articles mentioned, in this neutrodyne circuit transformers are used with a secondary coil (which may be tuned or not) without the tap to which the neutrodyning condenser is connected in the original neutrodyne; the primary has a *centre* tap for connection to the H.T. plus, the tuning condenser is arranged right across both halves of the inductance, whilst one end is connected to the plate of the first valve and the

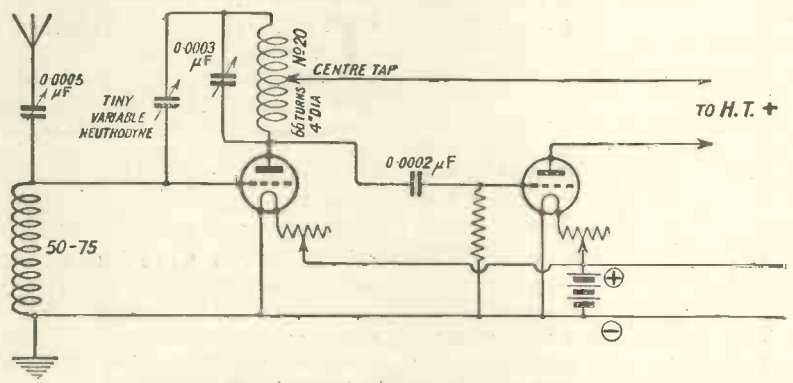


Fig. 5.—Illustrating a bridge-neutrodyne control.

other end *via* the tiny neutrodyning condenser back to the grid of the same valve. A balanced bridge is thus set up, so that the feed-back along the path of plate-to-grid capacity is exactly balanced out by a feed-back *via* this small neutrodyne condenser, and complete stability results.

To adapt this to tuned-anode coupling, the secondary of the transformer is simply omitted, and the usual small coupling condenser of .0002 μF capacity

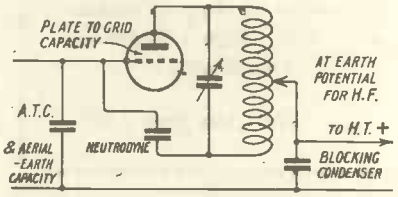


Fig. 6.—The circuit of the essential H.F. neutralizing bridge.

passes on the impulses directly to the grid of the second valve. The circuit in Fig. 5 is obtained. For sharp tuning and the maximum build-up of signals, low-resistance circuits should be used—there is no need here to introduce deliberate damping; the writer tried accordingly an efficient inductance of 66 turns of No. 20 S.W.G. d.c.c. wire on a waxed cardboard former 4 in. diameter, 4½ in. long, with a centre tap for the H.T. plus connection, tuned by a .0003 μF parallel condenser over the broadcast range and beyond. The circuit operated exceedingly well on trial, giving the sharpest possible tuning and ultra-selectivity, whilst oscillation and reaction could be controlled in the smoothest manner by means of the (variable) neutrodyning condenser. The anode and A.T.I. must of course be kept well apart, preferably both at an angle of 60 degrees to the horizontal to minimise accidental couplings.

The Neutrodyning Condenser

The principal difficulty and one which some experimenters may probably find discouraging, is the extremely minute value needed for the neutrodyning condenser, which should be variable, and also free from hand-capacity effects. Actually the writer used two *two*-plate "vernier" condensers *in series*; the minimum capacity of even a two-plate condenser especially constructed for such refined work proved to be too great. A small fixed condenser in series with a two-plate variable will give the required control; the sizes are a matter of practical experiment. The maximum capacity required is of the order of a few micro-micro-farads only. A wavemeter is almost a necessity in setting up this circuit for the first time.

As a matter of curiosity this neutrodyned tuned-anode coupling was combined in a two-valve receiver with a "transmitter" type of aerial-tuning—a coil with centre tapping for earth-connection and a second tapping, giving 8 aerial turns, for the aerial connection, and of low resistance. The result was certainly the most selective—and the hardest to tune—that the writer has come across. The local "big noise" (2LO at 13 miles) seemed to be balanced on a razor-edge, and had to be sought with a wave-meter. Those who live near GNF or GBL, and do not mind devoting an hour to tuning-in once for all to the B.B.C. station desired, might find it worth while to experiment with it; it is not recommended for general use.

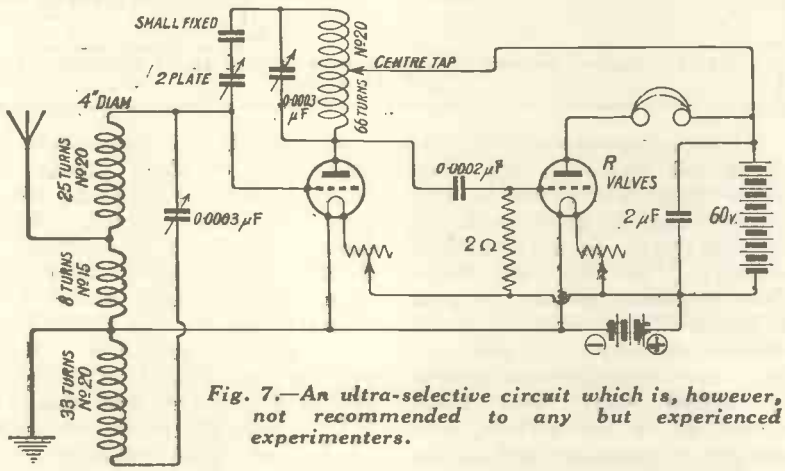


Fig. 7.—An ultra-selective circuit which is, however, not recommended to any but experienced experimenters.

All-British Wireless Exhibition, 1924.

THE second great exhibition, devoted exclusively to the development of wireless, and organised by the National Association of Radio Manufacturers, will this year be held at the Albert Hall, Kensington, from September 27 to October 8 inclusive. The public will be admitted, at a charge inclusive of tax, of one shilling and sixpence at 12 noon on the opening Saturday, and thereafter, excepting that on the first Tuesday, the price of admission from 10.30 a.m. till 6 p.m. will be half-a-crown.

It is believed that this is the first occasion upon which the Albert Hall has been used for trade exhibition purposes. It has been selected because of its convenience, comfort, and accessibility.

A very large floor space is available, and upon this a uniform system of open stands, each on its own raised platform, will be erected.

An elaborate and conspicuously tasteful scheme of decoration in blue and gold has been devised, and in every way the organisers have aimed at setting in this exhibition a new standard of pleasure to the visiting public.

It is hoped that, in addition to the displays which will be made of British radio products and now generally admitted to be the best in the world, the British Broadcasting Company will give a regular programme of demonstrations.

During the past year wireless in the British Isles has made immense strides forward in popularity, and it is not too much to say that it has now become an important factor in the life of the nation.

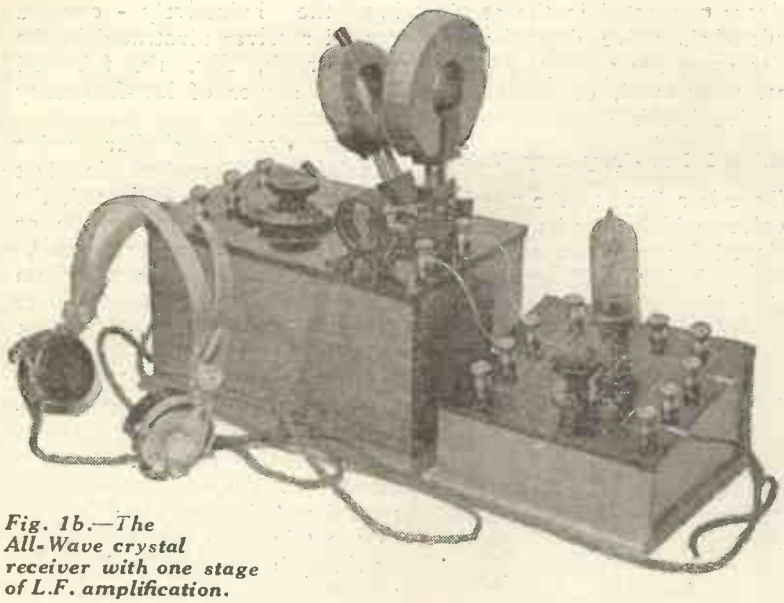


Fig. 1b.—The All-Wave crystal receiver with one stage of L.F. amplification.

How Every Crystal User may become a Valve Expert

By E. REDPATH, Assistant Editor

Continuing from last week's instalment, the present article deals with further methods of using a valve as a low-frequency amplifier.

The Valve as a Low-frequency Amplifier

Fig. 1a is a theoretical circuit diagram and Fig. 1b a photograph of an inductively coupled crystal receiver with an untuned or aperiodic secondary circuit (the construction of which is described by the present writer in the current issue of *Modern Wireless*), with the diagram valve panel added so as to provide what is often termed "one stage of low-frequency amplification."

Apart from the advantage due to the variable coupling between the plug-in coils L1 and L2 (Fig. 1a), the transfer of energy from the aerial circuit to the detector circuit may be made to give rise to higher potentials in the detector circuit than are available across the inductance L1 itself, providing that the coil L2 consists of a greater number of turns than the coil L1.

If L2 comprises, say, twice as many turns as L1, a much higher initial potential will be available to actuate the crystal detector D, and subsequently to effect a variation in the potential of the grid with respect to the filament of the amplifying valve.

For certain technical reasons, however, it is impracticable to employ either a very tight coupling or to obtain a high "step-up" ratio by the use of an exceedingly large number of turns in the coil L2.

The Iron Core Transformer

Accordingly another type of transformer, designed to give a strong electro-magnetic coupling, together with a fairly high "step-up" ratio (varying from 1 :4 to 1 :10) is employed and connected in circuit at a point where it will be clear of oscillatory or high-frequency currents, namely, *after* the detector.

Figs. 2a and 2b show a theoretical diagram and pictorial arrangement respectively of a simple single-circuit crystal receiver with the input or primary winding of such a transformer connected to the telephone terminals, the secondary winding (S) of the transformer being connected to the grid and negative filament terminals of the valve panel, the battery and telephone connections of which are as in previous diagrams.

In this arrangement the rectified pulses of current passing the detector traverse the primary windings (P) of the iron core transformer. This primary winding will probably consist of some 3,000 to 3,500 turns of insulated wire wound upon a soft iron core, and, in accordance with the well-known electro-magnetic law, these varying or pulsating currents induce other currents in the secondary winding (S), which will consist of from 15,000 to 20,000 turns of very fine insulated copper wire. The increased potential variations thus obtained are applied to the grid and filament of the valve, with results as already described.

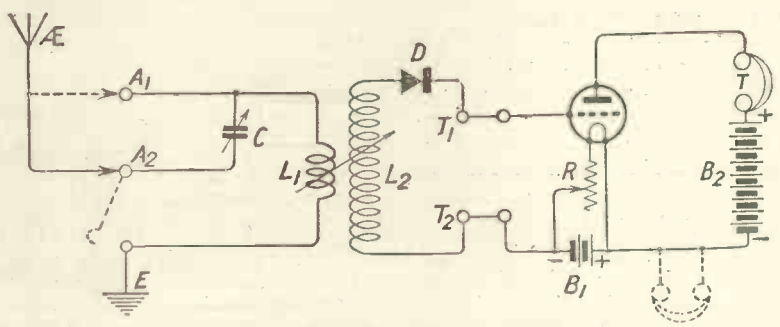


Fig. 1a.—Theoretical diagram of the arrangement illustrated in the photograph above.

Referring to Fig. 1a, an iron core transformer could be introduced by connecting the primary of the transformer to terminals T1 and T2, and the secondary winding to the grid and negative filament terminal on the valve panel.

There are, of course, practical limits to the potentials which can

be usefully applied to the grid and filament of an amplifying valve. With the ordinary type of receiving valve and moderate anode potential (say up to 60 volts), really large variations of grid potential may cause the anode current to reach the end of the straight part of the characteristic curve. In extreme cases saturation point may be reached, though this is not likely to occur with less than two stages of amplification and strong incoming signals.

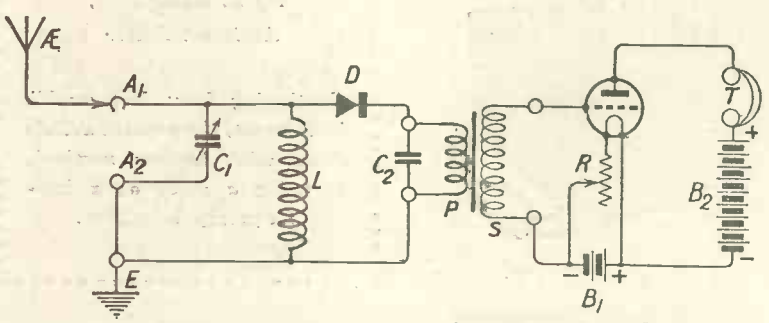


Fig. 2a.—Circuit arrangement showing method of employing an iron-core transformer.

In order to obtain the best results, it is important to connect the ends of the secondary winding of the low-frequency transformer to the grid and filament of the valve in a certain manner, dependent upon the connections of the primary winding. To ascertain with a minimum amount of trouble which is the correct method in any particular case, connect up the primary winding and then connect each end of the secondary *in turn* to the grid of the amplifying valve, temporarily omitting the filament connection altogether. When the correct secondary wire is connected to the grid, signals in the telephones will be found to be almost as strong without the filament connection as with it.

Provided that fairly good signals are receivable upon the crystal detector alone, the addition of a low-frequency amplifying valve will increase the signal strength some five or six times.

For all-round efficiency the arrangement indicated in Figs. 2a and 2b in which an iron core step-up transformer is employed, will be found the most satisfactory. The actual degree of magnification obtained and the purity of the resultant sounds emitted by the telephone receivers connected in the anode circuit of the valve depend principally upon the quality of the transformer, and, of course, of the valve itself.

Additional Low-frequency Valves

There is a limit to the number of valves which may be usefully employed for purposes of amplification. With fairly strong incoming signals, it will probably be found that two valves of the ordinary receiving type are the most that can be employed satisfactorily, the variation in anode current of the second valve being so considerable as to reach, or at any rate approach, saturation value.

This value, it will be remembered, is determined by the total electron emission from the valve filament. Accordingly, if it is found necessary to add a further or third valve, it should be of a type known as a "power valve," designed to have a very heavy electron emission from the filament, and usually operating with a fairly high-anode voltage of from 150 to 300 volts.

Fig. 3a is a theoretical circuit diagram and Fig. 3b a pictorial illustration of a circuit comprising the inductively-coupled crystal receiver illustrated in the photograph, Fig. 1b, followed by two stages of low-frequency amplification.

Two exactly similar valve panels, as described in last week's article, are indicated, the filament lighting and anode or H.T. battery being common to both valves. The output from the crystal receiver is applied to the grid and filament of the first valve (V1), via the iron core step-up transformer T1.

By means of the small two-way switch, indicated at K in the diagram, the output or anode current of V1 may be made to pass direct through the windings of the telephone receivers TEL, or through the primary P of the second transformer T2. In the latter case the current variations are inductively applied to the grid and filament of V2, and the resulting low-frequency variations of anode current of this valve actuate the telephone receivers.

Other Methods of Inter-valve Coupling

Before leaving this section of the subject, and passing along to consider the question of high-frequency amplification, it is desired to mention two other methods by which the valves of a two or three-valve amplifier may be coupled.

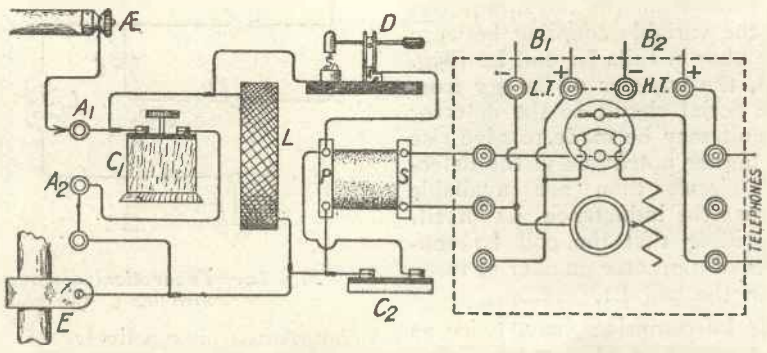


Fig. 2b.—Pictorial representation of Fig. 2a, with "diagram" valve panel as described last week.

Both methods are illustrated in Fig. 4, reference to which will show that in the anode circuit of the first valve, actually between the anode itself and the positive terminal of the H.T. battery, an iron-core choke-coil is introduced. For experimental purposes, either the secondary

winding of an ordinary inter-valve transformer, or the fine wire winding of a step-down telephone transformer, may be tried, or a serviceable choke-coil may be constructed by winding from 10,000 to 12,000 turns of

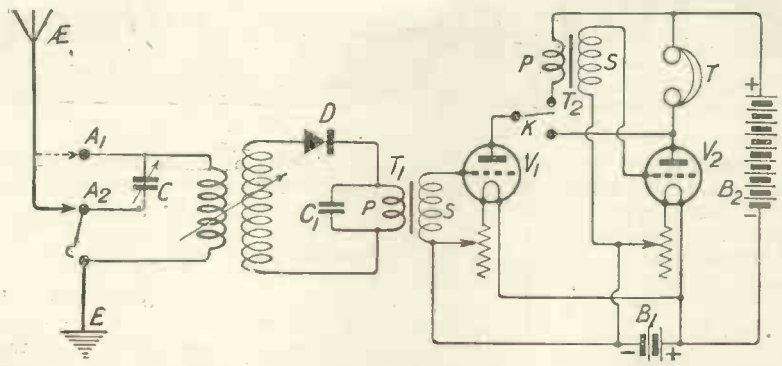


Fig. 3a.—A theoretical circuit diagram showing arrangement for two stages of L.F. amplification. The crystal set is the "All-Wave" receiver.

No. 40 or No. 42 S.W.G. d.s.c. copper wire upon a core consisting of soft iron wires, No. 20 S.W.G. or finer if obtainable, ⅜ in. in diameter and about 4 in. long.

The iron core should be carefully insulated by means of thin silk tape, and each end should be fitted with a piece of ebonite about 1½ in. square, which, if made a tight fit upon the iron core, will retain the winding in position and provide a convenient mounting for the terminals to which the commencing and finishing ends of the winding may be connected.

Referring again to Fig. 4, the anode end of the iron-core choke is connected to the grid of the second valve (V2) through a fixed condenser C1, having a capacity of about 0.005 μF to .3 μF. Low-frequency pulsating currents in the anode circuit of the valve V1 set up differences of potential between the ends of the winding of the iron-core choke.

These changes in potential are passed on to the grid of the second valve (V2), via the fixed condenser C1, and, as the grid of V2 would otherwise be entirely insulated and therefore in a position to collect and retain a negative charge due to intercepted electrons, a grid discharge or leakage path is provided by connecting a suitable resistance R1, usually of a value of about 1 megohm, between the grid itself and the negative side of the filament.

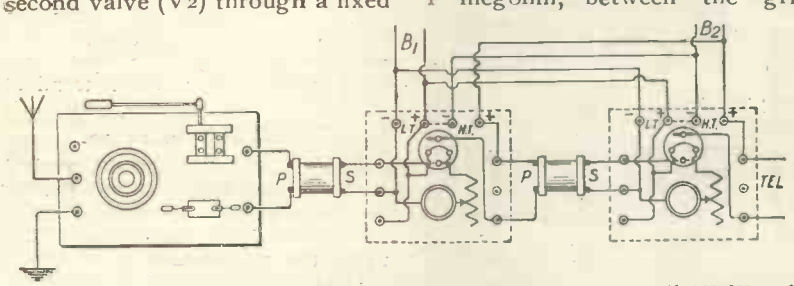


Fig. 3b.—A pictorial representation of Fig. 3a, using the "All-Wave" crystal set and two "diagram" units.

Resistance-capacity Coupling

Between the anode of the second valve V2 and the positive terminal of the high-tension battery a 100,000-ohm resistance is introduced, which gives rise to an effect similar to the iron core in the anode circuit of V1, although in this case the effect is due to resistance alone, whilst in the case of the choke-coil it is due to the very high inductance of the coil.

The varying potentials at the anode end of the resistance are again passed on to the grid of the subsequent valve, via a fixed condenser (in this case C2), whilst the grid of the valve V3 is maintained at a suitable average potential by means of the resistance R2. The condenser C2 and resistance or leak R2 may be of similar values to C1 and R1 respectively.

Neither of these methods is as efficient as that in which a really well-designed and well-made step-up transformer is employed, whilst, in the case of the resistance-capacity method, it is necessary to employ a somewhat higher value of anode voltage than usual in order to compensate for the loss introduced by the resistance. The results obtained with a three-valve low-frequency amplifier are found in practice to be very satisfactory indeed as far as the purity of the resulting signals is concerned, but the actual magnification obtained with three valves is found to be about equal to that yielded by a two-valve transformer-coupled amplifier.

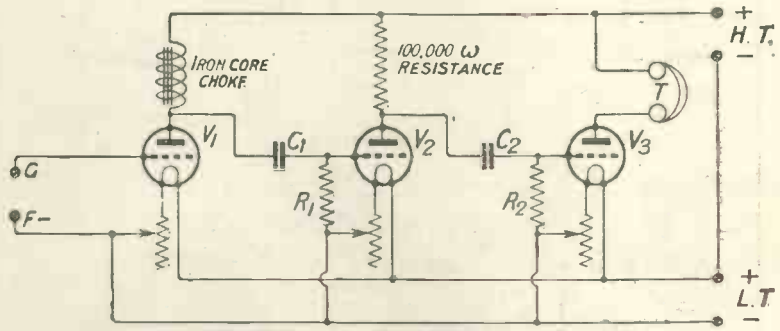
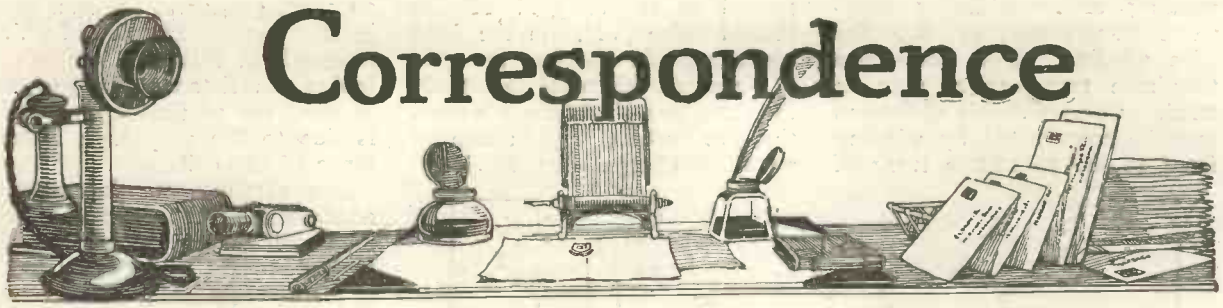


Fig. 4.—Illustrating the arrangement when using choke-capacity and resistance-capacity coupling for L.F. amplification.

Although both the choke-capacity and the resistance-capacity methods of coupling are illustrated in the one diagram, Fig. 4, it is to be understood that either method may be employed exclusively in any one amplifier.

NEXT WEEK.—Adding High-frequency Amplification to a Crystal Receiver.



FROTHING

SIR,—Regarding Mr. Holmes' letter in your issue of July 2, many owners of accumulators are doubtless troubled with spraying of the acid during charging, particularly so if the cells are not totally enclosed, which causes a great deal of surface leakage, particularly in H.T. accumulators of the order of 1 ampere hour, as well as from frothing, which appears to occur to a greater degree in celluloid containers.

At the same time, many will be somewhat chary of adding soap to the acid, after being so carefully warned to use nothing but distilled water.

In this connection I notice that the makers of Exide batteries have brought out a special anti-spray film oil for this specific purpose under the trade name of "Blancol," and I have ordered a small amount for my H.T. cells, as spraying in them has caused me a good deal of trouble.

If this were put up in very small phials at a cost of a few pence and advertised, I should expect a good demand would result.—Yours faithfully,

L. J. WORTHINGTON.

Leek.

The interior of the U.S. Shipping Board Station at Bush House, London, W.C. The frame aerial may be seen on the roof of Bush House from Kingsway.

ST100 AS AN AMPLIFIER

SIR,—May I give you particulars of what is, I believe, a new use for ST100?

The other night, whilst experimenting with a novel circuit of my own, I was getting Ecole Superieure comfortably in the 'phones with a frame aerial, but wanted him on the loud-speaker.

This is the procedure I adopted for using ST100 as a plain two-valve amplifier. It can be done by anyone in less than five minutes.

1. Connect like terminals for H.T. and L.T. of both sets together.
2. Remove 100,000 resistance.
3. Short reaction coil socket
4. Pull catwhisker away from crystal.
5. Take *one lead only* from the telephone terminal on experimental set connected to plate to crystal cup of ST100. (Leave other terminal dead.)
6. Connect L.S. to ST100.

I found this arrangement worked very well, but with a slight tendency to audio-frequency howling on the first valve of ST100, due no doubt to the two primaries being in series.

It can also be used as a single-valve amplifier on the last valve only by the simple expedient of taking the lead to the catwhisker instead of the crystal cup.

I must say in fairness to your excellent circuit that the only reason that I have had to put it to this use is that in my flat I am limited to a frame or a 14 foot indoor aerial.—Yours faithfully,

H. JOHNSTONE PRATT (Capt.).

Chelsea, S.W.

EXPERIMENTS WITH THE ST100

SIR,—Many readers must have wondered why Mr. Scott-Taggart did not give his famous ST100 circuit credit for long-distance work, while enthusiasts all over the country give evidence of reception of all stations.

In connection with this receiver some may have difficulty in getting accumulators charged, and may be glad to hear how to get results with only one valve burning.

The writer built ST100, a "Chinese copy" in every way of that described by Mr. Percy W. Harris in the March number of *Modern Wireless* in 1923, and while getting the local station too loud could not get any other station, so started to try how one valve could be used alone.

It may be said that ST100 is a splendid crystal receiver if the 'phones are coupled to the left hand (primary) terminals of the left hand transformer, so that when the accumulator is away being charged those within 20 miles of a broadcasting station need not miss their programmes. In the writer's case, critical adjustment of the "cat's whisker" is performed in these circumstances, *i.e.*, without H.T. or L.T. switched on.

If the 'phones are connected to the *right hand* (secondary) terminals of the right hand transformer and the *left hand* valve only in use, many users of ST100 may be amazed at the resultant reception, but the telephone condenser is not in the circuit to govern the reception, so a double-pole change-over-switch was located on the spare bit of panel to the right of the right hand transformer; the leads were cut at the telephone condenser on the side farthest from the telephone terminals. Two leads were then taken from the telephone condenser to the centre points of the D.P.C.O. switch, thus having the telephone condenser and the telephone terminals always in the circuit, and the disconnected leads were lengthened and connected to one end of the D.P.C.O. switch. Thus when the blades of the switch are in these contacts we have ST100 as per Mr. Harris. Two leads were then taken from the leads connected to the secondary terminals of the right hand transformer and connected to the other end of the D.P.C.O. switch.

With a 32 turn-coil in the aerial, and a 48 in the anode holder, all stations of Newcastle's wavelength and below are received; and, with the 48 coil in the aerial and an 88 coil in the anode, all above Newcastle's wavelength up to shipping wavelength are obtained, including posts and telegraphs, Paris and Berlin on one valve with a very poor out-door aerial which was put up in a hurry as a temporary measure when the first set was installed.

Many users of ST100 have said that they cannot cut out the local station. Set everything to give the local station at its very best (a good "whisker" setting is essential), and don't forget to vary the H.T. to give the maximum. Now turn the anode condenser about 20 degrees, at which setting the local station should "go out," and then find another station. (They come at about 20 degrees intervals on the aerial condenser with the above-mentioned coils, by means of the aerial condenser and the reaction coil.) The local station may still be heard. Now adjust the H.T. again and the reaction coil, and it will be found that the other station can be brought up at the expense of the local station until the latter is not heard at all. Berlin, for example, though near Aberdeen and Birmingham's wavelength, requires twice the H.T. that the local station requires to bring it up, and the writer has often found that a station which was frightfully incoherent is very amenable to four volts more or less of plate voltage.

Two more little refinements. It may be desirable to put a dull emitter valve in the (left hand) "solo" sockets. A couple of yards of 36 eureka wire wound on to an inch of wood (pencil) can be connected to one of the filament legs and the lead which originally went to it. This can be shorted easily if it is desired to try an "R" valve in its place, but when in circuit ensures that the D.E. cannot be overrun—a point not emphasised sufficiently by some makers; and, being a permanent resistance of 30 ohms, cannot be decreased accidentally. It is advisable to have a concealed switch if much comparison of "R" against D.E. valves is to be attempted.

The occasional use of an "R" valve in the other socket in the form of the original ST100, with both valves burning, will keep the accumulator in condition by giving it sufficient work to do.—Yours faithfully,

A. G. LOTINGA.

VALVE NOTES

SIR,—I am writing to inform you of the results I am getting from your dual circuit given in Valve Notes, Fig. 2, in your issue of May 14. This is the best dual I have yet tried. It is quite surprisingly selective, and gives good, clear loud-speaker reception on 5SC five miles away on an indifferent aerial. Good 'phone reception is also obtained from other stations, but as it is light up here till almost midnight, no real test for long-distance work has been attempted. I use dull emitter valves, Mullard D.F. Ora with 100v. high-tension and 6 volts grid bias as dual amplifier, and B.T.H. B5 as detector with 40 volts. Reaction control is very smooth and sensitive, and no buzzing is present. A stabilising leak is fitted, but not used. I have a milliammeter wired permanently on the panel, and it helps considerably in getting fine adjustment. The radio choke is a 250 Igranic removed from its plug and clamped under the panel. Again thanking you for this circuit, which in moderately experienced hands gives wonderful results—I am, yours faithfully,

E. FISHER.

Glasgow.

A SINGLE VALVE BROADCAST RECEIVER

SIR,—I thought it would be of interest to you to know what excellent results I have obtained with a circuit described by Mr. Redpath in the January 2 issue of *Wireless Weekly*.

I may say that my own set consists of this circuit with one or two refinements plus one stage of L.F. amplification.

I was so pleased with the results, the simplicity in working and the low cost of making up that I have assisted several friends in making sets from one to three valves with this form of detector, making up the combined AT1 and reactance, and winding same for them, and the results are splendid.

To continue with my own set, the refinements I refer to are:—Stator of ebonite; ball rotors, also of ebonite, making a very tight coupling; variable grid leak; grid bias.

With this set I can cover all B.B.C. stations, also *Berlin* "Vox Haus," *Paris* "Ecole Supérieure," *Brussels* "Radio Electrique," and *Madrid* "Radio Iberica," and I work a loud-speaker on London, 11 miles distant.

In order to be ready for the new station at Chelmsford I have now added basket coils to give the necessary extra windings to AT1 and reactance, and can get Paris "Radio" 1,780 metres all right.

I should be interested to hear if you have had the same favourable reports from other readers, as I think it is quite one of the best circuits going, and would certainly bear repeating in your Journal with any alterations and additions which might be thought to still further improve it.—Yours faithfully,

STANLEY M. FORWOOD.

Loughton.

Apparatus we have tested

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

Audio Choke Coils

Messrs. A. Roberts & Co. have sent for test and review samples of 750- and 1,000-ohm audio-choke coils, for use in choke-capacity-coupled L.F. amplification circuits, etc. These are small coils, about 3 in. long and $\frac{7}{8}$ in. diameter, mounted in metal cases, and with soldering-tags for connections at one end. The iron cores are therefore necessarily of small dimensions.

On test, the resistance was found to be about the figure quoted. Used in choke-capacity L.F. amplification, in actual reception of local broadcasting, the quality of speech and music in each case left much to be desired, being thin and somewhat tinny; the actual amplification measured (signal-voltage across the 4,000-ohm 'phones, time-average on fairly uniform transmission) being only about 1.5 for the 1,000-ohm choke, which gave the better result; this compared with around 7 with a really good L.F. transformer stage and with otherwise identical apparatus.

We cannot therefore recommend these extremely small choke-coils for this purpose.

Allison Loud-speaker

Messrs. Cromwell Engineering Co. have submitted their "Allison" loud-speaker for trial. This is of the medium large type, of conventional appearance, and is made with either an aluminium or oak horn. That submitted was of 2,000 ohms resistance.

A special point is made of the fact that the diaphragm is securely clamped all round its rim. The base of the receiver is filled in with solid paraffin wax, with favourable effects on the electrical insulation and acoustic resonance properties. The micrometer adjustment of the distance of the diaphragm from the magnet-poles is effected by means of a fine-threaded ring which locks at any point; this adjustment was found on trial to be made readily.

On trial in comparison with other large loud-speakers, on a set which was above suspicion as far as distortion was concerned, considerably less of that unpleasant hollow or trumpet-like sound associated with large loud-speakers in many people's minds and ears, was noticed with this loud-speaker. A large volume of sound was easily handled by the instrument without signs of distress

Microstat Filament Resistance

Messrs. Wates Bros. have sent samples of the "Microstat" filament resistance for use with both dull-emitter and bright-emitter valves. This is of the single-hole-fixing variety, being contained in a small brass case 1 in. diam. by about 1 in. overall depth, and requiring a 5/16 in. hole in the panel. A standard ebonite knob provides the external control.

On dissecting one of these, it was noted that the variation in resistance was obtained by variable screw-pressure on thin carbon powder, an ingenious spring cushion arrangement being provided to avoid packing. On measurement, the resistance was found to be variable between wide limits, the highest effective being around 200 ohms, and the minimum below one ohm. The variation of resistance with a given movement of the controlling knob was rather sudden in the higher ranges; in actual trial with R. and L.S. valves taking a fairly high filament current the control was found to be sufficiently fine. There would be some tendency when using the .06 type of dull-emitter with an accumulator, to turn the filaments on rather far at first, unless the knob was carefully manipulated. In extended use in a power-amplifier the writer obtained very satisfactory service with these filament resistances, handling 1.5 ampere or more with a single resistance.

A Correction

With reference to the report on the coil former introduced by Messrs. Watmel Wireless Co., in Vol. 4, No. 7, p. 224, we learn with interest that the makers are now putting in an extra row of holes in the former, so as to make it suitable for winding smaller coils, as was suggested in the report.

"Apex" Cat's Whisker

Messrs. Apex Electrical Supply Co. have sent for trial samples of their "Apex" cat's whisker, described as "platinum." At the modest price asked for these it was scarcely to be expected that these contained much of the metal named; on chemical analysis of the material little platinum was found.

However, in actual reception of local broadcasting the whisker was found to be very effective, giving results up to the usual standard with various samples of galena crystal on actual measurement of resulting signal-strength, and having the right physical character.

NEW ADDRESSES.

Peto-Scott, Ltd., have now removed to 77, City Road, E.C. This firm is also opening a new shop at 62, High Holborn, W.C.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

H. R. W. (BIRMINGHAM) asks how many valves he must expect to use to obtain good reception of the American broadcasting stations.

This is a much more difficult matter than is apparent from our correspondent's question, since all such receptions are dependent upon good conditions, and it is not possible for the average experimenter of only moderate resources to obtain reception of one or more of the American broadcasting stations upon *all* occasions. At this time of the year, for example, there is little chance of success with any kind of set such as experimenters are likely to use, and during the more favourable winter conditions it is desirable to use a receiver containing two high-frequency valves, and, if possible, one low-frequency amplifier to give a good chance of success.

T.R.A. (SOUTHSEA) states that the arrival of summer conditions has greatly reduced his reception from distant stations, and he is wondering whether he could improve matters by fitting what he has heard described as a "Regenerative Unit" to his set.

Since you are already using reaction upon the aerial, we do not see that any alteration in the reaction arrangements is likely to give you improved results. The unit to which you refer is for the purpose of using reaction upon the tuned intervalve circuit, which is no doubt a valuable addition to sets which did not previously employ any form of reaction. In your case, however, you are no doubt already obtaining the fullest benefits from reaction, and to substitute the tuned-anode method would probably be a step in the wrong direction. One of the principal

advantages of tuned-anode reaction is that it minimises to some extent the chance of radiation when the set oscillates, provided that the general design of the set is suitable.

C. P. T. (BRADFORD) asks whether it is really possible to rejuvenate crystals which have lost their sensitiveness in use.

Various processes have been recommended and used with varying success in bygone years, but in view of the present reasonable prices of quite satisfactory crystals, it hardly seems worth the trouble to attempt to restore the sensitiveness of one which has been in use for some time. If our correspondent is merely interested from the experimental point of view, he might try washing the crystal with absolute alcohol, or carbon bisulphide, or very cautious heating. In the case of most crystals, of course, the mere chipping off of the surface to expose a fresh one will have the desired effect, but this can hardly be described as rejuvenating the crystal.

J. G. (BRENTFORD) inquires whether it is possible to determine the adjustments of a receiving set for any particular wavelength without actual trial.

As the adjustments of the aerial circuit (that is to say, the setting of the aerial condenser or slider on the aerial tuning inductance) will depend almost entirely upon the aerial to which the set is connected, it is obviously impossible to determine this except by receipt of actual signals from either a transmitting station or a wavemeter provided with a buzzer to enable it to transmit feeble signals on a definite wavelength. The closed or secondary circuit of an inductively-coupled receiver is only subject to a slight variation due to alteration of the coupling between the aerial and secondary coils. Accordingly this circuit may be calibrated beforehand (by the makers for instance), and the adjustments for different wavelengths, indicated by figures engraved upon the instrument, or set out in a "Table of adjustments" supplied with the set. Provided that a wavemeter is obtainable, the owner of an inductively-coupled receiving set will always find it an interesting and useful piece of work to calibrate the secondary circuit and draw up a table of adjustments.

P. S. O. (SHEFFIELD) states that he is using a crystal set and a two-valve low-frequency amplifier for loud speaker work upon the local relay station, but is very much troubled by persistent howling in the low-frequency circuits. He submits a diagram and asks for an opinion.

As our correspondent is not using an earth connection from the batteries of the low-frequency amplifier, it is not surprising that he has trouble from instability, since this very often occurs with a crystal receiver and amplifier used in this way. Take a connection from earth to the low-tension battery negative, and the trouble will almost certainly disappear.

Building up a whisper of sound

JUDGE an Audio frequency Transformer firstly in terms of tone, quality; and secondly in terms of volume.

With LISSEN transformers Tone quality has always come first. LISSEN Transformers are so designed that you can build up a whisper of sound to a great degree of loudness with absolute purity of tone—each of the three types of LISSEN Transformer is tested for purity first right through the whole range of audible frequencies—then tested for volume.

Up and down the musical scale, a LISSEN Transformer must reproduce every note with perfect fidelity—and volume.

No Transformer gives greater value—and none such purity.

How to choose your Transformer—

IN adding a first stage in a straight circuit, remember that any distortion at the first stage of amplification is magnified by each succeeding stage—take extra care, therefore, that you have purity at the first stage. The LISSEN type T.1 Transformer, was the first made and designed specially to meet the peculiar requirements of a first stage transformer. It was made with a low ratio, and a high impedance value, so that the impedance should match the impedance of the valve circuit before it. There is more Wire in the Lissen T.1 Transformer than in any other Transformer sold. The Price of the LISSEN T.1 should be £2 in comparison with the coils used in other Transformers. The coil of the LISSEN T.1 Transformer would amplify by itself without any iron core at all. If you contemplate buying an expensive Transformer, be sure there is none to equal the LISSEN T.1—use it always behind the detector valve, and throughout, when superlative amplification is desired. And always for Power Work also. **30/-**

T 1

In adding a second stage of audio frequency, it is not necessary that the transformer should have such a high impedance, and the LISSEN T.2 Transformer can be used. **25/-**


T 2

FOR REFLEX CIRCUITS.—Under all conditions, the LISSEN T.2 Transformer is one which will give very pure and powerful amplification in all these circuits. **25/-**

A POPULAR TRANSFORMER—Because of the skilful balance of its design, the LISSEN T.3 Transformer compares with other Transformers sold at nearly twice the price. **16/6**

In buying a LISSEN Transformer you can be sure you are getting the best Transformer value.

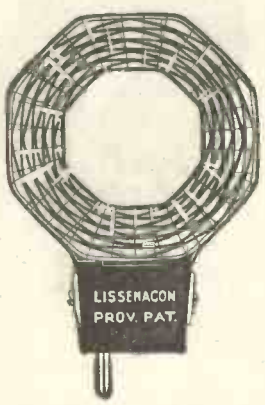
T 3

Coils that are responsive to faint signals

GALVANOMETERS are largely used to detect electrical currents. There is for instance, the type known as the linesman's galvanometer, and there is the fine mirror spot-light galvanometer which costs quite a lot of money. Both are the same in so far as they are used to detect electrical currents, but there is a vast difference in the sensitivity of the two types of instruments. The spot-light mirror galvanometer will detect currents where no deflection of the needle at all could be obtained with the linesman's instrument.

Now LISSENAGON coils are to other coils what the fine spot-light galvanometer is to the linesman's instrument—they are responsive to faint signals in the same way as the spot-light galvanometer is to minute electrical currents.

The analogy can be strikingly proved by alternatively plugging in LISSENAGON coils on distant signals and then plugging in other coils. Distant stations that will be distinct on LISSENAGON coils often cannot be heard at all as soon as the other coils have been substituted. In the design and making of LISSENAGON coils provision has been made for the fact that the low wavelength coils have to deal with enormously higher frequencies than high wavelength coils. Each LISSENAGON coil has been designed to be strongly resonant to a certain pre-determined band of frequencies. The appropriate LISSENAGON coil for a given wavelength is more resonant to the frequency corresponding to that wavelength than any other make of coil, and will also more effectively bar out all frequencies except that to which it is definitely tuned—in other words, LISSENAGON coils are highly selective, and the circuits in which they are used can be tuned much more sharply than the same circuits when other coils are used. This gives LISSENAGON coils an immense advantage on distant Telephony. And while LISSENAGON coils are more efficient than any other coils, they are still interchangeable with them.



LISSENAGON COILS TUNE SO SHARPLY AND SO STRONGLY BECAUSE THEY TUNE WITHOUT ENERGY LOSS.

Hold a LISSENAGON coil up to the light.

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

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

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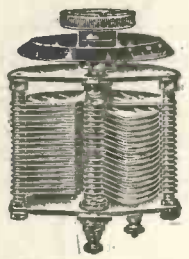

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Cap.	Price.	Height without connections.
·001	6/11	3⅛ in.
·00075	5/11	2⅝ in.
·0005	4/11	2 in.
·0003	4/6	1⅜ in.
·0002	4/-	1½ in.
·0001	3/6	1 in.
·00005 (vernier)	2/6	

EBONITE DIAL 8d. extra.

POST 6d. SET.

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

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

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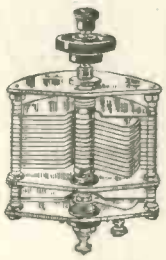
Height	Cap.	Price
4 in.	·001	8/11
2¾ in.	·0005	6/11
2¼ in.	·0003	6/6



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LISSEN—

Variable Grid Leak	2/6
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T1 Transformers	30/-
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Coils: 25, 5/-; 35, 5/-; 50, 5/2; 75, 5/6;	100, 7/-; 150, 7/10; 200, 8/8; 250, 9/-; 300, 9/5; 400, 10/3; 500, 10/6
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All Valves stocked Post 6d. each.	

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4,000 ohms ..	12/9
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Stock sizes.

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BEST MAKES.
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4 v. 40	17/6
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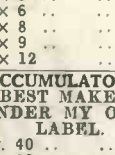

Ebonite Valve Holder, cut from solid rod, hand-turned, 8 nuts and washers .. 1/3

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Post 6d. pair.

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4,000 ohms .. 12/-
Post 6d. pair.
Single, 120 ohms. 5/6
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Post 3d. each.
Dr. Nesper adjustable leather Headbands .. 13/-
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Ebonite 200/650	4/6
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2-way, ex handles	4/6
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Radio Instruments	25/-
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Spade Screw terms, 4 for	3d.
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Ebonite Coil Plugs ..	4d.
Ditto, extra quality 6d., 7d.,	8d.
72 in. 'Phone Cords	1/5
Panel Switches, nickel S.P.D.T.	10½d.
Ditto, D.P.D.T. ..	1/4
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Studs, complete, doz.	4½d.
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Single Phones, 120 ohms.	5/-
Ditto 4,000..	7/-
Button Brass ..	3/9
Button Aluminium ..	4/9
Stand for Phone ..	2/3
Coil-Stands, 2-way	2/6
Ditto, ext. handles ..	3/3
Ditto, 3-way ..	4/9
Electron Aerial, 100ft.	1/4
Copper Aerial, 100ft.	1/10
Extra Heavy, 100ft.	2/3
Egg Insulators ..	1d.
Rubber Lead-in, 10yds.	1/3
English 4.5 Batteries	4d.
Clips .. .. 2 a	1d.
Sleeving 4d., 3 yds.	10d.
16 g. Sq. Tinned Copper, 18 ft. ..	6d.
Twin Flex, 4 yds.	6d.
Burndept Detector	5/-
Variometers, 250/650	1/6
Raymond Transformer	9/11
Mic-Met Detector ..	6/-
Many good ones 10d. &	1/2
Nickel or Brass, best	1/6
(All above glass enclosed.)	
Hertzite	8d.
Tungstalite .. 1/- &	9d.
Gecosite 1/3 Neutron	1/6
Whiskers, silver or gold	2d.
Spearpoint	2d.
Filament Rheostats	1/3
Ormond Rheostat ..	1/9

Right Opposite **DALY'S** Gallery Door

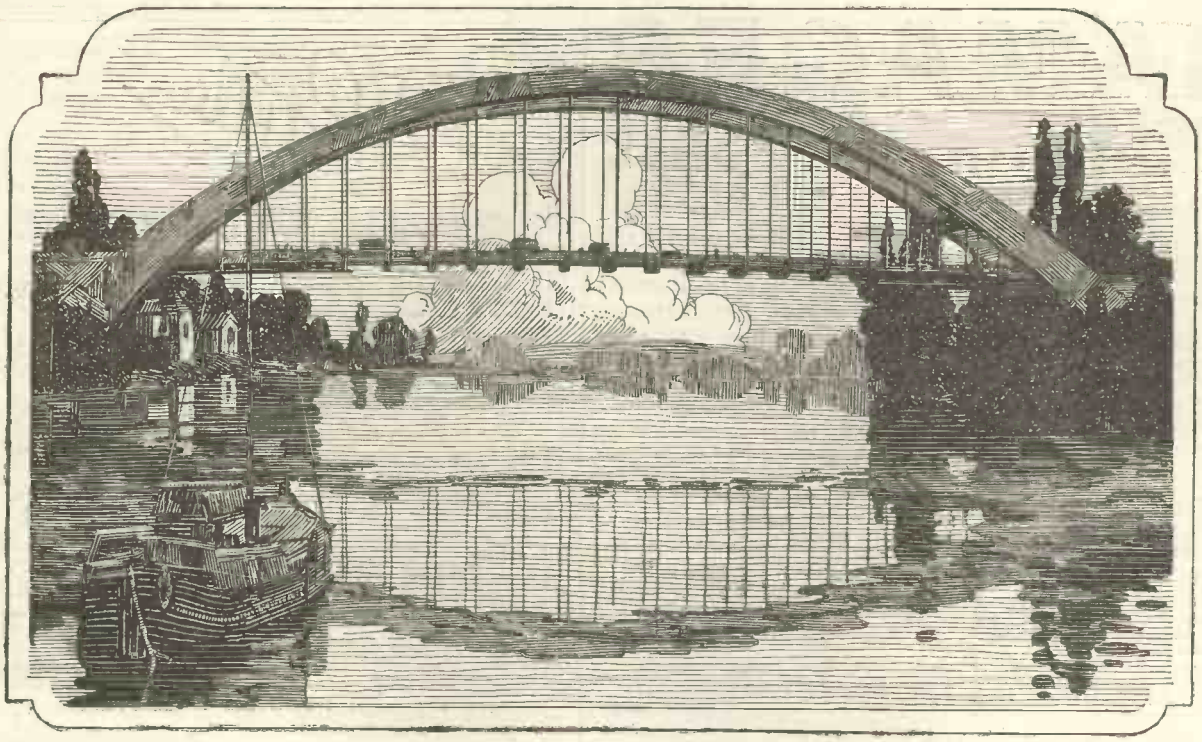
K. RAYMOND
27, LISLE STREET, W.C.2

'Phone: Gerrard 4637.

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

HOURS OF BUSINESS:

Daily - - 9 to 7.45
Sundays 10 a.m. to 1 p.m.



The wonderful Bridge at St. Pierre-du-Vauvray.

THE wonderful concrete bridge at St. Pierre-du-Vauvray, crossing the Seine, is the longest bridge of its kind in the world. How is its tremendous mass—entirely without centre pillars—prevented from collapsing? The early Romans—although not the first bridge builders—knew the answer to this problem. *The secret is in the arch.*

Now this is a point of great interest to all Valve users. All metals when heated expand, and the filament of a Valve is no exception. In Valves with long straight filaments this expansion must be counteracted, otherwise it would cause the filament to sag, and, touching the Grid, would put the Valve out of action.

Therefore, a spring of some kind is usually incorporated—or else the supporting electrodes are sprung apart. Sooner or later, however, this constant stretching and contracting causes a fracture and the Valve is useless.

The Cossor filament, on the other hand, is arched like a bridge, thus it can support its own weight at all times. It never sags, neither is it easily fractured.

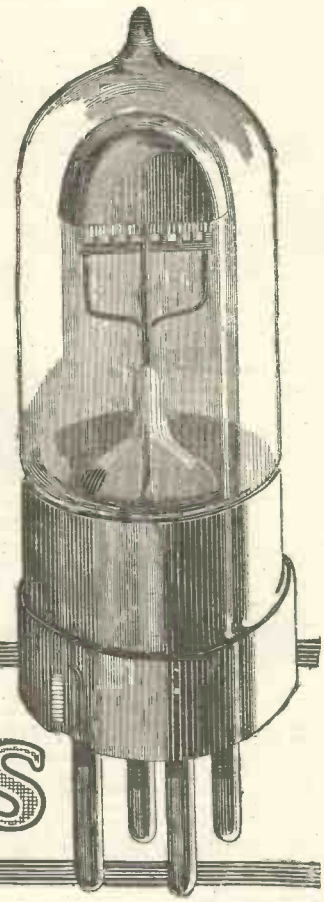
No matter how many times the filament is lit, the constant expansion and contraction will in no way affect it. *The secret of its long life, too, is in the arch.*

Every Cossor user knows that his Valve can be depended upon to give him longer service, greater range, and increased volume at no greater cost than the price of an ordinary Valve with half the life.

PRICES

P.1 (For Detector and L.F. use) .. 12/6 P.2 (with Red Top for H.F. use) 12/6

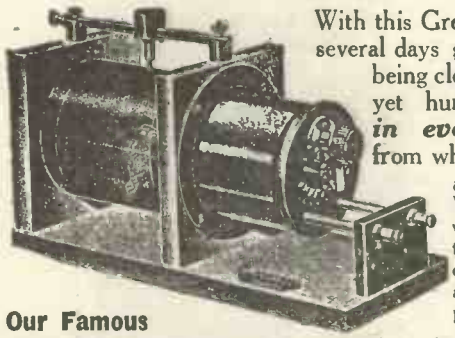
From all Dealers.



Cossor Valves

Advertisement of A. C. COSSOR, Ltd., Highbury Grove, N.5. *Gilbert Ad.* 1060

GAMAGES
GREAT Wireless SALE



With this Great Clearance already several days gone, stocks are fast being cleared. But there are yet hundreds of Bargains ***in every department*** from which to select. Here are a few offers for the Wireless Enthusiast—all well worth ordering from this announcement direct on our Moneyback guarantee. Sale Catalogue post free on application.

Our Famous

LOOSE COUPLERS

A loose coupled Receiving Inductance or Transformer is without question a most sensitive and selective Tuner and is estimated to give 10 per cent. better results than the ordinary "Tight" type. During the sale, Gamages are offering a limited number of these, slightly shop soiled, at greatly reduced prices. Loose coils easily rewound. If a variable condenser be used in shunt or series with the inductance, atmospherics can be partly cut out and signals increased. Usual price 27/6. SALE PRICE **20/-**

COIL HOLDERS

This is the Ideal Coil-Holder for Honeycomb and Burndept Coils. Made in best ebonite with all brass parts finished dull nickel. For two Coils. Post 6d. Usual price 6/6. SALE PRICE **4/-**
For Three Coils. Post 6d. Usual price 8/6. SALE PRICE **6/-**
This has a perfect movement which can be tightened when using large coils.

FULLER'S BLOCK ACCUMULATORS

offered at Greatly Reduced Prices during the Sale.

2 volt. 40 amp. Post 1/-. SALE PRICE **9/-**
4 volt. 40 amp. Post 1/-. SALE PRICE **18/-**
6 volt. 40 amp. Post 1/6. SALE PRICE **27/-**

Order by post with every confidence — you will not be disappointed.

Sale Offer of the Famous

SUPER PHONE PANEL

A beautifully finished component with lacquered terminals. TO TAKE 4 PAIRS OF 'PHONES. Size 5 in. × 2 in. × 1¼ in. high. Usually sold at 3/6 but offered during the Sale at .. .. **2/9** Post 4d.

SERIES PARALLEL SWITCHES
Remarkable Sale Offer.
An instrument every experimenter should possess.
SALE PRICE **5/-** Post extra.

SALE OFFER

FAMOUS CRYSTAL DETECTORS

Famous Dust-proof Crystal Detector, supplied complete with a piece of Gamages' famous "Permanite" Crystal. Transparent Cover to protect Crystal from dust. Usual price 3/9 SALE PRICE **3/3** Post 4d.

Crystal Detector, fitted with our renowned "Permanite" Crystal. Lacquered Brass. mounted on ebonite, ball joint and "cat's-whisker." To secure at prices now ruling, order immediately. SALE PRICE **2/2** Post 4d.

GAMAGES, HOLBORN, LONDON, E.C.1.
Also at Benetfinks, Cheapside, E.C.2.

Stella

"gives you more and costs you LESS"

True economy this—you pay less for wireless which is more perfect when you insist on these Stella specialties.

STELLA PHONES.

Tested and Guaranteed to give perfect reproduction without distortion. Light and comfortable to wear. Equal to phones costing much more.

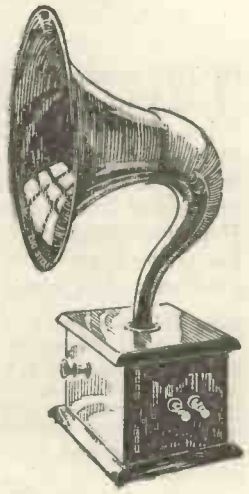
4,000 OHMS Stamped B.B.C. .. Per Pair **17/6**

WEMBLEY PHONES.

These have the same diaphragm as the Stella and give the same faultless reproduction. They are lighter and are made that only the earpieces, and not the headband, touch the head at the sides.

4,000 OHMS, Stamped B.B.C. .. Per Pair **14/6**

BIG STELLA LOUD SPEAKER.



For every Loud Speaker used in the home, in public hall or outdoors, Big Stella gives clearest and most perfect results at a price which will prove to you the folly of purchasing the costly instruments now on the market.

BIG STELLA carr. paid **70/-**

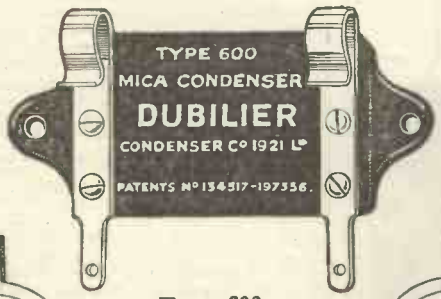
LITTLE STELLA.

A smaller model giving equally wonderful reception carr. paid **35/-**

As Exhibited at Wembley. Avenue 11. Bays 8 & 9.

Buy at Wembley, or from any good Wireless Dealer. Substitutes are inferior—do not accept. If unobtainable write direct to

STELLA WORKS,
31-37, Wybert Street, LONDON, N.W.1.
Telephone: Museum 8390.



Type 600

Confidence.

When you buy a fixed condenser of any unknown make for your set, you buy on trust.

You hope that it really will be of the capacity stated; you hope that it will remain constant and not produce mysterious faults by leaking or altering its capacity.

Not having an electrical laboratory at your disposal, you cannot prove the matter either way. So you hope for the best.

.....

How much wiser to buy a condenser in which you CAN have confidence. There may be an extra outlay of a few pence, but the soundest possible insurance against condenser faults in your receiver is to

"Specify Dubilier."

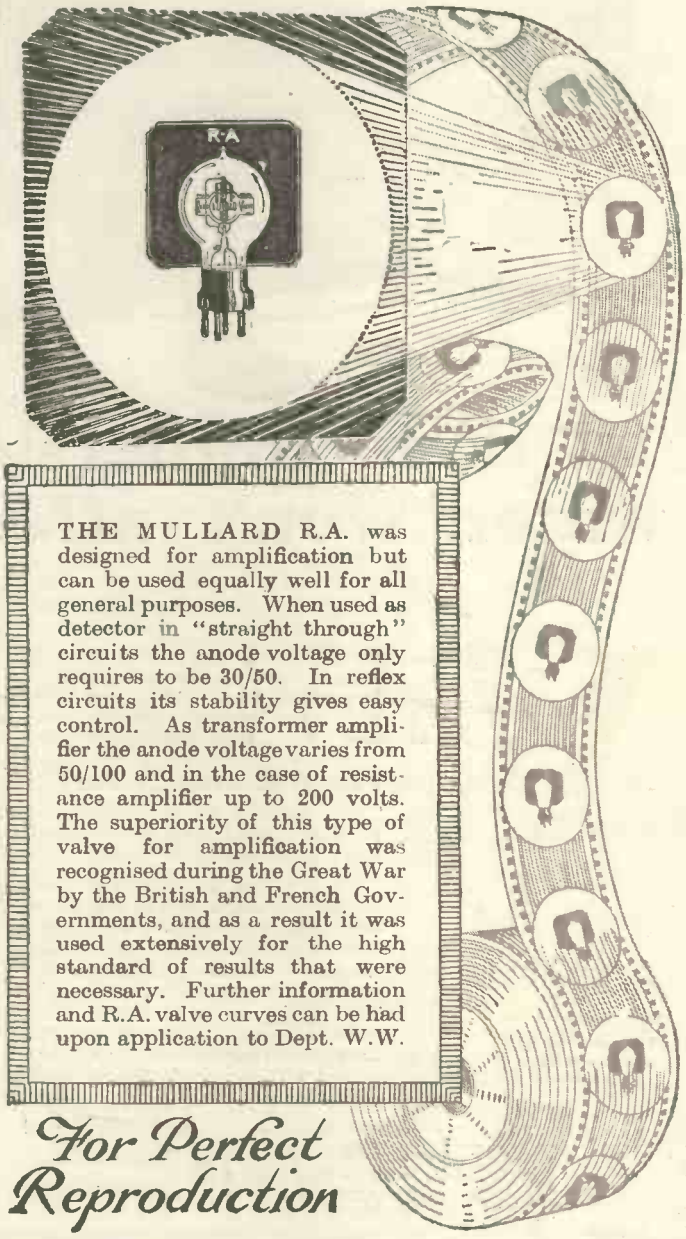
The Dubilier Condenser Co. (1921) *Ltd.*
Goldhawk Road, Shepherd's Bush,
*London, W.*12.

DUBILIER
CONDENSER CO (1921) LTD

E.P.S.59.

A Valve for Every Wireless Circuit

THE R.A.



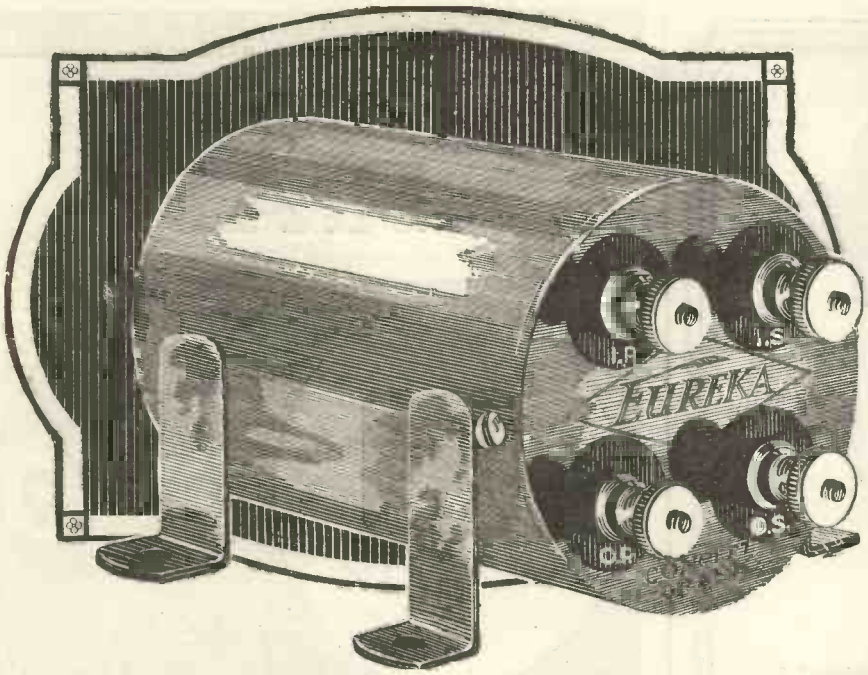
THE MULLARD R.A. was designed for amplification but can be used equally well for all general purposes. When used as detector in "straight through" circuits the anode voltage only requires to be 30/50. In reflex circuits its stability gives easy control. As transformer amplifier the anode voltage varies from 50/100 and in the case of resistance amplifier up to 200 volts. The superiority of this type of valve for amplification was recognised during the Great War by the British and French Governments, and as a result it was used extensively for the high standard of results that were necessary. Further information and R.A. valve curves can be had upon application to Dept. W.W.

For Perfect Reproduction

Mullard
THE · MASTER · VALVE

*Advt.—The Mullard Radio Valve Co., Ltd., (W.W.), Nightingale Works, Nightingale Lane, Balham, S.W.*12.

BRITISH EMPIRE EXHIBITION, PALACE OF ENGINEERING, Avenue 14—Bay 13, (160).



14 days' immersion in water won't affect it!

IT is safe to say that few other Transformers could live up to half the stringent tests which every Eureka has to pass before being issued.

For instance, each one is hermetically sealed within its coppered steel case and guaranteed to be absolutely impervious to all atmospheric influences. If you want to try out an interesting test you can immerse one in water for a fortnight, take it out and wipe it dry and your Eureka will still function perfectly—our guarantee stands at the back of this test.

The insulation on every Eureka is so perfect that on Faraday House tests the tremendous pressure of 2,000 volts was required to break it down.

Thus you can be sure that the Eureka you may buy to-morrow will be giving you faithful service years after other cheaper Transformers have broken down through inferior insulation. In the Eureka we make sure that the insulation is as perfect as modern electrical engineering methods can make it and then we seal it up for good. That's why when a man contemplates spending a few pounds on parts for a new Set intended to give him and his friends real pleasure for a very long time to come he should eliminate trouble by fitting a Eureka Concert Grand.

Sold by all Dealers and manufactured only by
PORTABLE UTILITIES CO. LTD.,
7 & 8, Fisher Street, LONDON, W.C.1.
Scottish Agents: FULLER, BLACKIE & RUSSELL, Ltd., 30, Gordon Street, Glasgow.

Made in two types
Concert Grand ... 30/-
Eureka No. 2 ... 22/6
(For second stage).

EUREKA
Low frequency Transformer

Gilbert Ad. 1073

WIRELESS WEEKLY SMALL ADVERTISEMENTS.

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

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

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.

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.—M. & G., 60, Churchfield Road, Acton, W.3. Telephone: Chiswick 2681.

THE WIRELESS BOOM. Traders should purchase their stocks from reliable establishments. We are Factors and Manufacturers, established 1896, and supply Component Parts and full stocks. Orders should be accompanied with Cash, any sent in excess returned with the goods. The Newtonia Wireless Factory, 13-15, Whitcomb Street, London, W.C.2. BANKERS: The Westminster Bank, Streatham Branch.

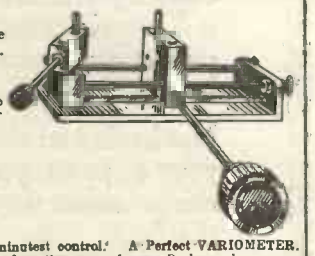
RADIO Sets and Components, bought, sold, and exchanged. All makes of components post free over 10s.—Nicholson, 9, St. Peter's Place, Fleetwood.

EL-BE UTILITIES

The "MIKROTUNE" MAKES TUNING SIMPLE & CERTAIN

Reversible Coil-holder.

Adds 50% value to any set.



12/6

Coils under minutest control. A Perfect VARIOMETER.

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

LEIGH BROS., 37, Sidmouth St., Gray's Inn Rd., LONDON, W.C.1

Telephone: MUSEUM 4192.

6/6 "C" BRITISH MADE "C" 6/6

R.A.F. "C" Valves made by Osram G.E. Co., Ltd., and Ediswan Co., the finest H.F. and Det. valve ever offered under 13/-. Fit Mullard "Ora B" sockets. Adaptors for "R" Valves supplied at 1/- each.

"C" Valves were made under Government supervision for W/L of the Broadcast Bands, and there is no valve to touch them under DOUBLE THE PRICE. 5-valve New R.A.F. Receivers with valves £7, post free.

5 v. ¼ amp.

Four Electrode "R" Valves, 17/6 each.

Limited Number delivered from Stock. Trade Supplied.

Send 3d. stamps for Illustrated Catalogue of Radio Bargains.

LESLIE DIXON & Co.

9, COLONIAL AVENUE, MINORIES, LONDON, E.1.

Johann Bach was born in 1685—the year that witnessed the birth of Handel. From his earliest days he showed a marked love for music, yet his parents prohibited him from using his elder brother's scores. Bach, however, undaunted used to rise at night and steal away to copy them by moonlight—permanently injuring his eyesight by so doing.

"—my Transatlantic Set has a record of five American Broadcasting Stations:"

says Mr. McIntyre.

NOT bad for a home built Set, is it? And it was really the first serious Receiver I had built.

Its cost? Well, apart from the three valves I dare say the whole Set cost me less than six pounds, including the cabinet and a couple of H.F. Transformers.

I have read descriptions of many other Receivers, but none aroused my interest quite as much as this one. It seemed so simple to make, and as a matter of fact, once I had collected the components together and planned them out on the panel, the whole job took just two evenings—one for the drilling and assembly and the other for the wiring.

Certainly I am much indebted to Mr. Harris for the clever way in which he has planned this two-H.F. Receiver. Its sensitiveness is astonishing and yet, with potentiometer control it is childishly simple to operate.

Up-to-date I have logged five American Broadcasting Stations and of course all the BBC Stations and most of the principal Continental ones.

The Transatlantic Set referred to by Mr. McIntyre is only one of a dozen described in Mr. Harris' Book. Whether your tastes lie in long distance reception or merely a Set to pick up your local Station you will find a ready choice available. Get a copy to-day from the Publishers (Radio Press Ltd., post free, 2s. 8d.) or from your Bookseller.

2/6

12 Tested Wireless Sets

By Percy W. Harris.

Gilbert Ad. 1029.

STEPPING STONES TO SUCCESS

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

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

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

RADIO PRESS PANEL CARDS.

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

		Price.
14	12 Tested Wireless Sets ... ... By *Percy W. Harris.*	2/6
15	More Practical Valve Circuits ... By *John Scott-Taggart, F. Inst. P.*	3/6
16	Home-Built Wireless Compouents ...	2/6
17	Wireless Sets for Home Constructors By *E. Redpath.*	2/0
18	Tuning Coils and How to Wind Them By *G. P. Kendall.*	1/6

RADIO PRESS ENVELOPES.

No. 1.	How to Build an S.T. 100 Receiver By *John Scott-Taggart, F.Inst.P.*	1/6
No. 2.	How to Build a 4-Valve Receiver By *Percy W. Harris.*	2/6
No. 3.	How to Build a "Simplicity" 3-Valve Set ... ... By *G. P. Kendall, B.Sc.*	2/6
No. 4.	How to Build the All-Concert de Luxe Receiver ... ... By *Percy W. Harris.*	2/6

SIMPLEX WIRING CHARTS.

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

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

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

Gilbert Ad. 1099.

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Wireless Weekly, 6d. Net. Wednesday July 23rd, 1924.

Wireless Weekly

and the Wireless Constructor.

Vol. 4.
No. 12.

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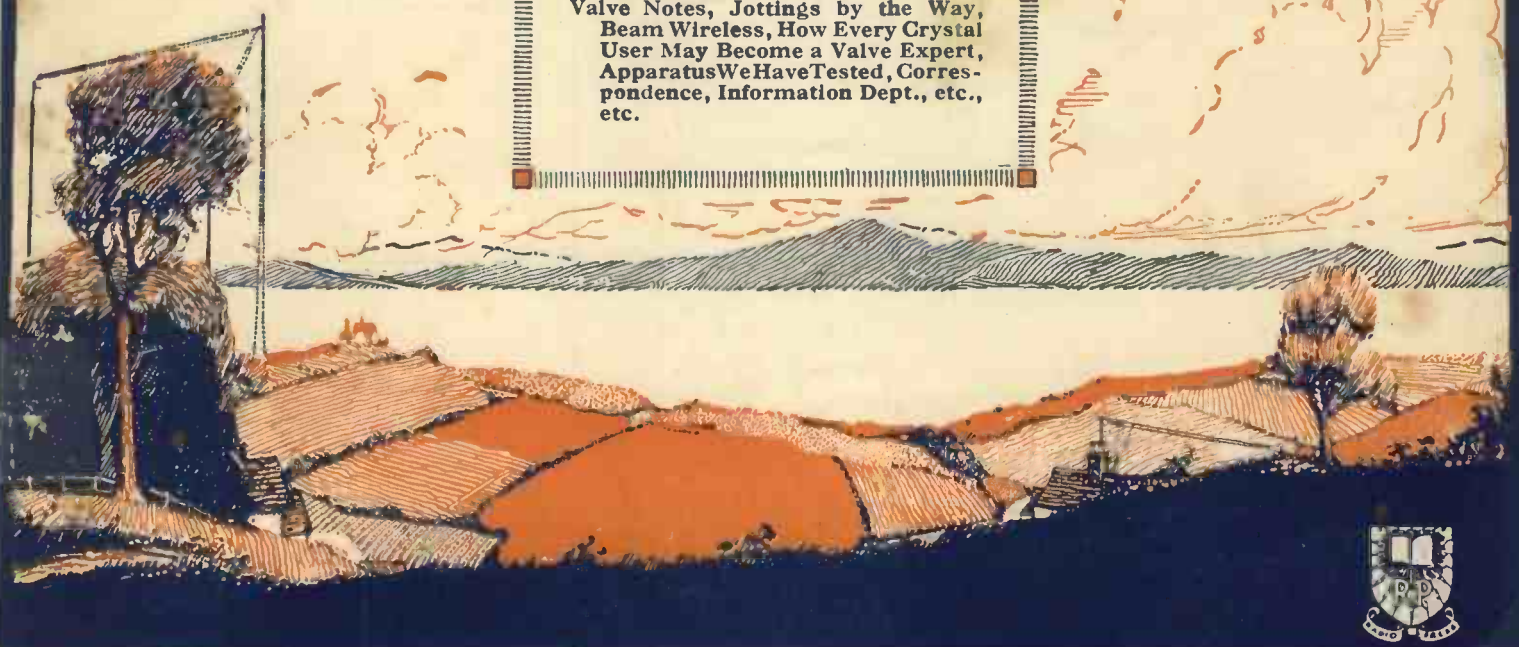
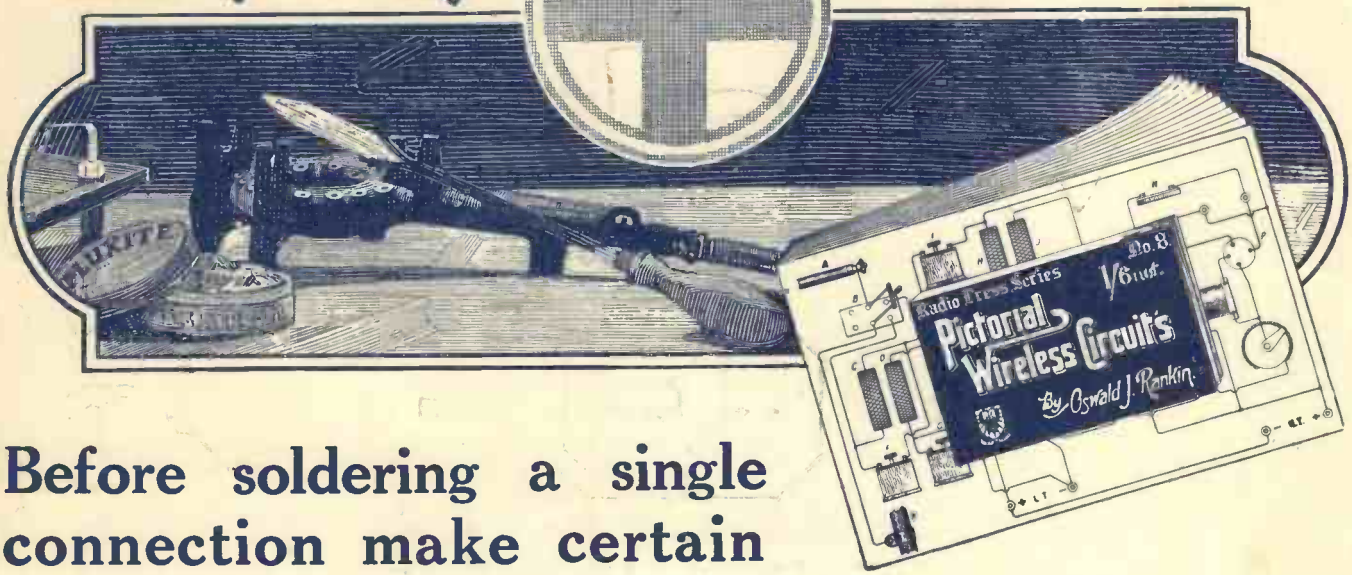


Special 1,600 Metres Number

Safety First



Before soldering a single connection make certain your Circuit is correct.

MANY a man has built up a Receiving Set, inserted the Valves, coupled up the batteries and . . . . hoped for the best!

Perhaps at the worst the result of his efforts has only been complete silence, but if he has been really unlucky, and his wiring inextricably mixed there has been a blue flash indicating the premature decease of his valves.

And almost invariably the cause of the whole trouble is inability to read a Circuit diagram.

Now Radio Press, Ltd., have published an entirely new Book, "Pictorial Wireless Circuits," which makes use of a different principle to that usually employed. Instead of conventional signs every Circuit is shown with illustrations of the actual components connected together. It gives, in effect, a bird's-eye view of the finished set.

Naturally such a method makes wiring up extremely simple and as a very wide range of circuits is shown, ranging from simple Crystal Circuits to multi-valve Circuits, it is a Book which should be in the hands of every Wireless enthusiast.

Obtainable from all Booksellers or direct from publishers (postage 2d. extra).

Every Circuit is individually described and its advantages explained. Full details of all variable components, such as condensers, resistances, grid leaks are given, so that the home constructor can build up a Receiving Set from the information furnished.

R. P. Series
No. 8.

Radio Press Ltd., Devereux Court, Strand, W.C.2

1/6

Pictorial Wireless Circuits

By Oswald J. Rankin.

G.A. 1147.

Wireless Weekly

Vol. 4, No. 12
July 23, 1924

CONTENTS

Editor: JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.
Assistant Editors: P. W. HARRIS. E. REDPATH.

Radio Press, Ltd.

Publishers of Authoritative Wireless Literature.
DEVEREUX COURT, STRAND, W.C.2.
Tel.—Central 3763.

Advertisement Managers: SCHEPP PUBLICITY ORGANISATION, LTD., 125, Pall Mall, London, S.W.1
Tel.—Regent 2064.

All correspondence relating to contributions is to be addressed to the Editor of "Wireless Weekly."

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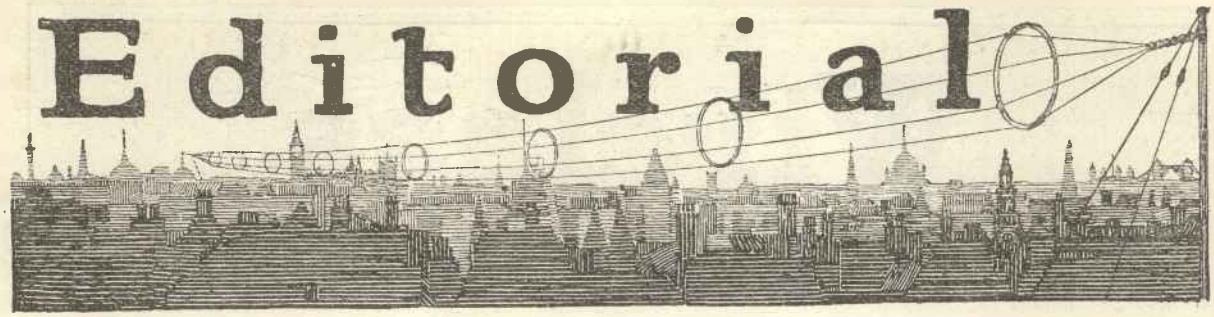


Truth in Advertising

The holding in London of the International Advertising Convention has once again drawn attention to the importance of clear and accurate statements in advertisements of every kind. While we can say with certainty that the day has passed when blatant falsehood could pass unchallenged, we are still some distance from the ideal of perfect truth in such announcements. In this regard it may be said that perfect truth is a matter upon which philosophers will always dispute.

Between a flamboyant disregard of accuracy and an academic ideal, there must, of course, be a happy medium. Wireless as a new industry, has still much to learn in the matter of truth in advertising, although in this country at least we may congratulate ourselves that there is a very little deliberate misrepresentation. There are a few points, however, to which we would direct the attention of advertisers most earnestly; as the present unsatisfactory state of affairs is harmful not only to the public, but also to the advertisers themselves.

Condenser Values

Take, first of all, the question of the actual and reputed values of variable condensers. Practical experience has shown that certain capacity values are most useful in wireless receivers. Perhaps the four most popular values are .001, .0005, .0003 and .0001 μF. The largest of these, and, until a year or two ago, the most popular, is gradually passing out of use with the realisation that high values of capacity shunt are often detrimental to signal strength. The .0005 μF value is immensely popular, and is of just the correct value for aerial tuning when used in a suitable circuit.

Let us take the case of the home constructor who desires to build one of the sets described in these pages. He will choose the design, and soon afterwards order the component parts from his dealer. For the successful functioning of the particular set it is probably necessary that the full capacity values should be available. What does he usually find? The condenser sold to him as .0005 μF on actual measurement may have a value as low as .0003 μF. The probable result will be that the set will fail to tune the wavelength range required, and the design may be condemned.

If such mis-statements of value occurred in a few isolated cases of little-known manufacturers, it might be overlooked, but it is doubtful whether one condenser in three now sold is properly rated. Certain manufacturers are guaranteeing the capacity of the condensers sold, and these should be encouraged.

Another matter of importance is that of the range of receiving sets. It is far too common a custom to make a statement that all stations can be regularly received upon a set which is only capable of receiving them all in most favourable conditions.

In this connection the value of the independent test reports conducted by this journal is quite evident. The careful tests and measurements and the practical use of components in the constructional articles published in this journal afford an excellent guide and assistance to our readers in their own work. It is in this way that the confidence awarded to our publications has been built up. This, combined with our policy of accepting only advertisements of genuine goods, serves to protect our readers' interests in the fullest possible way.

In our issue for 2nd July, we published our test report of a "Success" transformer submitted by the makers for test. Out of a sense of fairness we have permitted to be published on another page an advertisement in which the makers state their own claims.

Chelmsford Without Interference

A Wave-trap for 1,600 metres Crystal Sets.

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

BY the time these lines appear in print a considerable proportion of the readers of *Wireless Weekly*, who use crystal sets inside a distance of perhaps eight miles from 2LO, will have discovered for themselves that to tune-in 5XX while the local station is working is not nearly so easy as they had anticipated. The average crystal set is designed for reasonably loud signals with the minimum of trouble, and there has been little need, prior to the opening of the high-power station, for more than elementary selectivity. In any case, obtaining high selectivity is a matter of some difficulty in crystal sets, unless unduly complex circuits are used, since the damping effect of the crystal is so great that the tuning

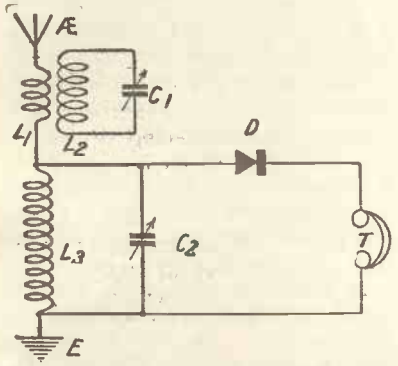


Fig. 1.—The B type of wave-trap applied to a simple crystal receiver.

is necessarily very much flattened, even when the crystal is tapped across only a part of the total inductance.

The result is that when the average crystal receiver is used within a fairly short distance of a main station it will usually be found that when a loading coil is inserted for the reception of the Eiffel Tower time signals the local programme continues to be heard at somewhat reduced strength. Further, when an attempt is made to receive 5XX on 1,600 metres the problem is still more difficult, and it may be found that the two stations are heard with equal volume, even when the best possible tuning adjustments have been made for the high-power station. This is exactly my own experience when using a commercial crystal set upon a rather high aerial at eight miles from 2LO.

Valve Reception

With a valve set the problem becomes much simpler, since tuning is normally sharper when no crystal is connected across the tuned circuits, and the proper use of reaction enables one to make the aerial or anode circuit really sharply resonant, and little trouble should be experienced at distances of less than about three miles of a main or one mile of a relay station.

Selective Circuit or Wave-trap

Turning to remedies for the trouble, it will be seen that there are two main lines of approach, the first depending upon the use of more selective circuits, and the second involving the provision of some definite absorbing device to eliminate the unwanted station.

In the majority of cases the second method is to be preferred, since it does not involve any alteration in the set itself, consisting of the use of an additional unit of some kind, and does not seriously increase the complexity of the set.

The adoption of a more selective type of circuit, on the other hand, requires a considerable amount of alteration to the set itself, and specially selective circuits are in their very nature more difficult to handle, and hence less desirable for general purposes. I would therefore always advise the use of a circuit of a perfectly straightforward type, to which an external eliminator can be added when needed, possibly with a switch to bring the trap into circuit without trouble.

Suitable Wave-traps

By comparison with the problem of cutting out the local station in favour of another working on a wavelength within the ordinary broadcast band (300-500 metres), it is an easy matter to devise a trap which shall completely eliminate interference on 1,600 metres. The trap need not be of a very drastic nature, and hence it is unnecessary to use one of the types which upset the tuning adjustments seriously, and render the set less simple to work.

I have found best the trap known as type B, and a modification thereof which I propose to call type D. Type B is illustrated in circuit form in Fig. 1 as applied to a crystal receiver, and it will be seen that it consists of a trap circuit tuned to the unwanted signals, coupled as tightly as possible to the aerial circuit by means of a relatively small number of turns wound directly on top of the main trap coil. These turns are connected in series between the aerial and the aerial terminal of the set, and, of

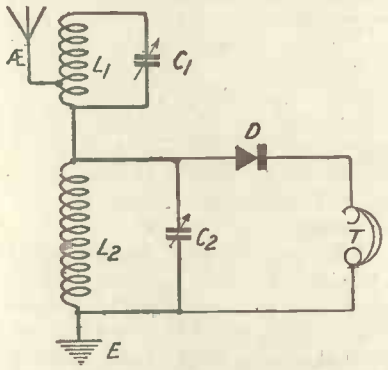


Fig. 2.—A modification of type B.

course, only affect tuning to a small extent.

Type D is illustrated in the same way in Fig. 2, and differs from B only in that no special turns are wound on for coupling purposes. A suitable number of turns of the trap-winding are tapped off and used for coupling, the arrangement resembling an auto-transformer. Of the two, I have found type B slightly more dependable (there is a very small element of uncertainty in the behaviour of almost any wave-trap), but type D is much less troublesome to make. In any given case they are both worth trying, since different traps seem to be required by different aerials.

The two types are shown pictorially in Figs. 3 and 4, which

give the actual connections of the components.

Efficiency Wave-traps

One hears exceedingly conflicting opinions expressed by experimenters of experience as to the effectiveness of wave-traps, and it appears that aerial and earth conditions modify their action to a considerable extent, that there are instances where no known type of trap is of much use. These cases are certainly rare, however. Recent experiments upon various types of traps have convinced me that, although the H.F. resistance of the aerial-earth circuit is important, the discrepancies between the results of different experimenters are more often due to the use of traps of inefficient construction.

The efficiency of a wave-trap as an eliminating device appears to be very largely dependent upon keeping all energy losses in the trap circuit as low as possible, paying great attention to such matters as possible dielectric loss in coil formers and wire covering, resistance losses, and so forth.

The variable condenser, for example, *must* be of the best, preferably of the air dielectric type, and with ebonite end plates. A really sound electrical connection to the moving vanes is also essential.

The coil former should be of ebonite of good quality; it is desirable that as little dielectric material as possible should be included in the field of the coil. I have obtained a perceptible improvement by using a sort of skeleton former cut from ebonite tube, but such refinements as this are unnecessary in traps used for the purpose which we are considering here.

Single layer winding appears best, and double cotton-covered wire should be used, no varnish or wax being employed for impregnation. Leave the cotton without impregnation and try to keep the coil dry. Wire of large gauge (not less than No. 22 S.W.G.) is essential, fine wire being one of the commonest causes of failure in wave-traps.

Constructional Details

The diagrams give the connections of the two types of trap, and it only remains to provide practical data as to tubes and windings.

Type B requires a tube (ebonite) 3 inches in diameter and length, upon which 40 turns of No. 22 S.W.G. d.c.c. wire are wound in a single layer. Over the top of this winding put ten turns of No. 18 S.W.G. d.c.c. wire, to be connected in the aerial circuit. A variable condenser of 0.001 μF is connected to the

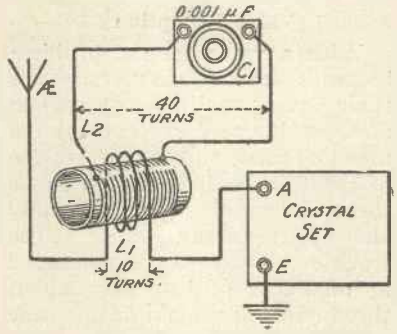


Fig. 3.—Type B represented pictorially.

ends of the 40-turn winding, and the trap is complete.

Type D consists of the same tube and trap-circuit winding, but the ten turns of No. 18 wire are omitted. Instead, a tapping is taken out, so that eight turns can be brought into the aerial circuit. The connections of the variable condenser are as before.

Operating the Trap

The use of traps of this type is very simple. Set the controls of the set very roughly to the settings required for 5XX, and pro-

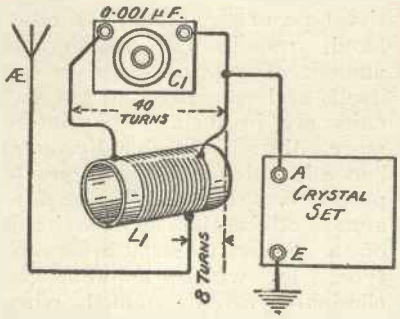


Fig. 4.—The actual connections of type D.

ceed to vary the capacity of the wave-trap condenser. Signals from the local station will be heard almost all over the dial, but with a little patience a point will be found at which they disappear, and upon *either side* of which they reappear. Leave the trap set to this value, and proceed to tune in the desired station.

A Tip for the Tapless

IF you are one of those who have not yet acquired the art of threading holes by means of taps, or if at any time you wish to be able to insert a screw for which you have not a corresponding tap, here is a simple hint which will enable you to get over your difficulties when engaged in wireless construction. The tip is to make plain holes two sizes smaller than the clearance size for any particular screw. Thus, supposing that you wish to fix, for example, a 4 B.A. screw tightly you proceed as follows:— By reference to a table you find that the clearance size for 4 B.A. is a No. 26 drill. You therefore use a No. 28—note that the drill numbers increase as the sizes become smaller; No. 1 is the largest Morse twist drill, No. 60 is the smallest. Now take a 4 B.A. screw, and, with a file, bevel off the last two or three threads so as to make the end rather pointed. Moisten the screw with a little turpentine or oil, and you can turn it in with a screwdriver. Go easily, and do not use too much force, especially with very small screws, or they may twist off. The clearance sizes for other B.A. screws which the constructor uses are 12 for No. 2, 19 for No. 3, 30 for No. 5, and 34 for No. 6. In order to drive screws straight in without tapping one would therefore drill plain holes with No. 14, 21, 32 or 36 drills.

It will be found that screws of any size inserted in this way grip quite tightly, and that they can, as a rule, be driven in without the least trouble. It must be noted that metal screws only can be used for ebonite. Never attempt to use wood screws which are almost certain to twist off whilst being screwed home. Even those who do use taps will find the "two sizes smaller" tip most useful for putting screws into "blind" holes, that is, those which do not go right through the panel. Here tapping is often very difficult, even if one has a plug tap, and it is really better to make plain holes of the sizes indicated. R. W. H.

The Great Idea

IT is not often that Poddleby has a really good inspiration, but there are times when, like Felix of the films, he experiences a kind of boiling up of ideas which explode with startling results to all around. The other day, when the Little Puddleton wireless club was holding one of those meetings which have now become so famous, General Blood Thunderby, who was in the chair, asked for suggestions for a summer outing. My own contribution, which I regret to say was promptly turned down, was that we should visit the North Foreland and contemplate the beauty of GNF, whilst lying quietly upon our backs in the summer sun. I have always felt that the hot weather calls for something of a peaceful nature. Others proposed that we should journey to some great factory and see how wireless things are made. But, mindful of the old saying that the epicure should never go into the kitchen if he wishes to preserve his appetite, I strenuously led the opposition against this. It was Poddleby, our own Poddleby, who had the meeting with him at once when he said: "Why not go to Wembley?" Admiral Whiskerton Cuttle rose promptly to his feet to protest against a wireless club wasting its time in watching tennis tournaments. As everybody started to speak at once, we had a little difficulty in explaining to him that it was not wimbling to Wimbledon but wembling to Wembley that was being mooted. Eventually he saw the point and withdrew his objection. Poddleby and other speakers pointed out that there was no need for us to visit one factory or one wireless station when all the radio wonders of the Empire were collected together within the boundaries of the Exhibition. Breadsnapp told us that we could spend the whole day in the Palace of Engineering, and, having been there once himself, volunteered to act as guide-lecturer. This offer was tactfully declined.

We Start

After an animated discussion it was decided that we should all go, making use if possible of a convenient excursion. Reference to the handbills, however, disclosed the fact that the only excursion was timed to leave Little Puddleton at 3.30 in the morning, and, as most of us are making up during the summer months for the sleep which we lost in the winter when Trans-Atlantic reception was in full blast, it was thought that this would not be good for our health.

A Sad Incident

We agreed, therefore, not to go by train at all, but by the ever useful charabanc. I have little to tell you of our journey Exhibitionwards—in fact, the only event that marked it was the demise of the General's beautiful white bowler. Gubbsworthy, who was sitting beside him, rose from his seat in order to exchange some light badinage with Winklesworth in the row in front. As he stood up the General thoughtlessly placed his hat upon the seat, with the result that it became a casualty when Gubbsworthy resumed his place. The General's fury was not lessened by Gubbsworthy's insisting that it was not seemly for the chairman of the wireless club to play practical jokes in a public conveyance.

Some Progress

Poddleby's scheme for the day was this: It would be just midday when we were decanted at the main entrance, and we were all to spend the first hour on our own to obtain some idea of the wonders of the Exhibition. At one o'clock we were to rendezvous for lunch, after which we were to proceed to the Palace of Engineering until tea-time. From then onwards we would visit the remaining wireless marvels of the Exhibition. When the General called the roll at one o'clock it was found that several members were lost, stolen or strayed, and not until three-quarters of an hour later was the entire club able to assemble round what the reporters call the festive board. Luncheon over, we sat round the table sipping our coffee whilst the details of the afternoon's programme were discussed. This took some little time, since not all of us were in perfect agreement as to details, and various counter proposals were made to each suggestion. When perfect accord had been reached Gubbsworthy looked at the clock, and said that as it was now half-past four we might as well have tea. This was the first proposal of the day to be carried by acclamation. Poddleby hurried off after a hasty meal, bidding us proceed independently to the Palace of Engineering, and meet him at 5.15 at the magnificent stand of a firm of wireless manufacturers whose name is a household word, though for the moment I have forgotten it.

A Fall from Grace

As I loathe unpunctuality, I did not linger too long over my tea, and with the help of a bath-chair reached the appointed place very shortly after 5.30. I was amazed to find Poddleby absolutely alone before the wonderful stand. On seeing me he leapt forward with joy in his eyes, and

would, I believe, have embraced me had I not kept him at rather more than arm's length with my walking-stick.

A Solitary State

It appeared that I was the sole member of the club to put in appearance. Poddleby was quite willing to work off upon me the lecture that he had prepared for the club, but I persuaded him to keep it for an occasion more worthy of its quality. After we had stood making conversation for some minutes I said: "Well, this does not seem much use, and time is slipping away. Let's just have a look at the Amusement Park before it is time to go." Poddleby agreed with alacrity, and we went. You probably know the thing called the Jack and Jill. You get on to a little trolley built on the lines of an Irish jaunting-car, so that passengers sit back to back. This is wound up to the top of a steep incline by a chain arrangement, and when it gets there the seats simply turn over and tip their occupants on to a long curving slide, down which they career madly sitting on mats. You may imagine Poddleby's amazement and mine when, as we watched, we saw that the occupants of one of these cars were the General and Admiral Whiskerton Cuttle. Rushing up, I was just in time to witness the descent of the warrior, all flying arms and legs and a beaming smile, whilst Poddleby, going to the other side, found the admiral in a similar state of beatitude. "Why, General," I called. "Get out of the way," was the only retort. "Come on, Whiskers, I'll race you again for another bob." I hastily joined Poddleby, and found that he had been similarly rebuffed by Whiskerton Cuttle. We went away musing upon the sad fall from grace of two of our most respected members.

And the Professor

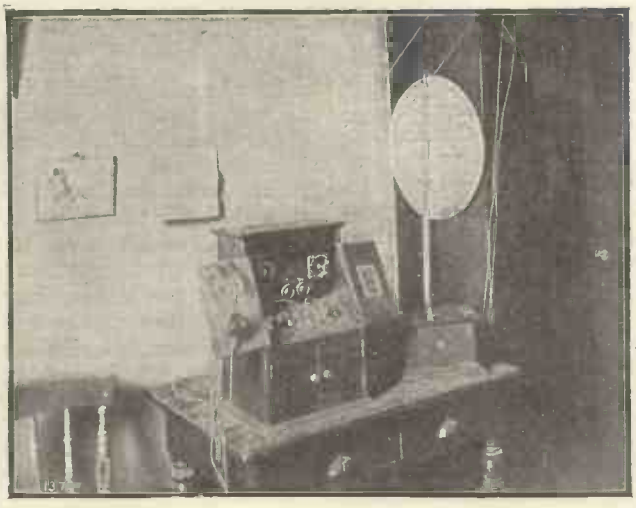
If the Jack and Jill surprised us the Witching Waves did much more than this, for there, careering round in a small vehicle like a cross between a bath-chair and a motor-car, his hat off, his collar undone, and the ends of his tie flapping all over the place, was—can I write it? No, I can't. Yes, I must. Well, here goes—was no less a person than Professor Goop, who appeared to have taken leave of his senses. Seldom have I seen upon any face the expression of reckless abandonment. As soon as the professor completed one round he waved wildly with his arms, and the blue-jacket fellows on duty pushed him off again for another. When at length he came into port Poddleby and I sought him out with reproachful glances. The Professor, like most of his kind, is absent-minded and not infrequently at a loss for words. Wishing to inquire his way to the wireless part of the Palace of Engineering, he suddenly found that he had entirely forgotten the name of the great science of which he is so illustrious a devotee. All that he could say to the policeman was "Oscillations. Undulations. Waves." The policeman at once handed him over to a guide, who rushed him on to the Witching Waves. As he had no words with which to expostulate, he was duly launched in a chariot, and at the end of each round the gestures by which he tried to indicate that he wished to stop were taken by the attendants to mean that he wanted to go round again. Little by little the thing grew upon him, and it was not until he had run up a bill of £2 14s. 6d. that he joined us.

What a Day

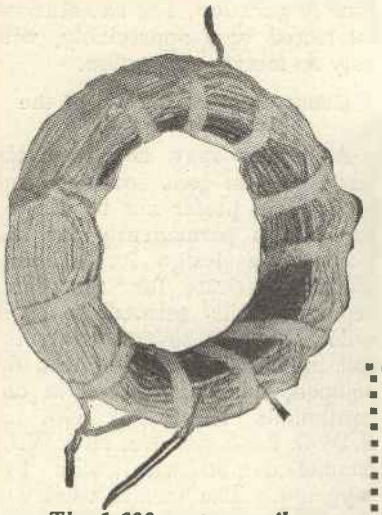
As we passed the Jack and Jill again we saw that the General and the Admiral were still hard at it; but perhaps the worst sight of all was provided by the Racer. As we came opposite to this two cars reached the top of the steepest bit of it and rushed madly down amidst the wildest yells from their occupants. As they crawled up the opposite slope we were able to see that each was crowded with members of the Little Puddleton wireless club, who were apparently divided into crews, and were racing under the leadership of Gubbsworthy and Breadsnapp. Such members as we had not so far accounted for we found either playing Skeeball or having their brains rattled on the Whip. Poddleby grew sadder and sadder over the terrible conduct of his flock, until with a certain diffidence I suggested that, as all the others were doing it, we might as well sample some of these things ourselves. When the party was finally ejected from the Exhibition at closing time we all agreed that we had spent a most instructive day. The only person whom I do not envy is the General, who, before the visit was made, undertook to read a paper at the next meeting upon the Wireless Wonders of Wembley!

WIRELESS WAYFARER

EDITORIAL NOTE:—*We regret to state that the necessary twopence which Wireless Wayfarer had saved up, in connection with the article, "Telephones for Twopence," was expended in the Amusement Park, and the article is thus delayed.*



Our photograph shows an interesting two-valve set designed by the British Thomson-Houston Company.



The 1,600 metres coil.

Efficiency on 1,600 Metres

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

A New Coil for long wave reception.

THE activities of the new B.B.C. high-power station, operating on a wavelength of 1,600 metres or thereabouts, have necessarily turned the attention of British experimenters in the direction of longer waves, largely unexplored territory for the majority of the new generation of broadcast listeners. Some Continental stations, of course, have been operating on long waves for a considerable period, but it is the exception rather than the rule to hear these discussed in radio circles, so that comparatively few can be receiving them regularly. Eiffel Tower on 2,600 metres used to be a regular stand-by in the early days; one seldom hears of him nowadays.

5XX

The frequent tests carried out (on just over 1,600 metres) by the Chelmsford station (5XX) recently have given a welcome opportunity of experimenting with a view to finding the best conditions for successful reception. In London these test transmissions come in well on the crystal, though presumably they are not sent on full power yet.

Experiment showed that better results in crystal reception were obtained by using a two-coil tuner, loose-coupled primary and secondary, each inductance being tuned by parallel tuning-condenser, and coupled at, say, 2 in. centres—in the method developed for long-wave reception before short-wave broadcasting was thought of. A No. 150 plug-in coil for primary, and a No. 200, or, better, 250 for secondary, were called for, with .0005 μF tuning condensers.

Aperiodic Aerial Coupling

To many, however, even with the flat tuning associated with a crystal receiver, the three simultaneous adjustments demanded by this equipment may be irksome, especially when a wavemeter is not available for the preliminary search. It seemed desirable, therefore, to see if the semi-aperiodic aerial coupling which has become popular lately for short-wave reception could be adapted here. A little experimenting brought out the fact that a No. 150 semi-aperiodic (i.e., not actually "tuned") primary coil, jammed close up against the No. 250 secondary coil, the latter being tuned as usual by a .0005 (or .001) μF parallel tuning condenser, gave excellent signal-strength on either the high double 40 foot P.M.G. aerial, or on the single low 70 foot. This corresponds to the Chapman-Harris type of short-wave tuner.

With a view to economising wire, and using smaller coils, it was thought that this might be modified so as to be in line with the aerial-tap auto-transformer type of aerial coupling lately developed in some detail in various circuits by the writer: here the aerial portion of the coil is also common with the secondary circuit, but the latter has an extra loading coil superimposed on the other coil, and is tuned across the whole by the usual tuning-condenser. The circuit No. 1 resulted: this gave excellent signals on the two pairs of 'phones from 5XX in London, with good crystal-setting. Changing from one aerial to the other required less adjustment of the tuning condenser than might be expected, though the effect of varying aerial characteristics is considerably greater, naturally, than when a very small aperiodic primary is used, as can be done with short waves.

Coil Sizes

Practical trial showed that the use of a primary of much less than 150 turns involved a considerable loss of signal-strength: the precise size of the primary is not critical, but nothing is gained by departing much from the size indicated, i.e., from the inductance-value implied (in case other types of coils are used than the ordinary standard plug-in coil indicated here).

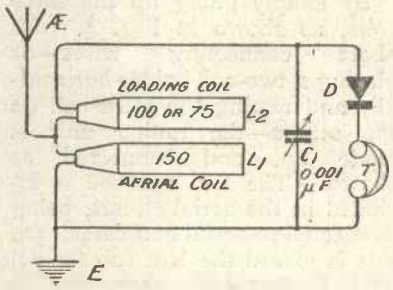


Fig. 1.—A simple auto-transformer circuit for 1,600 metres.

Valve Receivers

Turning to valve-reception, the question of suitable and really smoothly controlled reaction arises. Of course, a No. 200 coil used in a three-coil holder as usual, provides an immediate solution. But only a small proportion of listeners possess a three-coil holder on their sets; and the swinging reaction-coil offers what appears to the writer to be a very serious defect in the inevitable change in tuning pro-

duced when adjusting the reaction-coil; this makes the fine tuning necessary for distant telephony reception an extremely irritating process, and one not in the least likely to be successful in the hands of the non-technical in daily reception of broadcasting. Accordingly the well-tried method of reaction associated with the Reinartz receiver was adopted, modified for the particular conditions. This method, as is well known, gives an extremely smooth and easily-controlled reaction effect, with a fixed reaction coil and a reaction-condenser; and the wavelength is very little affected (in general) by reaction-adjustment.

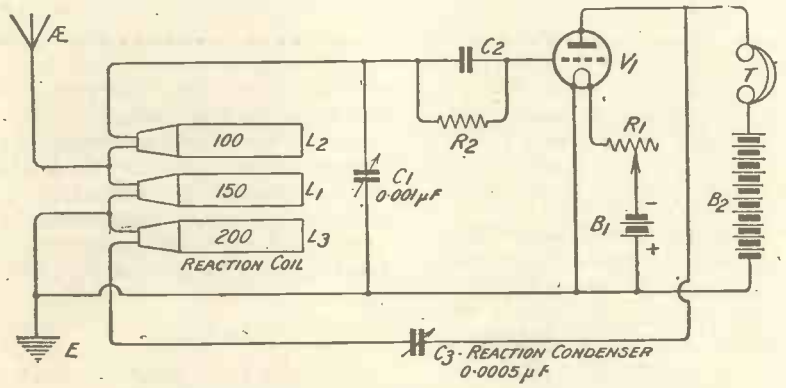


Fig. 2.—A single-valve circuit for plug-in coils.

The Tuning Unit

By simply piling up the three coils, as shown in Fig. 2, with short connecting wires—or placing a two-coil holder horizontally and resting the third coil on the others—the tuning unit is made up, and connected as shown. The No. 150 coil is included in the aerial circuit, being connected to aerial and earth. On this is placed the No. 100 (or 75) grid loading-coil, connected in series with the first. The tuning condenser is placed across the whole. The No. 200 reaction coil is put at the other side of the primary, and connected up with the earth end of the No. 150. With these longer waves the effective resistance ("reactance") of the capacity-path to earth via the casual and distributed capacities in the 'phones and their leads is high enough to divert the H.F. impulses coming from the plate of the valve, largely to the reaction condenser and coil. A reaction-condenser of, say, .0003 or .0005 μF should suffice, with a good R valve and 50 or 70 volts H.T., to give oscillation over a wide range.

Continental Reception

With the circuit as shown (Fig. 2) Eiffel Tower telephony on 2,600 metres came in quite well in London on the single valve, and also another telephony station (speaking French) a little higher (about 2,660 metres). Radiola was distinct on 1,780 metres in day-time, but was badly jammed by a station on 1,800 metres, extremely powerful—coming in like the local broadcast station on an average crystal-set—giving a long series of (apparently) market-reports or weather bulletins, etc., in a harsh language which was not French, German, Dutch, Spanish, or Italian certainly, but might possibly have been one of the Scandinavian languages, with which the writer is unfamiliar. Prague, in Czecho-Slovakia (about 600 miles) is scheduled for meteorological bulletin and news on this wavelength and at the time in question. The two stations interfered very appreciably, with only 20 metres separation.

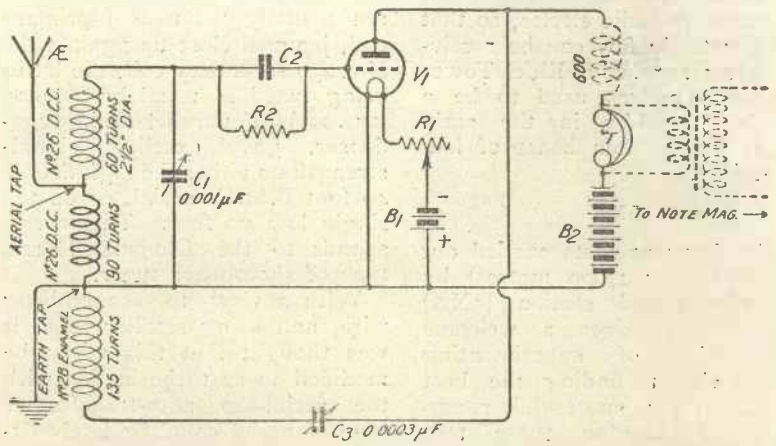


Fig. 3.—A long wave telephony receiving circuit, on the Reinartz principle.

Constructional Details of the 1600-Metre Coil

As many may not have the large plug-in coils specified, and others will prefer not to tie up three coils permanently for this purpose, a design for a home-made substitute for the three separate coils seemed to be in order. After several trials the coil indicated in Fig. 4 was developed, which is wound in one continuous length of No. 26 S.W.G. d.c.c. and No. 28 S.W.G. enamel-covered wire, with two tappings. The former used was the Watmel, 2 in. diameter and effective width of 1 in., with two rows of spokes of 11 each, staggered. The winding was done alternately simple single-layer or solenoid type, and zig-zag across the former to make a spacing layer of only five turns after the fashion of the familiar lattice-coil. (Actually the wire was passed across and around the third spoke on the opposite side each time, giving an effective spacing layer.) A total of 10 single layers resulted, the No. 28 being of 30 and the No. 26 of 20 turns: a total, with spacing layers, of 285 turns. The innermost reaction-coil part was of 135 turns actually of No. 28: this is by no means critical, and can be departed from fairly widely. Thus at first 200 turns reaction were used.

Aerial Turns

The aerial-coil part consists of 90 turns of No. 26; the grid load-

ing-coil part of 60 turns of No. 26. The effective diameter of the finished coil was about 2½ in. It was simply bound with narrow tape, no wax or varnish being used.

The wavelength range on a P.M.G. aerial was found to be about 1,100 to 2,800 metres, with a .001 μF actual tuning condenser. The writer used a new-pattern Raymond for this purpose. With the circuit arranged as shown, without radio-choke in the plate-circuit, Radiola (Radio-Paris) on 1,780 metres came in at night on the single valve in London steadily and at excellent 'phone strength, with an extremely quiet background. The writer has never heard him so well: on most elaborate commercial receivers, if found at all, he comes in unsteadily, distorted, and jammed by numbers of noisy Morse stations, with marked fading effects, so that it is an unpleasant ordeal to have to seek him. With a single note-mag. reception was excellent on three 'phones (two double and one single ear-piece); another valve would have given loud-speaking good enough for a small dance—American dance-music was being

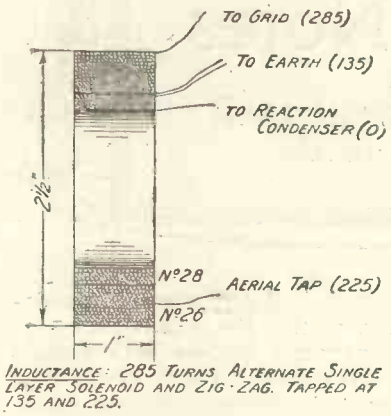


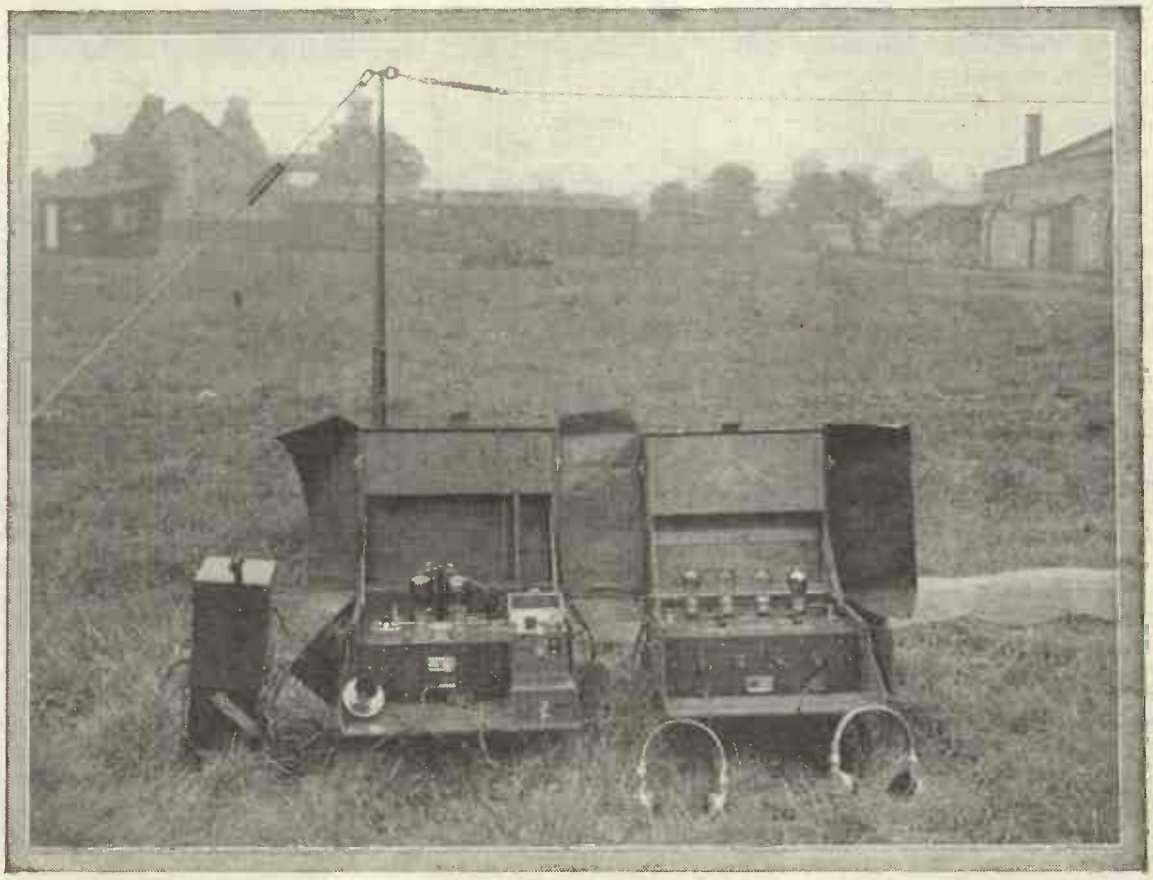
Fig. 4.—Constructional details of the new coil.

played by a small jazz orchestra at the moment.

When a second valve is used, the H.F. path to earth via casual and distributed capacities through the L.F. transformer may be too easy, so that reaction cannot be obtained. In this case a very large radio-choke coil should be included in the plate circuit of the first valve, as indicated in Fig. 3: the writer used a No. 600 plug-in coil, which happened to be available. It is a matter for trial: in any case there must not be a shunting condenser across the transformer primary here. The circuit works more smoothly if this path is stopped completely by a large choke.

A Curious Phenomenon

A curious and unexpected phenomenon was observed with these circuits, in connection with the local broadcasting: the No. 150 coil in the aerial-circuit can act as an effective radio-choke for short waves, leaving an aerial tuning-circuit consisting of a No. 100 (or 75) coil *in series* with the combined capacity of the grid-filament and the tuning condenser, and at low settings of the latter this can tune exactly to the local station's wave. The latter then comes in at good strength, with sharp tuning. But, of course, without reaction-effect, on apparently 1,200 metres or so!



A complete portable telephony transmitting and receiving station, manufactured by Marconi's Wireless Telegraph Co., Ltd., and exhibited at the British Empire Exhibition.

Valve Notes

By

JOHN SCOTT-TAGGART,

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

Mixing Valves

A rather interesting point arises when valves are mixed in a receiver. This is particularly the case where low-frequency amplifiers are employed.

In the first place, different anode voltages are required for different kinds of valves in many cases, but the greatest trouble likely to be experienced is in connection with the filament battery. In the ordinary way all the filaments are lit by current from a single accumulator, and if we have, say, a valve taking 4 volts and another valve taking only 1 volt (*e.g.*, the 1-volt Ora), the feeding of these valve filaments from the same accumulator will result in varying potential differences across the rheostats used for controlling the filament current. If we use a rheostat, such as the Lissen, Burndept dual or Microstat, we can employ any kind of a valve, but the potential drop across the rheostat will vary with different valves, according to the amount of current the filament takes. If, for example, a 6-volt accumulator is in use and a 4-volt valve is employed, the potential drop across the filament rheostat will be 2 volts, whereas if a 1-volt filament valve is worked off a 6-volt accumulator, the drop of potential across the used portion of the rheostat will be 5 volts. It is customary to include the rheostat in the negative lead to the filament, and this means that the negative terminal of the filament accumulator will be negative with respect to the negative side of the filament in each case.

Grid Voltage

In the case of a low-frequency amplifier, the secondary windings are connected to the negative terminal of a filament accumulator, so that the grid is always at a negative voltage with respect to the negative side of the filament, in the case of each valve. This, of course, is desirable because it eliminates, or lessens, grid currents which would introduce damping into the grid circuit and so lessen the built-up potential on the grid, thereby decreasing amplification.

A Practical Example

Fig. 1 illustrates a three-valve receiver in which a detector valve is followed by two note magnifiers. It will be seen that the valves V2 and V3 are of different types, the second valve, for example, being an Ediswan A.R. valve and the third a 1-volt Ora. Both these valves have their filaments heated by current from the accumulator B1, which gives 6 volts. In the case of the valve V2, the rheostat R2 is adjusted so that the voltage across the filament F2 is 4 volts and the drop in potential across the used portion of R2 is therefore 2 volts. The potential of the grid with respect to the point W will therefore be −2 volts, which is quite suitable for ordinary purposes with a valve of this kind used as a low-frequency amplifier. In the case of the valve V3, however, the resistance R3 has to be much greater, and the potential drop across the used portion of R3 becomes 5 volts. This means that the grid of the valve V3 is at −5 volts potential with respect to the point Y.

The Second L.F. Valve

In the case of this third valve, the operating point on its characteristic curve may be entirely unsuitable. Fig. 2 shows a typical characteristic curve, and it will be seen that when −5 volts is applied to the grid we are working near the bottom bend, an entirely unsuitable point for operating the valve as an amplifier. A much more suitable potential would be about −2 volts.

We could, however, still keep the grid of the third valve at −5 volts, and move the characteristic curve over to the left by increasing the anode voltage of the third valve.

If, therefore, we mix valves in our receiver it is desirable to be

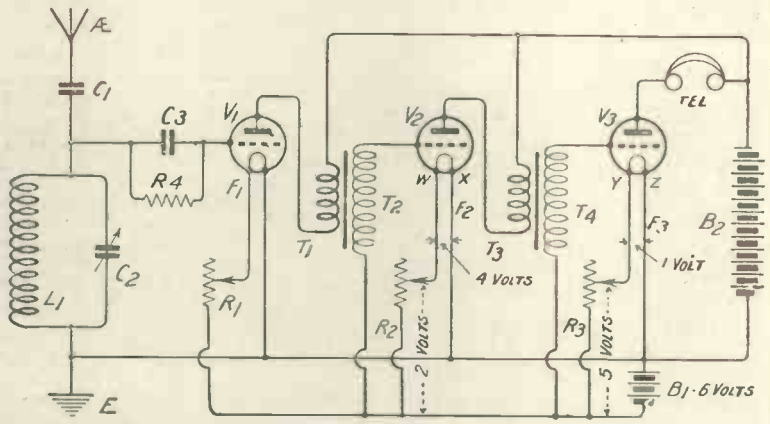


Fig. 1.—Illustrating the varying potentials across the filament resistances, resulting from mixing valves, with a common L.T. supply.

able to vary the anode voltage of each valve.

If it is desired to use a common high-tension battery, we can use the arrangement of Fig. 1, but connect the secondary T4 of the last intervalve transformer, not to the negative terminal of the accumulator B1 as shown, but to the point Y, *i.e.*, the point on the side of the filament rheostat nearest the filament. This, however, will not result in any negative potential on the grid, and, in the case of fairly strong signals, some loss in signal strength will be sustained, and a certain amount of distortion will also probably result.

An Alternative Method

An alternative scheme, of course, in the case of the last valve, would be to connect the rheostat, not in the negative lead to the filament, but to the positive lead, still connecting the bottom of T4 to the negative terminal of B1. Still another solution, which is probably the best of all, only the most expensive, is to connect a rheostat both in the negative and in the positive leads. In this case, the 5 volts, which has to be distributed over a filament resistance or resistances, may be distributed in any suitable manner between the two rheostats. For example, we might have a 1-volt drop across the negative lead rheostat and 4 volts across the positive lead rheostat; or we might have 2 volts in the negative lead rheostat and 3 volts in the positive, or 3 volts in the negative lead rheostat and 2 volts on the positive lead rheostat. The rheostat in the positive lead, of course, does not affect the grid potential of the valve.

Microphonic Reaction

Some little time ago I explained a rather peculiar buzzing effect obtained in the case of a low-frequency amplifier, due to a negative resistance effect in the grid circuit of the valve. This trouble, it was explained, could be remedied by changing the valve or by increasing the negative potential on the grid.

Another buzzing cause which, although probably well known, never seems to have been commented upon, is microphonic reaction, which is particularly prevalent in the case of valves having very fine filaments, such as the 0.06 amp. dull-emitter valves. These valves are certainly microphonic, and the buzzing, or rather booming, noise which is sometimes heard in receivers is due to the sound-waves coming from a loud-speaker striking the valves and setting up a vibration which causes a variation of anode current through the valve, which is amplified by the next valve, and ultimately produces the sound-waves which repeat the whole process. There is therefore a chain of reaction in which part of the coupling is effected by sound-waves. The effect is certainly very peculiar and interesting, and it may be exaggerated, very often, by turning the loud-speaker so as to face the valves in the amplifier. If the loud-speaker is turned away from the

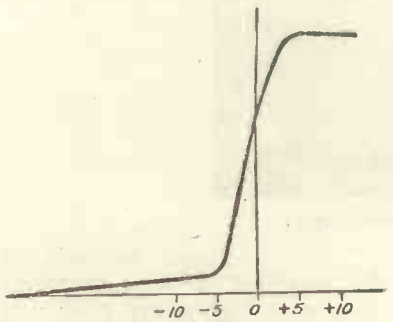


Fig. 2.—A characteristic curve showing how a negative potential of five volts brings the operating point near the lower bend of the curve.

valves the booming will frequently stop. It will be found that this kind of oscillation is not set up suddenly, like ordinary low-frequency reaction; it starts feebly and swells out until a loud, booming roar is produced. If this booming is stopped by switching off the set, it will start up slowly again on switching on the receiver once more. The booming may be stopped by holding the valves tightly in the hand, and this indicates clearly that the effect is a form of mechanical reaction, and explains why it takes some time for the peculiar reaction effect to build up, since it takes some seconds for the valve to vibrate fully.

A Remedy

The effect is specially noticeable in sets where the loud-speaker is built into the main apparatus, because the vibration of the loud-speaker is communicated to the valves.

Apparently the only remedy is to lessen the filament current through the valves. Altering reaction does not make any difference, as the effect is confined to the low-frequency side of the set. The effect is specially noticeable when two or more low-frequency amplifiers are employed, as would be expected. The enclosure of the valves would, of course, help considerably, and the separation of the loud-speaker from the set would also help matters. The loud-speaker should also be pointed away from the valves. The trouble is not a serious one, and the dulling of the filaments usually stops the booming, but many experimenters, when they first experience the phenomenon, may attribute the effect to something more harmful.

□ □ □

Burndept of Australasia

OUR large number of Australian readers will be interested to hear that Messrs. Burndept, Ltd., realising the possibilities of a great future in the wireless industry in Australasia, have established a branch, to be known as Burndept of Australasia, with their head office at 219, Elizabeth Street, Sydney, New South Wales. (Manager, Mr. A. W. Dye.)

The Radio Society of Great Britain

The Society is in touch with the Postmaster General regarding the restrictions concerning transmissions to the Dominions and Foreign Countries recently introduced into the Experimental Transmitting Licences now being issued. It is hoped that an official announcement may be made at an early date.

What the 1,600 Metres Station Means to You

SPECIAL "WIRELESS WEEKLY" INTERVIEW WITH CAPTAIN ECKERSLEY

A recent portrait of Captain Eckersley.

MANY readers will be wondering exactly what the 1,600-metres wavelength will mean to them in regard to their reception of broadcasting and in the handling of apparatus. They will also, perhaps, be wondering whether the new wavelength will be retained or whether some other wavelength may be chosen at a later date. With a view to elucidating this and many other points of like nature I sought out Captain Eckersley, the famous Chief Engineer of the British Broadcasting Company, in his sanctum at 2, Savoy Hill.

In the Sanctum

Now, Captain Eckersley, quite naturally, is a very busy man, and I was lucky to be able to obtain even a few minutes of his time. On being ushered into his private office I found the genial Captain feverishly wrestling with an automatic telephone, which seems slightly less automatic than it was designed to be. With this mastered, and a few more letters signed, he leant back to answer a few of my questions.

"Yes," he said, in reply to the first and obvious question, "the new high-power station is coming right up to expectations. We planned, as you know, to give listeners good signals in crystal receivers up to a distance of a hundred miles, and we have had numerous reports from much greater distances in every direction. I, personally, went out yesterday to a spot a hundred miles away and was astounded at the strength and freedom from interference.

A Mistaken Idea

"Some newspapers," continued the chief engineer, "have made out that the results are disappointing. So far as we are concerned, they are emphatically not so. Most of the comments of this nature appear to have been derived from the experiences of listeners in London, who found that Chelmsford was but slightly, if any, stronger than their local station two or three miles off. Their disappointment can only be due to a total misunderstanding of the position. We will assume, for example, that a man is situated three miles to the west, or south-west, of 2LO. To him Chelmsford will be some thirty miles away or ten times the distance of London. Now for Chelmsford to be as loud as London at ten times the distance would require, not ten times the power, but something nearer one hundred times, and, of course, Chelmsford is by no means so powerful as that. You can take it from me that if in such circumstances Chelmsford is as strong as London, it is doing pretty well!"

Many Reports

"Have you many reports yet?" I asked.

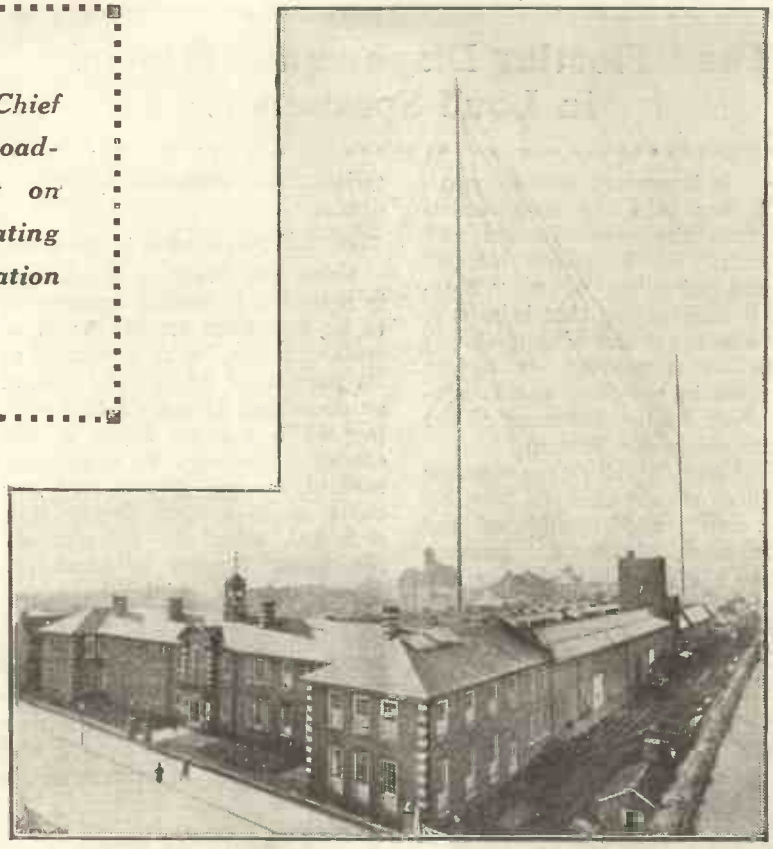
"Yes, very large numbers," replied Captain Eckersley. "Within the first couple of days we had over two thousand, and they are still pouring in." Here he rang for an assistant, and asked him a few questions, so that I might be right up to date with my information. From these questions it transpired that in the thousands of letters received there had been scarcely a single complaint, the vast majority of correspondents expressing complete satisfaction with the results obtained.

Few Bad Spots

"What about bad spots?" I next asked. "Are there many?"

"No. It is one of the characteristics of the longer wavelength that it is far less susceptible to shielding, and many spots which seemed to be shielded from 2LO are quite good for the reception of the longer wavelength. You may say quite definitely that there will be practically no blind spots for the longer wave, although in other direc-

In this interview the Chief Engineer of the British Broadcasting Co. throws light on many interesting points relating to the new high-power station 5XX at Chelmsford.



The Marconi Works at Chelmsford, where the 1,600 metres transmissions originate.

tions, such as in dielectric losses in walls and so forth, there may be some loss of efficiency with indoor aerials."

I next asked Captain Eckersley why Chelmsford had been chosen as the site of the high-power experiments, and whether it was likely to remain the transmitting centre. It appeared to me that it was one of the least suitable from many points of view, seeing that it was desired to supply the needs of a very large number of people with crystal receivers. A circle of 100 miles' radius described around Chelmsford passes over a considerable area of the North Sea, so that a large portion of the area covered is wasted. A spot in the Midlands would have appeared much more preferable.

Why Chelmsford was Chosen

"It is quite true," said Captain Eckersley, "that we lose a good deal in that way, but there are a number of most important considerations which have led to the selection of Chelmsford, and which will probably make it necessary to retain the position. We must, for example, have distortionless communication between the broadcasting centre chosen and the high-power station itself. London has been chosen as the centre for the obvious reason that it is bound in the nature of things to have the best programme. This is not any reflection upon the Provincial centres, but naturally the capital of the Empire is the best possible situation for a broadcasting studio. Now, we must communicate the programmes from the studio to the high-power station. How can this be done? Only by wire or wireless. Although we have done some very interesting experiments in the wireless relaying of programmes, the method is still in the experimental stage and cannot be relied upon. Ordinary land lines are far too unreliable. They give rise to distortion, and in addition we cannot allow, possibly, a tree falling across an overhead wire to suspend our operation for many hours. We must therefore have an underground cable. The only practicable means of avoiding distortion in an underground cable is by means of loading coils, and the only short distance cable containing loading coils that is available is that which runs through Chelmsford. Chelmsford was therefore chosen as it is far enough away from 2LO to be free from serious interference, and is near enough to give, on a loaded cable, the requisite purity of reproduction."

Jamming Problems

Captain Eckersley and I discussed the jamming problems for a few minutes. "Listeners within reasonable crystal range of London will, of course, not be interfered with by Chelmsford, and we think the difference of wavelength is sufficient to prevent any real trouble in this regard. Of course, when a listener is right up against 2LO he will not be able to receive Chelmsford without interference unless he makes his receiver really selective. But then, of course, the high-power station is not designed for him. He is already getting what he needs from the London station."

Readers of *Wireless Weekly* will thus see that a hundred-mile crystal range is already assured.

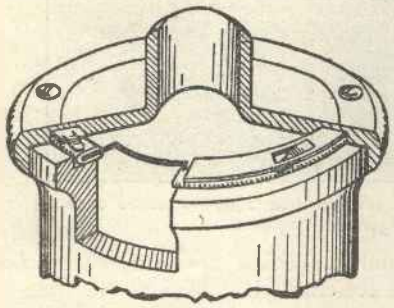
Still Experimental

"Let me impress upon you," said Captain Eckersley, as we parted, "that the work on the high-power station is still in an experimental state. We do not intend to form an opinion on the matter until a week or two has passed. The wavelength, you may take it, will not be changed, as it has been carefully chosen in consultation with the Services so as to cause as little interference as possible, and my own tests have shown that this particular wavelength is quite reasonably free from interference."

The "Floating Diaphragm" Principle in Loud Speakers

AN important feature entering into the construction of the new Amplion and a detail of technical interest is the adoption of a "floating" diaphragm, that is to say, the vibratory diaphragm simply rests on a seating, is lightly retained in position, and is subject only to the influence of the electro-magnetic system.

Hitherto the vibrating member has been rigidly clamped between the cover and casing of the instrument, screws passing through clearance holes in the diaphragm to ensure such rigidity, and it will readily be



The Clamping Ring in position.

understood that by this means of clamping, periodicity is imposed which involves the unpleasant diaphragmic resonance so noticeable in the majority of loud-speakers, particularly when a power amplifier is associated with the receiving set. This defect, as indeed it is, has undoubtedly prejudiced loud-speakers in the eyes, or rather the ears, of many "listeners-in."

Clamped Diaphragm May Cause Distortion

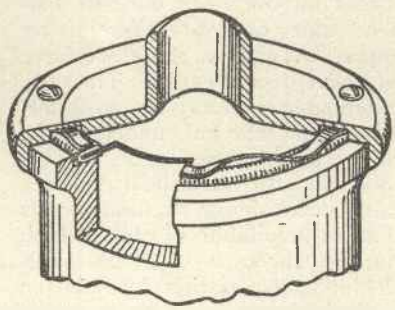
Although every material of a character suitable for application as a telephonic diaphragm possesses a fundamental note, the natural frequency of vibration of a diaphragm in the free or unclamped condition is or may be so low in the musical scale as to be, to all intents and purposes, aperiodic, but as soon as in a state of tension by reason of firm or substantially rigid clamping, and subject to the strains and stresses thereupon, the diaphragm becomes decidedly periodic, and distortional characteristics are immediately in evidence.

How the Diaphragm is Mounted

Now, the Amplion diaphragm is mounted in such a manner as to be free from strain, stress or undue tension, being embraced at its peripheral edge by a gasket or sheathing of rubber and resting on a narrow ledge in the casing. Between the uppermost surface of the gasket and the cover piece a light spring ring provided with six downwardly projecting fingers is arranged. These fingers reach the upper side of the gasket and exercise just sufficient pressure to retain the diaphragm on its seating and prevent "chatter" when the loud-speaker is associated with a set affording large output and the amplitude of vibration is increased.

The Spring Ring

The spring ring referred to is embodied in the latest Junior and Standard models, but in other types of Amplion units under manufacture an alternative style of spring washer is employed. This latter washer is of undulatory conformation and has six points of contact with both the inner side of the cover and the



An alternative ring of undulatory form.

gasket surrounding the diaphragm. The accompanying figures illustrate the two types of retaining rings described.

Advantages of the Floating Diaphragm

It will be appreciated that the "floating" diaphragm vibrates in correspondence with variations of the current flowing in the operative windings of the electro-magnetic system, so that faithful reproduction, throughout the entire musical range, is obtained.

Two Aerial Hints

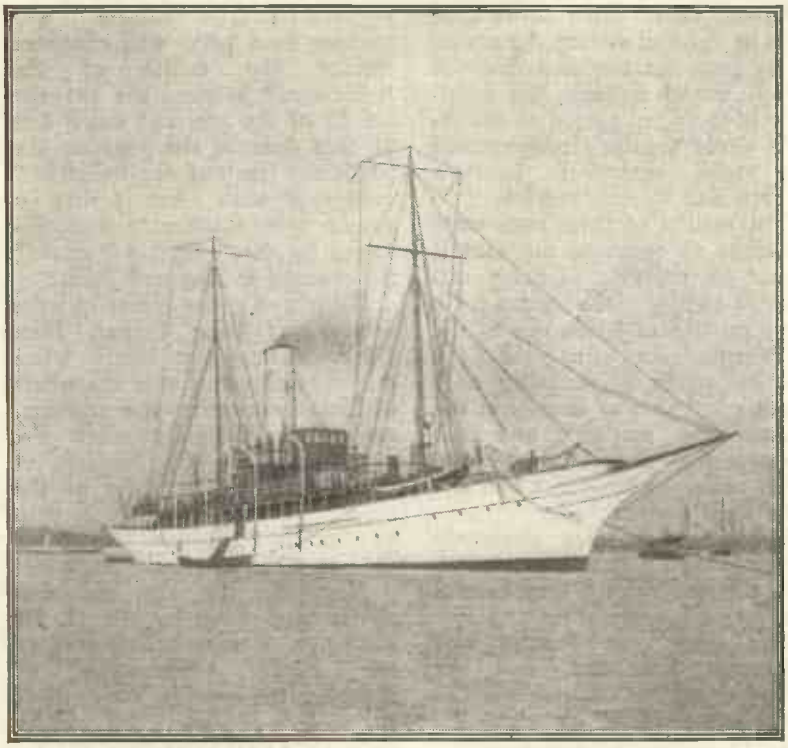
Most of us have had trouble at one time or another with the pulley fixed to the top of the aerial mast. Sometimes it happens, particularly when wire is used, that the halliards become jammed between the pulley wheel and the sides of the block; or, again, the wheel may stick through lack of lubrication, and unless the mast can be lowered, or one is something of an acrobat, oiling it is out of the question. The best tip I know for avoiding pulley troubles is not to use a pulley at all.

An excellent substitute is an ordinary shell insulator. This is fixed to the mast by a very short length of cord passing through one of its holes whilst the halliards simply run free through the other. There is very little friction against the polished surface of the insulator, and the halliards simply cannot jam, no matter what happens. When using a shell insulator in this way one must, of course, be careful in lowering the aerial at any time. If it is let down with a run the insulator will probably strike the mast violently and be broken, but if reasonable care is taken no trouble of any kind will be experienced. Not the least of the advantages of using this substitute for the pulley is that it provides an extra insulator at the free end of the aerial wire, which is the point at which it is most needed.

One of the great disadvantages about using rope for aerial halliards is that it is very much affected by the state of the weather.

Good rope can be rendered weatherproof by the very simple process of immersing it before use in a pan of melted tallow, and allowing it to soak up as much as it will take. This not only eliminates the tendency to stretch, but also preserves the rope from rotting. It is well worth while to undertake the task which renders the aerial much more satisfactory.

R. W. H.



The S.Y. "Elettra" upon which many of these experiments were conducted.

Beam Wireless*

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

Continued from page 341. Vol 4, No. II.

A first series of tests was carried out without the transmitting reflector.

After rounding Cape Finisterre it was anticipated that the intervening land would have cut off signals during daytime and also would have considerably weakened them during the night.

These expectations were not verified.

Signals during the day weakened according to the distance and altitude of the sun, but were received right up to Seville (780 miles from Poldhu) although practically the whole of Spain, consisting of over 300 miles of high and mountainous land, intervened between the sending and receiving stations.

Night Signals

The night signals were always so strong as to appear almost as powerful as those received when the yacht was at her anchorage in Falmouth Harbour at only 12 miles from Poldhu.

It should be stated that the yacht, when at Seville, was moored in the Guadalquivir River, in a situation particularly unfavourable for the reception of signals, as the adjacent banks of the river were high and surrounded by trees and buildings.

At Gibraltar (820 miles), notwithstanding the greater distance, a better strength of signals was noticed during the hours of daylight, probably in consequence of the fact that the yacht was anchored in a more open space, and therefore in a more favourable position.

Similar results were also obtained at Tangiers (840 miles) and at Casablanca (970 miles).

I find it almost unnecessary to refer to the night signals, as these were always and in all places throughout the whole of the cruise extraordinarily strong and capable of being received at all times without using an amplifier, and with the aerial out of tune, or disconnected.

At Casablanca

At Casablanca I telegraphed instructions to hoist the reflector aerials at Poldhu.

The " Elettra " then proceeded to Madeira, but at Funchal was obliged to anchor in a very unfavourable position for the reception of wireless signals from England, being at the far end of the island and immediately under the mountains of Madeira, some of which rise to heights of over 6,000 feet.

On May 17 tests were recommenced between Poldhu and the " Elettra," but although the night signals were, as always, extremely strong, I considered it desirable to carry out daylight tests in positions not so completely screened by the immediate vicinity of mountains.

Thus it was ascertained that signals could be received from Poldhu by day up to 1,250 nautical miles when that station was using 12 kw. of energy.

On May 21 we sailed for St. Vincent, Cape Verde Islands, and although at St. Vincent our anchorage was at a position partly screened by mountains, day-light reception was still possible for a few hours after sunrise and for some time before sunset.

Cape Verde Islands

The night signals continued to arrive from Poldhu at all times with apparently unabated strength, notwithstanding that our distance had increased to about double what it was at Madeira, that is, to 2,230 nautical miles.

At St. Vincent, as at Madeira, the Poldhu signals could always be received with the receiving aerial disconnected, or with the heterodyne or L.F. amplifier switched off.

Mr. Mathieu estimated the strength of the night signals at St. Vincent from 400 to 500 microvolts per metre in the aerial, and with such a strength on the wavelength we were using no trouble was ever experienced in consequence of atmospherics or x's. In fact, for greater convenience, all messages from Poldhu were read with the aerial

* A paper read before the Royal Society of Arts, July 2nd, 1924.

out of tune or disconnected from the receiver.

At St. Vincent the signals received from the Post Office station at Leafield were weak and often unreadable, I therefore gave instructions that all wireless messages addressed to me should be transmitted by our short wave station at Poldhu. No difficulty was ever experienced in the accurate reception of these messages.

As, in consequence of my having to return to England, it was decided not to carry on these tests to still greater distances, I instructed Poldhu to gradually reduce the transmitting power from 12 kw. down to 1 kw., but even with this small amount of energy the signals received at St. Vincent were still stronger than would have been necessary for the carrying out of commercial work over that distance.

Low Power

Mr. Mathieu calculated that the signals would still have been readable at St. Vincent even should the power at Poldhu have been reduced to 1-10th of a kilowatt.

I might add that the night signals received at St. Vincent, even when Poldhu was using only 1 kilowatt, were stronger than those received from Carnarvon, or than those which could be received at either St. Vincent or Madeira from any of the other European or American high-power stations.

The signals by night or by day did not appear to be subjected to lengthy fluctuations in strength, nor inclined to give what have been termed freak results. The results obtained could always be repeated over the same distances under similar conditions in respect to the sun's altitude.

Periodical Fluctuations

Short periodical fluctuations of strength, lasting less than a minute, were constantly observed, but I believe that these variations were mainly caused by slight changes of the wavelength determined by imperfections of the arrangements in use at Poldhu, and also by the movements and rolling of the ship at the receiving end.

Although sunrise at St. Vincent occurred about three hours later than at Poldhu, during the period of the tests nothing was observed which would indicate the existence of the weak period so noticeable under similar circumstances in radio reception between Europe and North America.

The results of these tests were sufficient to convince me that it would be possible to carry out reliable commercial services for a large portion of hours out of the 24 over distances of at least 2,300 nautical miles by utilising only about 1 kilowatt of energy at the transmitting stations, and that the practical range of the system when using 12 kilowatts had not even been approached.

These results were obviously so encouraging that I decided to give the new system very careful study and consideration.

The station at Poldhu was somewhat improved, and the energy employed was increased to about 20 kilowatts.

Since February of this year a further series of tests have been carried out over ranges which included the greatest possible distances separating any two places on earth.

A Special Short Wave Receiver

A special short wave receiver was installed on the S.S. "Cedric," and reception tests were carried out with Poldhu by Mr. Mathieu during a journey of this vessel to New York and back. No reflectors of any kind were employed at either end.

For the tests to the "Cedric" the wavelength was 92 metres and the transmitter comprised two oil-cooled valves of special design controlled by an independent drive circuit to ensure steadiness of wavelength. The power supplied to the main valves was 21 kw., giving a radiation of approximately 17 kw.

These experiments were conducted with the object of supplementing our information on the general behaviour of short waves over long distances.

The results showed that on the "Cedric" signals could be received during daytime up to a distance of 1,400 nautical miles, and it was confirmed that the signals' intensity is symmetrical to the mean altitude of the sun at all times. As a consequence of this, the day limit of the signals on the "Cedric" was greater than what was observed during the cruise of the "Elettra," because the average height of the sun was much less at that time of the year on the particular track of the "Cedric" compared with what it was on the far more southernly track followed by the "Elettra" during the months of May and June.

Signals of great intensity were received at Long Island, New York, during the hours when darkness extended over the whole distance separating the stations, and of less intensity when the sun was above the horizon at either end, the intensity of the signals varying inversely in proportion to the mean altitude of the sun when above the horizon.

According to the measurements carried out by Mr. H. H. Beverage, Research Engineer of the Radio Corporation of America, the average strength of the signals at New York was 90 microvolts per metre.

Received in Australia

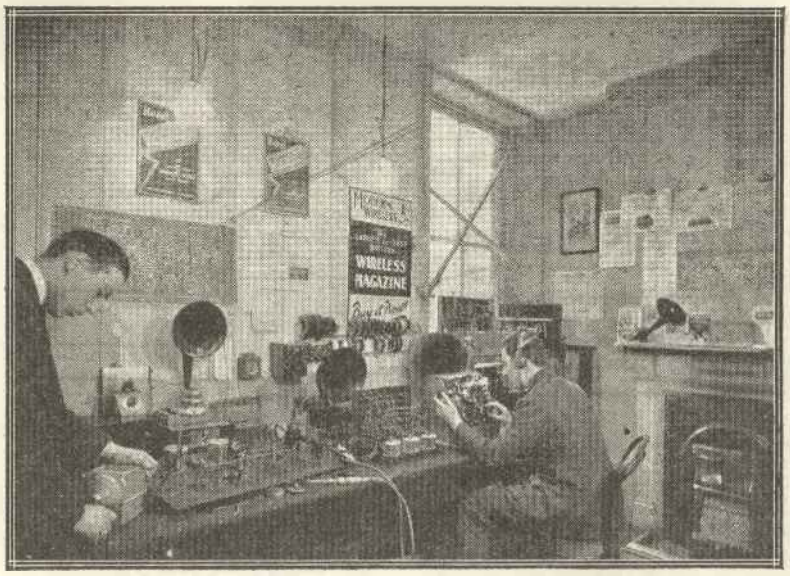
I might mention that a few days prior to the commencement of these tests between Poldhu and the "Cedric," the Chief Engineers of the Amalgamated Wireless (Australasia), Ltd., of the Marconi Wireless Telegraph Co. of Canada, Limited, and of the Radio Corporation of America had been requested by telegraph to attempt to receive the transmissions radiated from Poldhu in their respective countries.

Rather to my surprise, I must admit, Mr. Ernest T. Fisk, the Managing Director of the Amalgamated Wireless (Australasia), Ltd. reported to me by cable that he could receive the Poldhu transmissions at his house in Sydney every day perfectly well from 5 to 9 p.m. (Greenwich), and also that he had received them between 6.30 and 8.30 a.m., informing me also that for most of the time the signals were clear, steady and strong on an improvised receiver consisting of a 2-stage high frequency tuned plate and grid with one rectification. He also added that he had read every word that was sent and that the signals were better than those he had yet received from the high power station at Carnarvon.

(To be continued)

. . The . . Radio Press . Service . Dept., Ltd.

Some Further Notes upon the New Organisation.



Part of the test room.

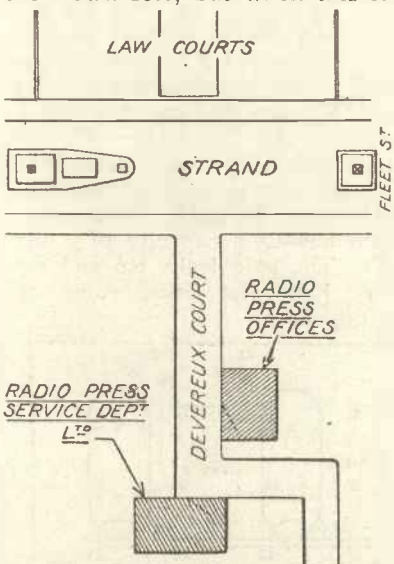
THE work of the new organisation is steadily increasing, and it seems that readers of *Wireless Weekly* have been quick to realise that it provides the one remaining link in the chain of Radio Press reliability. With the co-operation of the new department, our service of the set-builder becomes complete, in that in the first place he is given articles and diagrams of the greatest possible accuracy and clearness; next, that for a period of three weeks after the date of publication he can come to the offices of the Service Dept. and inspect the original set for himself; and, finally, if he will follow out the design faithfully we can positively guarantee that his results will be equal to those of the original, and that if he has any trouble in getting the set to work properly as a result of the presence of a faulty component, a trifling error in wiring, or some other cause, all that he has to do is to take the set to the Service Dept. and they will see to the rest. Thus at one stroke is abolished for all readers of Radio Press publications that feeling of uncertainty which has been the bugbear of the amateur constructor since the earliest days of the movement—the fear that at the end of all his expenditure of time, trouble and cash the set may not work properly.

A few further practical notes based upon the first few weeks of work should be given for the benefit of those who find themselves desirous of taking advantage of the services of the new department. The approach to the new offices from the Strand is given upon the accompanying plan, and it should be added that the nearest tube stations are the following:—

Temple (District Railway).
Holborn (Piccadilly Railway).
British Museum (Central London Railway).

The 'buses passing Devereux Court are Services No. 6, 9, 11, 13, 15, 96, 60, 67, 48 and 94.

It is best for readers to bring their own sets, but when this is impossible they can be sent by post or rail. They should always be most securely packed in a stout wooden crate, cardboard boxes having proved to be quite useless, and the set should always be either insured or registered. A similar precaution is taken by the Service Dept. in returning them. The set is, of course, at the owner's risk during the whole period that it is out of his hands, but every possible care is taken by the Test Dept.



The approach to the new offices.

The scale of charges for the ordinary set testing work has been provisionally fixed at 2s. 6d. per valve in multi-valve sets, dual valves being counted as two. This was announced last week, but it is necessary to remind readers that in view of the great amount of trouble which is given to the test staff by sets which have been made up with heavy alterations from the original design, an additional charge of 25 per cent. is made where any serious modification has been made. In these cases also it is not possible to guarantee that results fully equal to the original set will be obtained, since, of course, the placing of parts in a set is often very crucial to its proper performance. (This rule is only enforced in cases of real necessity.)

The Service Dept. can undertake a great variety of other services besides the mere testing of defective receivers, dealing with all sorts of components, visiting localities to investigate cases of special difficulty, giving advice by post, and so on. Visitors are asked to remember, however, that the testing staff are not authorised to give advice or answer readers' queries themselves, and these matters must either be submitted by post in the ordinary way as postal queries, or an appointment for a consultation must be made for which a fee of 2s. 6d. for a ten minutes' interview has been fixed.

A Modified "Puriflex" on the Omni Receiver

A further interesting circuit which may be experimented with upon this famous receiver.

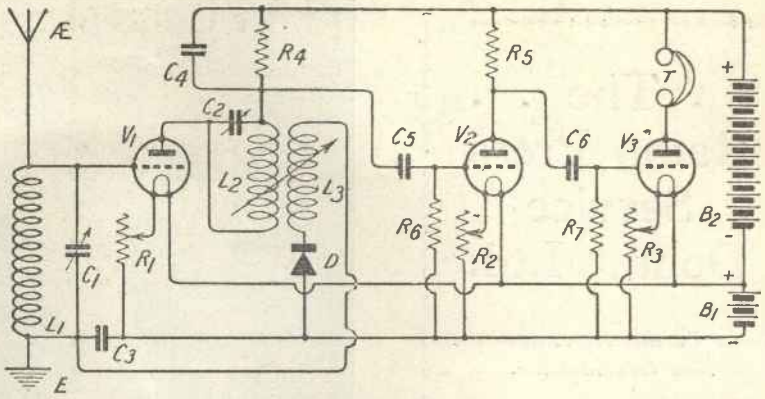


Fig. 1.—A modified "Puriflex" circuit as used on the Omni Receiver.

THE "Puriflex" receiver designed by Mr. Percy W. Harris, and described by him in the July number of *Modern Wireless*, has created great interest, and those readers who possess Omni receivers will be pleased to find that the "Puriflex" circuit in a somewhat modified form may be easily wired up on their sets.

The Circuit

The circuit to be used is that shown in Fig. 1, in which the reaction coil is not included, as the three-coil holder is to be utilised for the transformer coupling. To suit the Omni receiver the values of the original 0.25 μF condensers have been reduced to 0.002 μF. The only modification necessary to the Omni receiver is the temporary external addition of a fixed 80,000 ohm resistance, or alternatively a variable anode resistance may be used. To commence with, a common voltage will be applied to the anodes of the three valves, and the grid-biasing battery will not be included.

Since constant aerial tuning is not employed, the value of the aerial tuning coil L1 for any given wavelength cannot be definitely given, and the usual sizes of coils should be tried. C1 is a variable condenser of .0005 μF capacity, and may be placed either in series or parallel with L1. The inductance L2, tuned by the condenser C2 of 0.0005 μF, may be a No. 50 coil, and L3, across which are the detector D and condenser C3, should be a No. 75 coil. L2 and L3 are generally closely coupled, so that the condenser C2 suffices to tune both coils simultaneously. R4 and R5 are 80,000 ohm resistances, the condenser C4 of .0001 μF being placed across the former. C5 and C6 are the low-frequency by-pass condensers, each having a capacity of 0.002 μF. The grid leaks R6 and R7 may have the usual value of 2 megohms.

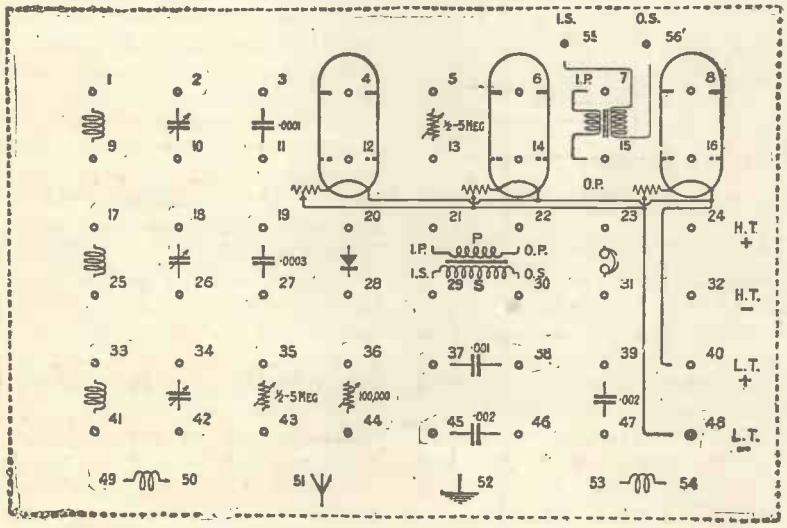


Fig. 2.—The terminal board.

Probably the most interesting point about the circuit is the total absence of low-frequency iron-core transformers, despite the fact that three stages of low-frequency amplification are used, and the natural result is great purity in reproduction, the usual loss in resistance-coupled amplifiers being counter-balanced by the reflex action of the first valve.

Wiring Connections

The circuit is easily adapted to the Omni receiver by making the following connections on the terminal board :—

51—49	47—14
49—34	14— 5
34—12	13—48
42—50	6—45
50—52	46—16
27—42	46—43
4— 1	35—48
26— 9	8—23
18— 1	31—24
9—44	17—20
36—24	28—35
3—36	35—19
11—44	25—27
44—39	32—40

Two more leads will be necessary for the extra resistance mentioned, these being taken from terminals 45 and 24, and the resistance connected across them. Into the centre socket of the three-coil holder a No. 75 coil should be plugged, and a No. 50 coil placed in the rear socket. The fixed socket on the left of the panel is that of the aerial coil, for which a No. 35 or No. 50 will probably prove suitable. The circuit is now complete, and the batteries, etc., may be connected to their respective terminals.

Operating the Set

The two coils which comprise the high-frequency transformer should be brought close together and tuning carried out by adjustment of the aerial and anode-tuning condensers, the former being that on the right of the panel, and the latter that in the centre. The adjustment of the cat-whisker on the crystal is not at all critical, and having obtained a point which gives results, it is best left thus until the other variable components have been adjusted. These include the two variable grid leaks, the resistances of which are not critical in this circuit, and the two anode-resistances (if the one added externally is variable). These, again, do not need special care in adjustment. An anode voltage of not less than 80 volts should be used.

With the particular size of coil used for aerial tuning, it may be found that best results are obtained with the aerial tuning condenser at its maximum or minimum value, in which case a size smaller or larger coil should be placed in the aerial socket. If signals are loudest with the condenser at its maximum value, a larger coil is obviously required, and *vice versa*.

Experiments to Try with the Circuit

Series aerial tuning may be used instead of parallel tuning by making the following alterations on the terminal board:—Disconnect 42—50, 27—42 and 51—49, and join 51—42 and 27—50. A size larger coil will probably be necessary.

It will be found that the 0.0005 μF anode-tuning condenser gives rather sharp tuning, and its capacity may be reduced by connecting in series with it a fixed condenser of 0.001 μF. Disconnect 4—18 and 18—1; join 4—1, 18—37, and 38—4. The maximum capacity of the variable condenser is now roughly 0.0003 μF, and finer tuning will result.

The anode of the first valve may be given a separate potential to that of the last two by disconnecting 36—24 and connecting a lead terminated at one end by a wander-plug to terminal 36. By connecting the wander-plug to different tappings on the high-tension battery the voltage on the anode of the first valve is varied independently.

If the quality of reproduction is not absolutely perfect, a few volts negative grid-bias should be applied to the last two valves. This is effected by disconnecting 35—48, 28—35, 35—19, and 13—48, and joining 19—48, 28—48, 13—35, 13 or 35 to negative terminal of grid battery and 48 to positive of grid battery. A flashlamp battery will be quite suitable for this purpose.

The results obtained with this circuit are naturally inferior to those obtained with the original "Puriflex" circuit, owing to the modifications necessary for its adaption to the Omni receiver, the greatest drawback being, probably, the exclusion of the reaction coil. The purity and volume obtained, however, will at least show the possibilities of this excellent circuit.

□

Some Neat Flush Fittings

I HAVE just obtained from one of *Wireless Weekly* advertisers two very neat little fittings which will make a strong appeal to the man who likes to have his wireless set just so. The first of these is a set of flush-fitting valve sockets of the kind in Fig. 1. These are only half an inch in length and furnished with a very small nut for fixing. For these one requires to make holes in the panel with a No. 4 twist drill. If they are fitted in the way which has already been described for the prevention of capacity—by drilling a central hole and making cuts from it between the valve legs—these little fittings make particularly neat and efficient holders. Personally I prefer to screw them into the ebonite and to dispense with the retaining nut, for I believe that everything which reduces capacity is a very marked gain, especially upon the high-frequency side of the set. These sockets have many other uses besides forming parts of valve holders. They can be used to replace terminals for making quick connections anywhere, and they make it possible to construct basket coil and other mountings on the plug and socket system, using these small legs and ordinary valve pins. They will be found very handy for low-tension and high-tension battery plugs.

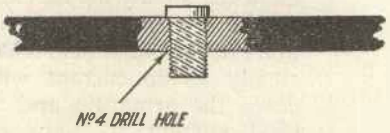


Fig. 1.—The flush fitting valve socket shown mounted.

The second gadget is a pair of flush-fitting plugs and sockets.

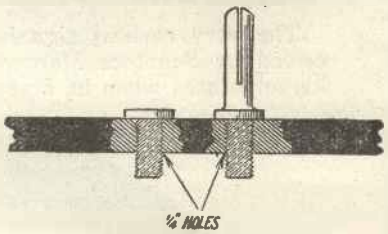


Fig. 2.—The coil socket and plug shown fitted.

These require ¼-inch holes in the panel, and though there is not much harm in fixing them with nuts they can, of course, be tapped in if desired. The amateur with an inventive turn of mind will find a great number of uses for the flush-fitting plugs and sockets as well as for the valve legs.

R. W. H.

SIMPLE WIRELESS RECORDING

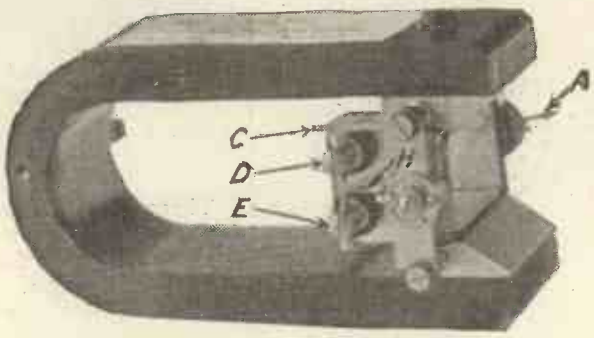
By PERCY W. HARRIS,
Assistant Editor.

The complete ap

THE owner of wireless apparatus who is anxious to try his hand at something other than the simple reception of broadcast signals will find that many a pleasant hour can be spent in experimenting with simple Morse recording. Contrary to the general opinion, elaborate and expensive apparatus is not required, nor is much experience needed. For example, an ordinary and fairly efficient three- or four-valve set containing two stages of note magnification can, with the auxiliary apparatus about to be described, faithfully record a considerable number of those Morse-signalling stations which are to be heard on 600 metres and above.

Principles of Wireless Recording

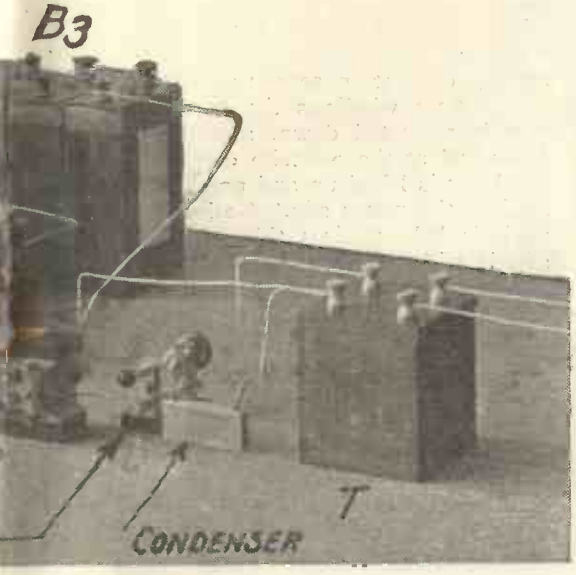
The very earliest signals received by Senatore Marconi on his apparatus when he first came to this country were taken down on a standard Morse inker (a device used in wire telegraphy for making dots and dashes on paper tape). It was the Marconi coherer, a small tube, the resistance of which was suddenly lowered on the arrival of wireless signals, permitting currents to flow through it that allowed the use of the inker; but with the advent of the magnetic detector and, subsequently, the crystal and the valve detectors used with telephone ear-pieces, recording apparatus fell temporarily into disuse. The reason was that loud signals are obtainable in a telephone headpiece with currents far smaller than the minimum necessary to operate the average relay.



D and E are the fixed contacts, H the moving tongue, and C the soldering lug for the tongue.

Difficulties of Using Relays in Wireless

A relay is, of course, a piece of apparatus which, when a feeble current passes through it, will bring into action a much stronger current. Most relays are electro-magnetic devices, the feeble current operating them passing through a fine wire coil with an iron core, this drawing towards it an armature to which a tongue is attached. This tongue vibrates between contacts, permitting a strong current from the local battery to pass through. The trouble about using such a relay in wireless work is that in the plate circuit of a valve we have the steady anode current on which are imposed the fluctuations of the signal current. This steady anode current will draw down the armature and cause a local current to pass continuously, whether signals are arriving or not. If we use a telephone transformer, to eliminate the steady anode current, we get alternating currents which will not operate such a relay properly. In the ordinary way we are driven to use elaborate balancing devices to cancel out the effect of a steady anode current.



pparatus set up.

The experimenter who wishes to try a new line of work will find simple Morse recording a fascinating new field to explore. This article gives full practical details of one successful method

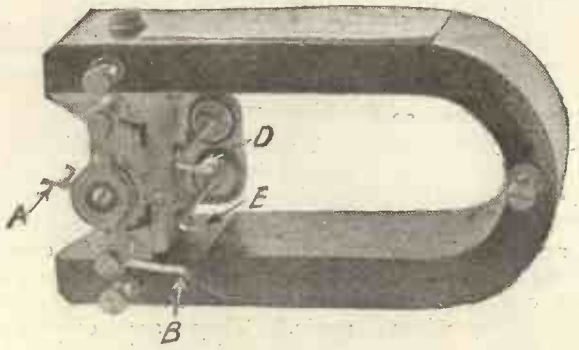
A Simple Method

A very simple and efficient method which is by no means new, and which I find is very little known even among more advanced experimenters, consists in the use of a crystal detector in the circuit of the step-down side of a telephone transformer, rectifying the alternating currents set up in this winding, so as to operate an ordinary electro-magnetic relay. The crystal detector will, of course, rectify low-frequency alternations just as well as those of high frequency, as it pays no regard to the frequencies impressed upon it. Therefore if we use a circuit as shown in Fig. 2 we shall obtain the results we desire. One winding of the telephone transformer indicated in the diagram is connected to the telephone terminals of the receiver, whilst the other winding of this transformer is connected as shown to a crystal detector and a fixed condenser of about .01 μF or larger. The crystal detector and the condenser must be well insulated. Personally I use a Dubilier condenser type 577 of .01 μF value, but a good Mansbridge condenser will do.

Across this condenser are shunted the windings of the relay (to be described later). When signals are impressed upon the telephone transformer they are rectified by the crystal detector, and energy is stored in the condenser. This will discharge through the windings of the relay, thus permitting currents from the battery B_3 to pass through the windings of whatever recording apparatus may be attached.

A Suitable Relay

An excellent and exceedingly sensitive relay with which the experimenter can begin his experiments in recording is the "Weston." Thousands of these devices were used during the war, and are now available through the disposal dealers at prices which are ridiculously low compared with their original cost. The relay which is illustrated in the photographs sells for a price varying from 15s. to £1 (17s. 6d. being quite a usual price). It consists of a large permanent magnet with specially shaped pole pieces, between which moves a coil of wire mounted on a very light former. To this former is attached a tongue which makes contact with one or other of a pair of fixed contacts. The relay is almost incredibly sensitive, but suffers from the defects of being sluggish in action. However, when suitably adjusted, it will suffice for recording speeds up to 18 or 20 words per minute, and thus will enable the experimenter to record time signals and many of



The relay viewed from the other side. A and B are the soldering lugs for the moving coil, and D and E the connections for the fixed contacts.

Morse transmission which can be heard with a good receiver.

Mounting the Relay

The simplest way to mount the relay, which is generally sold without any form of mounting whatever, is to take a piece of wood measuring approximately 7 in. by 4 in., and to stand the relay on one side in the middle of this. A strip of wood about 4 in. long and 1 in. wide should have two holes drilled in it to take large wood screws, the separation between holes being about 3 in. Wood screws can then be passed through these holes, and the relay gripped on to the board as shown in the illustration below.

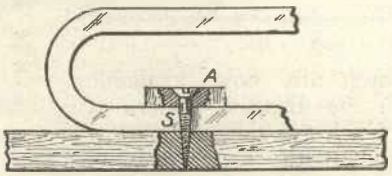


Fig. 1.—Method of mounting relay.

Connections

You will need to make soldered connection to five points on the relay, and these connections should be taken to five terminals suitably disposed on the base board. These terminals should be mounted in ebonite. The points of contact are as follows :—

Two to each end of the moving coil into which the received currents are fed, two to the fixed contacts of the relay, and one to the contact for the tongue. According to the direction of current in the winding, the tongue will move against one or the other of the fixed contacts. Obviously in using this relay for recording Morse, you will use one fixed contact only. It is just as well, however, to connect terminals to both contacts, so that, if necessary, you can change over.

Soldering Points

You will have no difficulty in locating the two soldering points for the two fixed contacts, as these latter have long wires attached to them. On the same side of the relay as the long stiff wires from the fixed contacts, you will find one long soldering lug attached to the bridge piece carrying the moving coil pivot. A shorter arm in the middle of the bridge piece will also be seen. These two arms, the long and the short, make connection with the two ends of the coil. On the other side of the relay you will find a further soldering lug, which is connected through a hairspring to the relay tongue. These contacts are made clear in the illustration.

Adjustment of Relay

On the side of the relay, where the contact for the tongue is situated, you will find a ring held by three screws. The two smaller screws can be slightly loosened, whereupon you will be able to rotate a kind of collar which will vary the pressure of the moving tongue against one or the other of the contacts. As you buy the relay it will probably be arranged to keep the tongue halfway between two contacts. These two fixed contacts should be adjusted to have a very narrow space between them, and the bias should be made so that the tongue rests lightly against one of them. When connected to the correct terminals, the signal current will then cause the tongue to move against the opposite contact, and by careful adjustment you will be able to make the relay work quite rapidly.

carried on the end of a lever, the opposite end of which has attached to it a soft iron armature which is attracted by a pair of magnets. Whenever a fairly strong current passes through the magnet windings the armature is attracted down, and the ink-wheel at the opposite end of the lever is lifted up and presses against the paper slip. So long as it is held against this paper slip it will make a continuous mark, so that, according to the length of time it is held against it, so it will make a dot or a dash. The terminals of the Morse inker are connected as shown in the circuit diagram.

Precautions Necessary

Unless we take special precaution, the apparatus will not work satisfactorily owing to the inductive nature of the magnet-windings, as when current is made and broken between the relay contacts there will be a bright spark which will quite likely weld the contacts together. To avoid this sparking at the contacts, the terminals of the Morse inker should be shunted by a large Mansbridge condenser of a value of one to two microfarads.

Those readers who do not find it convenient to purchase a Morse inker will probably devise their own recording apparatus with the

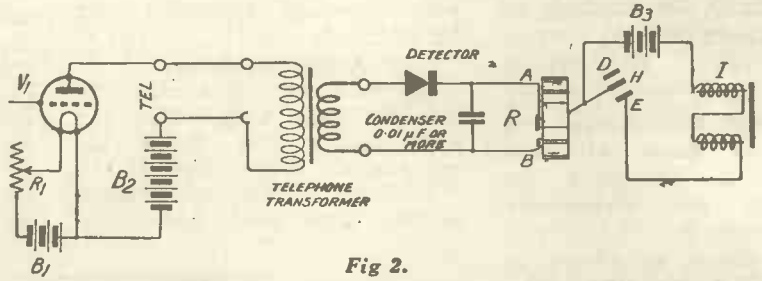


Fig 2.

Circuit for recording with Weston relay. A and B are leads to moving coil of the relay, H is the moving tongue which can be adjusted to make contact with D or E.

The Morse Inker

A really good Morse inker by one of the leading makers can be obtained second-hand from one of the "disposal" dealers at a price from £4 to £6. Of course, they cost a great deal more when new, and are exceedingly well made. They are clock-work driven, and are simply devices which cause a paper tape to move steadily past a small disc, the edge of which is immersed in a special ink-well. This disc is aid of an old post office sounder, the end of the armature of which can be attached to a lever carrying a small wheel rotating in an ink-well. A gramophone motor will suffice for drawing the paper tape over the roller.

Results Obtainable

It will be found that if signals from Morse stations are just a little too strong for comfort in the telephone, they will be strong enough to operate the relay device if the crystal is carefully

set. Using a four-valve set (H.F. detector and two note magnifiers), together with a separate oscillator, I have frequently recorded several of the high-power stations on the east coast of the United States. Very frequently these stations are working at speeds as low as 10 and 12 words a minute, although when conditions are good very much higher speeds are used. However, long-distance recording of this nature requires some skill and experience, very careful adjustment of tuning and a combination of critical tuning and reaction, which will not be found easy by the beginner. Stations such as Eiffel Tower and other European high-power stations using spark transmission will be found quite easy to record, if their speed of working is not too high at the moment. To get satisfactory recording from continuous wave stations, however, is not quite so easy, as the marking wave must be well separated out in strength from the spacing wave. It must be remembered that the difference in note of the marking and spacing wave makes aural reading quite easy, but in the recording device changes of note will not be differentiated.

A Peculiar Effect

One of the most amusing experiments possible with this device is to connect up a recording apparatus in parallel with the loud-speaker, so that the armature of the Morse inker will be drawn down sharply by strongly modulated signals. If the set is connected up when the Savoy Havana Band is playing, the armature of the inker can be made to beat time in the most intelligent way! The amazement of one's friends when observing this experiment is most interesting to behold.

□ □

The Useful Drill Plate

A TOOL which every wireless man who makes up his own apparatus will find one of the greatest aids to the turning out of neat, well-finished work is the drill plate. The most useful kind for his purposes is that giving the Morse twist drill sizes from No. 1 to No. 00. This consists of a steel plate 5½ inches in length by 1½ inches wide, in which are rows of accurately drilled holes, each marked with the number of the corresponding drill and with its diameter as a decimal part of an inch.

Uses for the drill plate will suggest themselves at once. Suppose, for example, that you wish to make clearance holes for a batch of screws. All that has to be done is to find by trial the hole in the plate through which one of them will just pass, and then to use the drill indicated for work upon the panel.

Again, let us suppose that it is desired to make either in the milled nuts of terminals or in a brass rod, holes into which valve pins will fit tightly. Since those sold by shops which specialise in components vary a little in diameter, it is not possible to give a standard drill size which will be suitable for all cases. But the drill plate will tell you in a moment, for it is the easiest matter to discover with its help the diameter of the hole into which the pins available fit comfortably, and the correct drill to use.

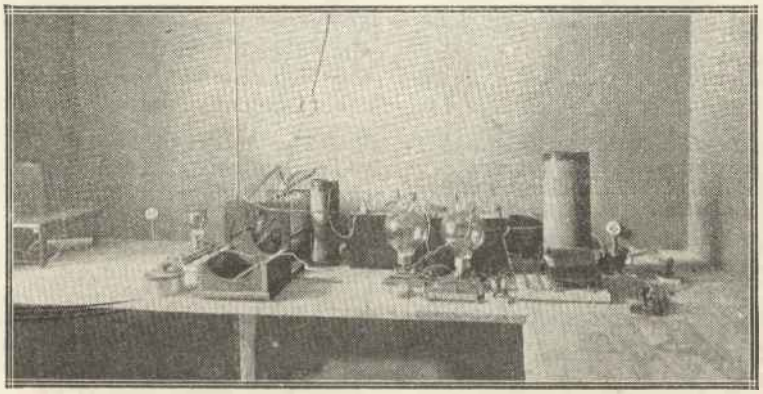
When wires have to be passed through panels one can make a neat job by drilling holes that are only just large enough to pass them—the drill plate will show the right size. With the drill plate, too, you can make your own brass bushes for the spindles of condensers, variometers and other instruments with a rotary movement.

It happens not infrequently that the knob actuating the moving coil of a tuning stand will insist upon coming loose. Condensers and variometers may offend in the same way, but tuning stands seem to be the worst. Sometimes the knob is tight, but the plug-and-socket block carrying the coil works loose. Here is a simple way of setting matters right. Take a stoutish piece of copper wire and pass it through the plate to ascertain what size of drill will make a hole into which it is a very tight fit. Make a hole of this diameter right through both the ebonite and the brass. Now cut off a piece of the wire long enough to protrude ⅛ inch or a little more at each end when inserted into the hole made. Place the wire in a vice and make a head, like that of a nail, at one end by tapping it with a light hammer. Then run the wire through the hole, cut off the plain end fairly short and rivet it tightly down. As the wire is an exact fit for the hole there will be no shake, and the knob or coil holder will give no further trouble.

If you do not wish to purchase a drill plate you can make a very useful one for your own set of drills by obtaining a piece of brass or milled steel of suitable dimensions and ⅛ inch thick and making in it a hole with each drill.

R. W. H.

100-METRE AMATEUR WORK



In view of the interest aroused by Senatore Marconi's work on 100 metres, we show above some of M. Leon Deloy's short-wave transmitting apparatus. M. Deloy (8AB), of Nice, was the first amateur to communicate with America on this wave.

How Every Crystal User may become a Valve Expert

By E. REDPATH, Assistant Editor

In the following article the theory of high-frequency amplification is dealt with, and some simple methods of using a single valve as a high-frequency amplifier in conjunction with a crystal receiver are explained.

WHILST dealing with low-frequency amplification in the preceding articles, reference was made to the fact that such method of amplification should be used only with a view to obtaining louder signals, and not with a view to increasing the range of reception.

There will no doubt be many readers who do not particularly desire loud signals. Their existing crystal sets enable them to obtain excellent results from their

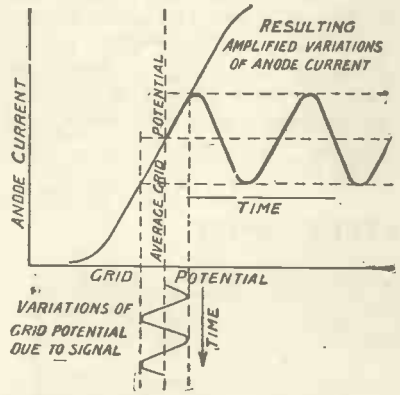


Fig. 1.—Graph illustrating the H.F. variations in anode current produced by H.F. changes of grid potential.

local broadcasting station in one or two pairs of telephone receivers, but they would be interested in an addition to their set which would enable them to receive one or more distant stations, still using the telephone receivers.

It will now be found that the addition of a single high-frequency amplifying valve to a suitably arranged crystal receiving set will effect a considerable increase in receiving range.

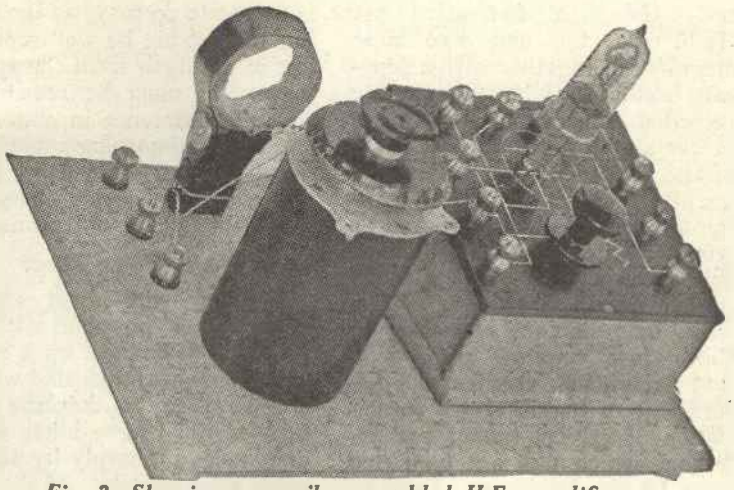


Fig. 3—Showing an easily assembled H.F. amplifier comprising a coil holder, variable condenser and "diagram" panel.

The Principles of H.F. Amplification

In the preceding articles the fundamental principle of the three-electrode valve was mentioned, namely, under proper working conditions the flow of electrons from the hot filament to the anode is controlled by the potential of the grid with respect to the filament.

With this fact it should also be remembered that a small change of grid potential will cause a comparatively large change in anode current, whilst the control, being purely electrical and involving no movement of working parts possessing inertia variation, can be effected at extremely high frequencies.

A three-electrode valve, therefore, can be made to act as a relay for electrical potentials whose value varies at frequencies altogether beyond the frequencies at which any relay of a mechanical nature could possibly operate.

The Action of the Valve

To explain the action of a three-electrode valve, when functioning as a relay or amplifier of high-frequency potentials, is by no means easy. It can, perhaps, be illustrated best by means of a graph as shown in Fig. 1. Readers who are not well acquainted with the graphic method of illustrating electrical conditions are urged to examine Fig. 1 carefully, bearing in mind that there are five important variable factors. Firstly, there are the varying grid potentials, positive and negative to the right and left respectively of the dotted line which represents the initial or steady average grid potential.

Secondly, there is the increase and decrease in anode current consequent upon each change of grid potential. In the earlier diagrams which were given to illustrate characteristic curves of valves, the grid potential was adjusted to various values, and the resulting anode current for each value was duly noted and marked upon the chart in order to form the curve. Under actual working conditions, however, the variations are occurring continuously, and, in order to represent such action in a clear manner upon our chart or graph, the different changes must be indicated progressively.

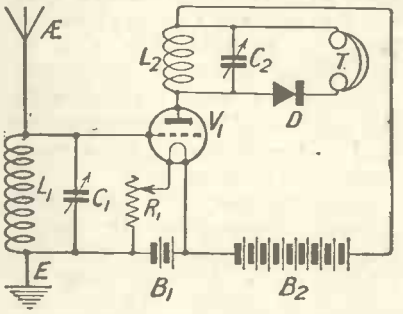


Fig. 2.—The simple but very effective "tuned-anode" method of H.F. amplification, which may readily be applied to almost any crystal receiver.

In other words, the time factor must now enter into our calculation, and accordingly changes in grid potential over a certain very small fraction of time are repre-

sented by the wavy line moving downwards from the horizontal base line. Similarly, the resulting changes in anode current are represented by another wavy line moving to the right from the point at which the "average grid potential" dotted line intercepts the anode current curve. This "time factor" is the third important point to be noted.

The fourth and fifth points are the amplitude of the changes in anode current and the amount of variation in grid potential which produces them, whilst, in this connection, it should be observed that the wavy line representing the anode current is an exact enlargement of the smaller wavy line representing varying grid potentials.

If the dotted line representing the average grid potential was moved either to the right or left for a distance of, say, half an inch, the anode current would not be varied *equally* on either side. Anyone interested may easily try this, but it will be found that the wavy line representing the varying anode current will no longer be the same shape as the grid potential line. In other words, the incoming signals, though duly amplified, will be considerably distorted.

From the foregoing, it will, no doubt, be appreciated that, in order to obtain distortionless amplification (as far as the valve itself is concerned, of course), it is important to obtain and maintain the correct average grid potential.

Fortunately, with the ordinary modern receiving valve, connecting the grid (via a tuning inductance) resistance, etc., to the negative side of the filament lighting battery maintains an approximately correct average grid potential for all ordinary anode voltages.

From Fig. 1 it will also be seen that, as in the case of low-frequency amplification, there is a limit to the amount of variation of grid potential. If this limit be exceeded, as may conceivably occur when several valves are used as high-frequency amplifiers, the resulting variations in anode current may reach, or at any rate approach, the upper and/or lower bend of the anode current curve. That is to say, saturation or extinction point may be approached with consequent lack of further amplification and the introduction of considerable distortion.

Some Simple but Useful Applications

Fig. 2 is a theoretical circuit diagram illustrating a particularly simple but, at the same time, quite effective method of using a three electrode valve as a high-frequency amplifier in conjunction with almost any type of crystal receiver.

In the diagram, L2, C2, D and T represent the tuning inductance, variable condenser, crystal detector and telephone receivers of an ordinary crystal set, connected as shown in the anode circuit of a valve.

By the provision of an additional inductance L1 and variable condenser C1, as a means of tuning the aerial circuit, the incoming signals which, in the ordinary way, would be applied to the crystal receiver direct are now applied to the grid-filament

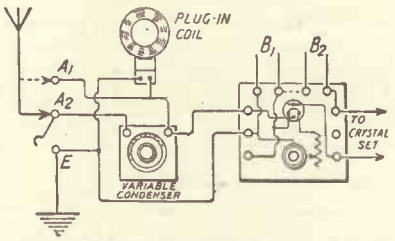


Fig. 4.—Wiring diagram of the apparatus shown in Fig 3.

or input side of the valve, thus causing the potential of the grid with respect to the filament to vary at a frequency to which the aerial circuit is tuned.

Controlled by the varying grid potential, electrons flow from filament to anode, equivalent to high-frequency pulses of current from the positive terminal of the high-tension battery B2, flowing to the anode via the inductance L2.

If the oscillatory circuit formed by the inductance L2 and the variable condenser C2 is tuned to the same frequency as the aerial circuit, the high-frequency pulses from the battery will be built up into comparatively powerful oscillations in that circuit, and these oscillations will be detected by the crystal D and made audible in the telephones T in the usual manner.

In this arrangement (Fig. 2) the valve acts as a relay or amplifying link between the two oscillatory circuits L1, C1, and L2, C2. The photograph (Fig 3) shows a practical form of the circuit of Fig. 2, comprising a "diagram" valve panel as previously described, a variable condenser (capacity 0.001 μF), a plug-in coil and fixed coil holder, and three terminals, the whole being mounted upon a convenient baseboard and connected up as indicated in Fig. 4.

As will be seen, the arrangement is extremely simple. Any kind of coil holder, coil and condenser may be used. On actual trial, the apparatus illustrated in Fig. 3, used in conjunction with the inductively-coupled crystal receiver with untuned secondary circuit, as illustrated in last week's issue, two distant British broadcasting stations were heard, as well as L'Ecole Superieure (Paris) and Radiola (Paris).

To obtain really satisfactory results it is important that the crystal receiver should be capable of tuning to its maximum wavelength *when included in the anode circuit of the valve*—i.e., without the usual capacity of the aerial to which it has previously been connected. To ensure that this condition can be complied with, the use of a variable condenser (maximum capacity 0.0005 μF) in *parallel* with the tuning inductance is recommended. In most cases of 0.0003 μF will be found suitable.

Readers already possessing crystal receiving sets, in which the aerial is tuned by means of a variometer, will be able to obtain quite good results by connecting a small fixed condenser in parallel across the variometer. The value of the condenser should be such as to compensate for the absence of the aerial, and, in general, a capacity of 0.0003 μF will be found quite satisfactory. The longer waves, such as 1,600 metres, cannot be tuned in this way owing to the small inductance range of the average variometer.

(Next week the use of reaction and the construction and operation of a compact all-wave valve and crystal receiver will be fully described.)

Daily Transmissions from Leading Continental Stations

Additions and Amendments

WEEK DAYS.

British Summer Time.	Name of Station.	Call Sign and Wave-length.	Locality where situated.	Nature of Transmission.	Closing down time or approx. duration of Transmission.
a.m.					
10.30	Lyons	YN. 470 m. ...	Lyons ...	Concert	Until 11.15 p.m.
10.40	Eiffel Tower ...	FL. 2600 m. ...	Paris ...	Cotton and coffee quotations ...	5 minutes.
p.m.					
12.14	Eiffel Tower ...	FL. 2600 m. ...	Paris ...	Time Signal in French Summer Time (Spoken), followed by Weather Forecast.	5 minutes.
1.00	Haeren	BAV. 1100 m. ...	Brussels ...	Weather Forecast	3 minutes.
1.15	Geneva	HB1 1100 m. ...	Switzerland	Weather Forecast, followed by Lecture.	One half-hour.
4.50	Haeren	BAV. 1100 m.	Brussels ...	Weather Forecast	3 minutes.
5.30	Eiffel Tower ...	FL. 2600 m.	Paris ...	Stock Exchange, closing prices (Saturdays excepted).	8 minutes.
8.15	Lausanne	HB2 800 m. ...	Switzerland	Concert (Thursdays excepted) ...	Until 9.30 p.m.
8.30	Ecole Sup. des Postes et Telegraphes	PTT. 385 m. ...	Paris ...	Lecture, followed by Concert. (Usually Outside Broadcast. Sometimes begins at 8.15 or 8.45 p.m.)	Two to three hours.
10.30	Madrid	—— 408 m.	Spain ...	Concert	Until midnight.

SUNDAYS.

p.m.					
8.30	Ecole Sup. des Postes et Telegraphes.	PTT. 385 m. ...	Paris ...	Concert or Lecture. (May begin a quarter-hour earlier or later).	Ends between 10.30 and midnight.
9.00	Radio-Paris ...	SFR. 1780 m. ...	Clichy ...	Concert, followed from 10 p.m. by dance music.	Until 10.45 p.m.
10.30	Madrid	—— 408 m.	Spain ...	Concert	Until 12.30 a.m.

SPECIAL DAYS.

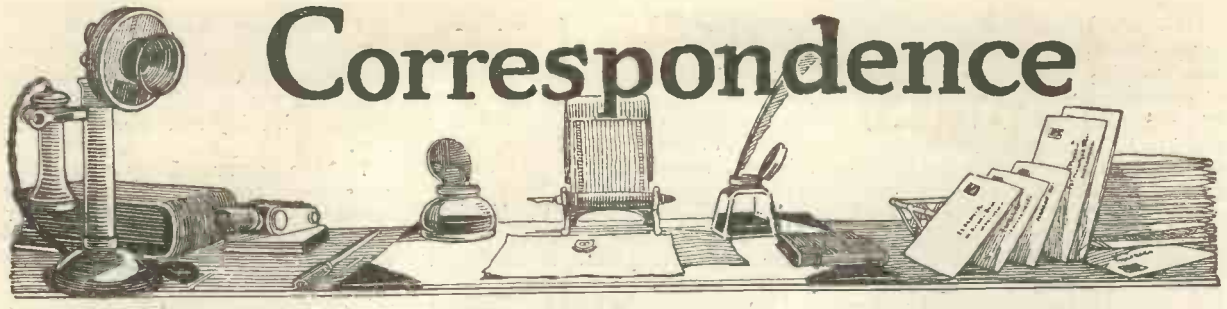
p.m.					
3.00	Ecole Sup. des Postes et Telegraphes.	PTT. 385 m. ...	Paris ...	Fridays, Concert or Lectures ...	Two hours.
5.00	Lausanne	HB2 800 m. ...	Switzerland	Thursdays, Children's stories ...	One hour.
10.00	Radio-Paris ...	SFR. 1780 m. ...	Clichy ...	Mondays, Thursdays and Fridays, Dance Music.	Until 10.45 p.m.

WIRELESS IN THE EMPIRE PAGEANT

IN the representation of Mr. Marconi's first experiments in Transatlantic Wireless Telegraphy at Signal Hill, Newfoundland, which is being included in the British Empire Pageant, the scene will be re-enacted as faithfully as possible to the events which took place in December, 1901.

Wireless instruments and apparatus of the type used at that time have been assembled for this purpose, and Mr. G. S. Kemp, Mr. Marconi's chief assistant in the Signal Hill experiments, is taking the same part in the Pageant that he did at Signal Hill. The instruments themselves will be exhibited in the Newfoundland Pavilion when not being used in the Pageant.

Correspondence



FROTHING

SIR,—I cannot allow the letter from Messrs. Peto & Radford in your issue of the 9th inst. to pass without a word of protest.

To any user of accumulators it would appear as if they have given their blessing on the use of "Hudson's soap" as a remedy for frothing. I do not for one moment disagree with the statement that it does stop frothing, and this is probably due to the formation of a slight film of oil on the surface of the electrolyte caused by the action of the acid on soap. The great point, however, appears to me, that the addition of this soap is detrimental to the plates themselves.

I have to-day tested several samples of "Hudson's soap," and in all cases I found that a solution in distilled water showed a far greater percentage of "chlorine" present than anyone who has had any experience in accumulator work would think of introducing into the electrolyte.

The frothing of accumulators is almost, if not entirely, confined to cells in which the containing cases, and especially the separators, are composed of celluloid. This material usually contains a considerable quantity of camphor, as it greatly adds to its plasticity and facilitates the operation of rolling into sheets, as owing to its high boiling point it retains the volatile solvents which are necessary in manufacture.

Camphor may be converted by oxidants into several acid bodies, such as camphoric acid, camphoronic acid, campholic acid, and others; and although, according to D. G. Fitzgerald, who carried out much research work on accumulators, these acids may not be detrimental to the actual working of the cells, their formation is at the expense of the celluloid cases and separators used, and are undoubtedly the basic cause of frothing.

It is questionable whether any amount of washing out with water and refilling, as suggested by Mr. Peto, will effectually cure the frothing, as it only means that a fresh surface of the celluloid is laid bare for a further attack during the next charge. It is probable that a small amount of the special light petroleum oil, which has been introduced by Prices and called "Blancol," would greatly minimise, if not stop, the frothing, although it would not touch the root of the trouble. The oil has been largely used by the Post Office for their storage batteries, and they have found that there is almost an entire absence of spray during charge, when this oil is used.

Yours faithfully,

ARTHUR W. FITHIAN, M.I.E.E.
Wandsworth Common,
S.W.17.

DOUBLE REACTION RECEIVER

SIR,—I have recently completed the double reaction receiver as designed by Mr. Stanley G. Rattee in the issue of *Wireless Weekly* of April 16, 1924.

The results are quite excellent, all B.B.C. stations and the Continental stations coming in at very good two-valve strength. The set is a good example of what can be done by careful designing, as although the set is as compact as possible, there is not the smallest sign of the bugbear of "hand-capacity." Naturally any experimenter also appreciates the testing of the "double reaction," which is most interesting and instructive.

Having long since subscribed to all the modern wireless publications, including, of course, your own *Modern Wireless* and *Wireless Weekly*, I would like to offer you my best congratulations on your productions. I think that I may fairly voice the opinion of the majority of genuine "C.Q.s" when I say that you have never published a "dud" number.

The amount of really useful information which you put into both your publications, including the very excellent whole-page photos and working diagrams, is a very great pleasure to me personally, and to all of us who enjoy this interesting scientific hobby.

Wishing you the continued success which you deserve,—Yours faithfully,

"TEMPLATE."

Norwich.

A specimen of the large Amplion loud-speakers which are used on the B.B.C. kiosk at Wembley for the public demonstrations of broadcasting.

THE RADIO ASSOCIATION

[In view of the recent alterations in the conditions of issue of amateur transmitters' licences and the apparent restrictions in facilities hitherto granted to transmitting amateurs by the P.O., the Radio Association communicated with the P.M.G. on the subject. Appended is the reply received by the Association.—ED]

"SIR,—In reply to your letter of June 27, I am directed by the Postmaster-General to say that the main changes recently introduced in the conditions of permits for the use of wireless sending apparatus are as follows:—

"(1) The use of spark transmission is forbidden as being unnecessary now for research purposes and causing the maximum amount of interference.

"(2) In the general interest, the use of the 440-metre wavelength is forbidden between 5 p.m. and 11 p.m. on week-days and during broadcasting hours on Sundays. This condition had been imposed for some time past in all new licences, and it is now being applied in all cases in connection with the scheme for re-licensing.

"(3) An additional band of wavelengths, *i.e.*, 115-160 metres, is granted in approved cases.

"(4) The licensee is required to keep a log of transmissions and to produce it for inspection, if desired. The Postmaster-General understands that it has hitherto been the general practice for experimenters to keep such a record for their own purposes.

"(5) Experiments in sending are normally restricted to sending messages to stations in this country which are co-operating in the experiments, and this fact is now stated in the permit. The Postmaster-General is prepared, in accordance with the practice hitherto followed, to consider favourably any application for an extension of the normal facilities for experiments which cannot be conducted with stations in this country, on receipt of particulars of the experiments and evidence of an arrangement for co-operation by a foreign or colonial station or stations.

"There has been no change in the general conditions which all applicants for sending licences must fulfil. The Postmaster-General is anxious that all reasonable facilities should be afforded to applicants who have in view experiments that are likely to be of real value, and who are competent to carry them out.

"Your Association will recognise the need for careful scrutiny of all applications, in order to ensure that the *bona-fide* experimenter is not hindered by unnecessary and unskilled transmission.—I am, sir, your obedient servant,

"(Signed) F. J. BROWN."

A SINGLE-VALVE CABINET RECEIVER

SIR,—Allow me to congratulate Mr. Rattee on the one-valve reaction receiver described in *Wireless Weekly* of June 18. I have built this set, and here is a list of the stations received:—

2LO, 5XX, 5IT, 2ZY, Konigswusterhausen, 6BM, FL, Nauen (time signals), 5WA, Radio-Paris, 5NO.

I do not say all these stations are comfortable to listen to from a music-lover point of view, but I certainly say that the set gives me the choice of 2LO, 5IT, Radio-Paris, 5XX and the Eiffel Tower, these coming in beautifully.

I am greatly indebted to Mr. Rattee for my success, this being my first home-built set.

Wishing *W.W.* and *M.W.* the best of success.—Yours faithfully,

F. AZER.

Potters Bar.

The neat Omni Receiver referred to by Mr. Jewell.

THE "ALL-CONCERT" RECEIVER

SIR,—I think I ought to let you know how pleased I am with your famous "All-Concert Receiver," about which I read in the September number of *Modern Wireless*. After Christmas I decided that my two-valve set was not powerful enough, and finally considered that the "All-Concert" would meet my requirements. It has now been in constant use for some months, and has given unfailing good service all the time. Besides WGY I have logged over 100 amateur stations (telephony), Petit Parisien, L'Ecole Superieure, SFR, and all of the B.B.C. stations; also GED, GEG, Berlin and Brussels. A fair number of these I have had at loud-speaker strength; I very much improved the quality of LS reception by placing a resistance of one megohm across the secondary of the L.F. transformer, together with a .0001 fixed condenser. Music on the loud-speaker is now as faithful and pure as one could wish.—Yours faithfully,

G. J. MARCUS.

THE OMNI RECEIVER

SIR,—I enclose a photograph of my enlarged Omni receiver, upon which I try all circuits given in *Wireless Weekly* and *Modern Wireless*.

I have arranged by means of a switch the ability to use a standard three-valve set, so connected that either one, two or three valves may be used.

Connections are made with rubber-covered wire with spade terminals.

One useful feature is the provision of external terminals which enables me to use a variometer or Reinartz tuner.

The D.P.D.T. is to enable either a perikon or cat's whisker type of crystal to be used.—Yours faithfully,

G. JEWELL.

London, S.E.

THE FOUR-VALVE FAMILY SET

SIR,—You will be pleased to hear I was able to pick up Vienna the other night on your four-valve family set.

I am situated 21 miles from Glasgow, and can tune-in almost all the B.B.C. stations easily, except Aberdeen. Radiola and Eiffel Tower (France) are easily heard on LS if conditions are good. All B.B.C. stations come in strong on three valves. The fourth I only use for LS for distant stations. Glasgow and Manchester come in on LS using three valves.

I had difficulty at first to tune out Glasgow, as it came in on all other stations. I experimented with a wave trap, but was not satisfied. At the present moment I am very successful in tuning-out Glasgow and all stations in without much loss of signal strength by using a .0001 variable condenser in series with aerial terminal. The method in use is certainly elementary, being aerial terminal to one side VC and other side VC to A1 on the instrument. I am able to tune-in Glasgow, 415 metres to Edinburgh, 325 metres with 35-50-75 coils. Cossor H.F. Red top, Thorpe Det. and 2 Marconi R5 as amplifiers.

Aerial, electron wire, height 25 ft., and full 100 ft. in length.

The first time I tried out the set my aerial was run through window and tied round four iron posts 6 ft. high without any insulation except the wire. I obtained Glasgow on the LS and several other B.B.C. stations strong on 'phones.

I am pleased to say I had good results from the commencement with this set. I intend making your last month's *M.W.* five-valve set in near future and trust to get equally good results.

This is the fourth conversion of sets described by you I have under-

taken and obtained good results. I have not attempted fancy circuits, as I consider that the best thing is to obtain good, pure reception of the various transmissions without noises, distortion, etc. I would not be without a set for worlds now.—Yours faithfully,

H. B. JONES.

Ayrshire.

A USEFUL COIL HOLDER

SIR,—It is a general opinion that the usual kind of coil-holder is not very efficient if heavy coils are used owing to the weight of the coil causing slipping and so requiring continual adjustment.

The enclosed sketch of an arrangement which I fitted to my set is very effective, and keeps the coil perfectly steady and also allows of fine tuning. It is very simple, cheap and easily fitted, consisting of a "Meccano" worm and gear wheel, a piece of spindle and collar, also a small piece of sheet brass with sleeve and knob.

The sketch speaks for itself and needs no further explanation.—Yours faithfully.

JAS. S. BARCLAY.

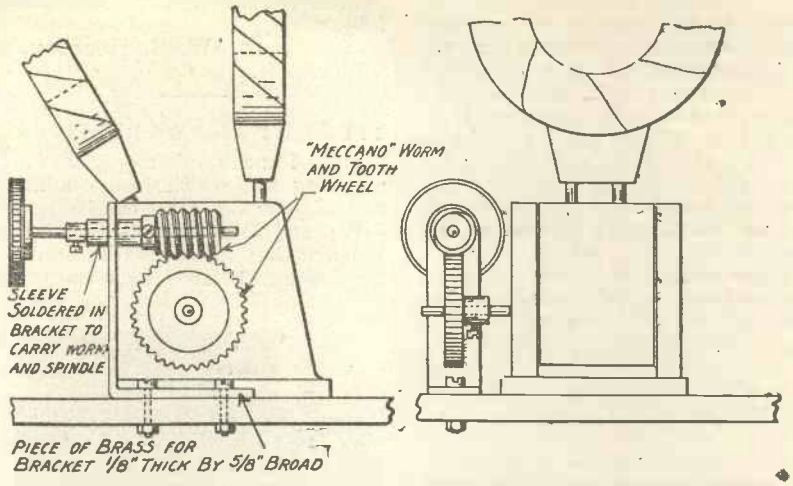
Kilmarnock.

A NEW SINGLE-VALVE CIRCUIT

SIR,—In the *Wireless Weekly* of November 21, 1923, a "New Single-Valve Circuit" is described by Mr. G. P. Kendall.

Mr. Kendall, very modestly, makes certain claims for his set, and those who have taken the trouble to construct it will have found that it surpasses all expectations. Indeed, it is surprising that more has not been said about this very peculiar type of circuit.

I have worked it for some time now, and, where local broadcasting is concerned, there is no trouble whether bell wire, gas pipe or ordinary aerial be used.



The addition of the "Meccano" worm and gear wheel to a coil holder prevents slipping as explained by Mr. Barclay.

I have, however, also discovered its shortcomings. There is lack of stability when tuning in distant stations, and the set does not seem to take kindly to loading coils. Possibly the author, in the course of experience, may have devised some means of overcoming these defects. I would be obliged for any advice you could give me on those two points.—Yours faithfully,

NELSON T. FOLEY.

Woodford, Essex.

NOTE.—The whole essence of this circuit is a very delicate control of

the reaction, reception of distant stations being entirely dependent upon smooth adjustment in the neighbourhood of the oscillation point. The circuit, therefore, requires careful adjustment of H.T. and L.T. supply, and a suitable valve. A valve which produces the slightest over-lap is practically useless for the distant stations.

The method of obtaining reaction is only suitable for the shorter waves and hence loading coils are not advised, although they can be used for so strong a station as 5XX. G. P. K.

H.F. ON THE ST100

SIR,—Having made your latest ST100 three-valve set I wish to say how satisfied I am with the results.

The nearest station is 110 miles away, and having acquainted myself with the method of using three condensers I get all B.B.C. stations and most of the Continental ones easily on the loud-speaker. London, Newcastle and Bournemouth are really *loud*, and the others are loud enough to be pleasantly audible.

The only difference in the choice of components is that I have used three Polar condensers with Lissen verniers. Thanking you for this useful addition to an already famous circuit.—I am, yours faithfully,

W. C. HODGSON.

Lowestoft.

TYPES W1 AND W4 RECEIVERS

SIR,—I enclose photographs of my receiving set, which is a combination of your two most excellent sets —W1 and W4. I constructed the W4 first, but soon was overcome by the desire to be able to use one, two or three valves at will. The results obtained with W4 were quite all that you claimed for it, and I got all stations at loud-speaker strength during April and May. Of late signal strength has fallen off, but I still get excellent telephonic signals on all stations. The new high-power station, 5XX comes in beautifully on one, two or three valves, and when the dark nights come again I feel sure that loud-speaker signals will easily be received.

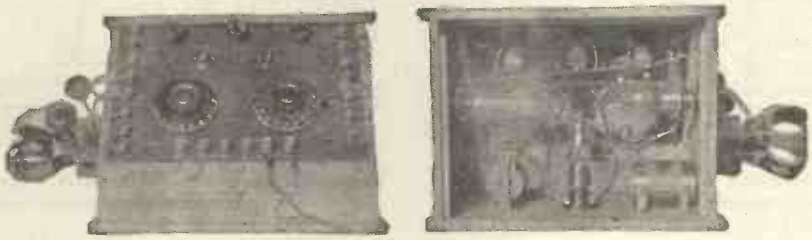
The general efficiency of the set has, if anything, improved since I modified it to the W1 type, but I have retained the Vernier condenser of W4 and Simpson connection across the second transformer—a Powquip. The first transformer is Eureka concert grand.

In this set, as you will see, I have enclosed the valves, so as to be out of the way of my maid whose cleaning is admittedly a "sweeping" success!

Wishing further success to your two most excellent journals,—I remain, yours faithfully,

WILLIAM SCOTT, M.B., Ch.B.

Dumbartonshire.



The compact receiver which was made by Mr. William Scott.

Apparatus we have tested

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

O'Keefe Inductance Coils

We have received from Messrs. the D.E.M. Company a set of four coils of the plug-in type, Nos. 35, 50, 75, and 100, of ordinary dimensions.

These are of a "double-basket" type of winding, for which low-distributed capacity is claimed. The inductance values measured were about 60, 120, 270, and 550 microhenries respectively, corresponding closely with those of the usual commercial coils. It was noted that these coils, though very light in weight, were wound with a reasonably large gauge of wire; offset against this is the point that with this type of winding there is a large proportion of inactive wire passing at an acute angle to the direction of the axis of the coil, so that the effective H.F. resistance was not so small as might be expected from the gauge of wire chosen. The coils were taped lightly, and mounted in a moulded cradle carrying the conventional plug-and-socket fitting, but provided with reversible plugs for turning the coil around (though, of course, this has no effect on the direction of the magnetic field).

The measured tuning-range was, with a 0.001 (actual) μF parallel tuning condenser of moderate minimum capacity, No. 35, 120—450 m.; No. 50, 160—660 m.; No. 75, 225—980 m.; No. 100, 350—1,380 m. On a P.M.G. aerial of .0003 μF capacity the minimum is accordingly about 260, 375, 570, and 780 metres. The requisite range of reaction and second-circuit coils was found available.

In actual tests, measuring signal strength in crystal and valve reception, satisfactory results were obtained, the results being exactly comparable with those of a well-known standard type of plug-in coils.

Terminal Clips

From Messrs. Runbaken Magneto Co., Ltd., come a sample pair of terminal clips, especially

suitable for making connections to accumulators, where the existing terminals have become corroded and stuck fast.

These are strong spring clips, with toothed jaws which open wide enough to clip on to the end of the terminal stem or even the top of a small terminal, and close with enough force to cut through any superficial coating of corrosion. The clips are 2 in. long and about ½ in. wide; a powerful steel spring within the clip gives it a vice-like grip. Connection is made with a flexible lead by means of a small screw—which might with advantage be rather larger—and tags which can be closed down on the insulated cover of the cable to provide a strong fastening.

On extended trial on our accumulator battery and charging plant, these clips were found to be invaluable, making the change of accumulators in the middle of an experiment, or the tapping of 4 volts from a six-volt cell, etc., a matter of a couple of seconds only; whilst the electrical connection was always sound—more so, in fact, than often happens with old accumulator terminals with a wire pinched apparently securely under a brass nut. The clips could also be pyramided for multiple connections with perfect security.

A Wide-Range Filament Control

The Gerrard Radio Stores have brought to our notice a new fine-adjustment filament resistance, suitable for both dull-emitter and ordinary bright-emitter valves, possessing a wide range of resistance values with narrow adjustment throughout that range.

The instrument (which incidentally is marketed at an extremely moderate price) is enclosed in an ebonite cylinder about ⅞ in. diameter and 1⅜ in. long, with single-hole fixing. A large ebonite knob outside the panel controls the mechanism, which is apparently of the screw-compression type. Small terminal screws are provided at each end of this cylinder for connections.

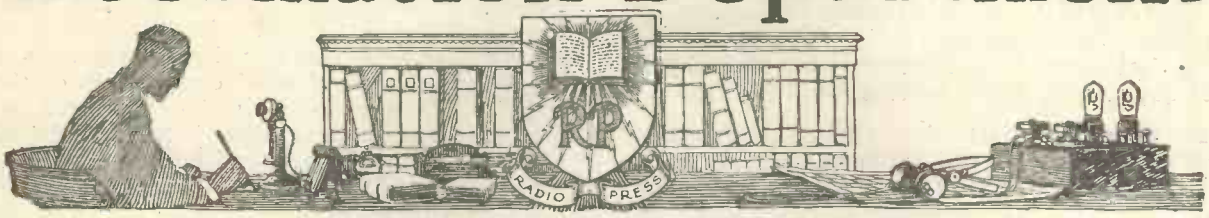
The resistance, on measurement, ran from about 200 ohms practical maximum (nominal 50 ohms) to a very low figure; and smooth and continuous variation was possible throughout this range. It is thus eminently suitable for a double-purpose resistance, as when both dull-emitters of the .06 type and ordinary valves—or even small power valves for power-amplification—are used in the same set. Actual test showed that it could pass the current for a small power valve at 6 volts without signs of distress; and control the supply to two R-type valves successfully. On extended trial with both .04 and .06 types of valves, R valves, and L.S. valves, several of these resistances have given most satisfactory service. They can, accordingly, be thoroughly recommended. In conjunction with the dull-emitter type of valve in particular, very nice control over rectification and reaction was observed.

□ □ □

A Gradual L.T. Switch

On page 310 of our July 9 issue, the wire with which the former should be wound is No. 20 S.W.G. enamelled Eureka, and not, as previously stated, No. 26.

Information Department



SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

R. D. (STOCKPORT) submits a diagram of his receiver, which he complains gives very distorted reproduction, and inquires as to the causes and remedies.

The diagram indicates that two stages of low frequency amplification are being used, the lower ends of the transformer secondary windings being connected direct to the negative end of the valve filaments. No grid bias is being used, and since the low-frequency transformers are both of good quality, this is the probable cause of the trouble. Take the connections from the transformer secondary windings direct to the low-tension negative terminal, and transfer the filament resistance of each low-frequency valve to the negative lead. With your present valves and a six-volt accumulator, this will give a negative bias of about two volts to the grid, which will probably be sufficient.

O. R. Q. (NORWICH) states that he has been informed that he is likely to cause interference with neighbouring listeners if he allows his receiver to howl at low-frequency. He explains that his receiver consists of a single valve set to which he has added a two-valve low-frequency amplifier.

So long as you are quite sure that the howling is the result of true low-frequency oscillation in the circuits of the amplifier, there is no chance of causing interference, but you must take great care to discriminate between such howling and that which results from operating the rectifying valve in the oscillating condition, thus producing a beat note with the carrier wave of the station which you are listening to.

To make the necessary distinction, try varying the capacity of the tuning condenser. If this makes no difference whatever to the pitch of the

note which you hear, you can be fairly sure that no interference can take place.

F.P.A. (BLACKPOOL) refers to the special method of mounting coils known as the Gimbal method, and asks what is the object of supporting coils in this way.

The principal object of arranging coils in this way is to enable a real minimum coupling to be obtained, which is quite impossble in the majority of cases with the ordinary two-coil holder and plug-in socket type of mounting. With the Gimbal method the coil can be revolved upon its axis, as well as moved away from or towards its neighbour, and the power to make adjustments of this nature is often most valuable when working with loose-coupled circuits. An incidental advantage of the method is that the two ends of the coil are brought out to points which are very widely separated, and there is no need to use a plug of material which may or may not be good from the insulating and dielectric point of view.

R. H. V. (GUILDFORD) refers to a certain popular type of anti-capacity valve socket, and asks whether we consider there is any real advantage to be gained by using such components.

With sets employing two or more stages of tuned high-frequency amplification, it is probable that some arrangement of sockets of this nature is practically essential to get anything like good results. Until such sockets were introduced, and their value appreciated, it was generally laid down as a rule that such receivers could only be worked with anti-capacity valves of the type of the V 24. The method of construction of the majority of these special sockets also reduces the chances of leakage through the material of which the socket is made, and further, eliminates the possibility of touching the filament pins of the valve across the wrong sockets, and thereby burning out the filament.

C. R. W. (KILDARE) states that he is making up the Trans-Atlantic Five receiver, and intends to use bright emitters throughout, and inquires whether there is any reason why he should use the special double resistances shown in the design. He desires to use another make containing considerable masses of metal, and asks whether this will be objectionable in the circuit in question.

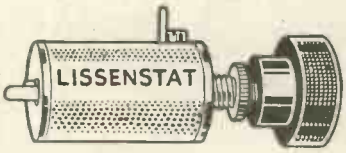
Since you intend to use bright emitters, there is no reason why you should not use any convenient type of filament resistance, and the presence of metallic masses at this point in the circuit should be quite harmless. Most of the metal in question, of course, is connected to earth.

Stepping in with LISSENSTAT Control

Oftentimes physical alteration of the tuning inductance or condenser fails to give just that acute control which means so much in long distance telephony. It is when this critical condition is reached that one realises how important LISSENSTAT control is to fine detection. Where further physical adjustment of the reaction control is ineffective then it is that you step in with that final touch of LISSENSTAT control. Immediately tuning becomes transformed—at once it is so acute that the distant station which previously was so elusive comes in clearly.

It is now generally known that LISSENSTAT control improves fine detection of long distance telephony in a truly remarkable manner.

LISSENSTAT (prov. pat.)



Critical electron emission is absolutely dependent upon the exact control of filament temperature. LISSENSTAT control gives that indescribable sensitivity to detection which has to be experienced to be understood **7/6**

LISSENSTAT MINOR (prov. pat.)

Such a high degree of LISSENSTAT control is provided by the LISSENSTAT MINOR and at a popular price, that no inefficient rheostat need longer be tolerated. The LISSENSTAT MINOR makes it worth while discarding any existing device. For dull emitter and all valves **3/6**

LISSENSTAT Control is an indispensable part in the building of any efficient receiver.

Why Transformers Break Down—

It is commonly assumed that transformers always break down because of overload. Oftentimes, however, the cause is far different. The windings of an audio-frequency transformer are called upon to carry comparatively heavy low-frequency impulses of varying audio-frequencies. The louder the signals the stronger are these audio-frequency impulses.

If the windings of a transformer were microscopically examined whilst audio-frequency impulses of varying frequencies were flowing through them, it would be seen that they were vibrating in sympathy with the frequencies they were passing.

If the windings had not been designed bearing in mind the conditions of service, although the effect of the vibrations might not be immediately obvious, the ultimate effect would be to alter the molecular formation of the copper in the windings and render the wire crystalline. Once the windings have reached this condition, it is only a question of time before the user will one day be surprised to find his transformer no longer amplifying. Unfortunately, even expensive transformers are not immune from this fault. That is why these break down even though in the factory testing room they may have withstood thousands of volts.

Apart from perfect mechanical constructions, LISSEN AUDIO-FREQUENCY TRANSFORMERS have certain technical attributes which place them above every other. For amplification of radio telephony they are unsurpassed.

The Low Tones of an Orchestra—

(1) **THE LISSEN T1 TRANSFORMER** is the only transformer which has a sufficiently high impedance value that it forms the ideal transformer for use immediately behind the detector valve. THE COIL WOULD AMPLIFY BY ITSELF WITHOUT ANY IRON CORE AT ALL. The secret of its beautiful amplification is in the expensive coil. Even the low tones of an orchestra are faithfully reproduced, perfect in every note **30/-**

(2) **AUDIO FREQUENCY IN REFLEX CIRCUITS.** Besides being exceptionally pure and powerful in all reflex circuits, the LISSEN T2 Transformer can be used for all stages. Recommended also to follow the LISSEN T1 where the latter is not used throughout **25/-**

(3) **SKILFULLY BALANCED DESIGN.** The LISSEN T3 Transformer actually compares with many expensive transformers of other make. It is certainly the best light transformer made. For all stages ... **16/6**

Fit a LISSEN Transformer—and make sure.

Altering Leak Resistance

Once a fixed leak is put into a circuit it offers no opportunity to the operator to alter its resistance either way. Although some circuits do not immediately respond to variation of grid potential others are decidedly susceptible to it. Valves also vary, and variable grid control is, therefore, highly necessary in many cases, and it is always reassuring to know that one has the means of controlling grid potential, so that the correct value is obtained for each circuit or valve, or the particular conditions under which a valve may be working on any given signal. With the LISSEN Variable Grid Leak fitted, a receiver is equipped to yield the utmost sensitivity which correct grid potential under all conditions implies.

LISSEN ONE-HOLE FIXING, OF COURSE—POSITIVE STOPS BOTH WAYS **2/6**

LISSEN Variable Anode Resistance—20,000 to 250,000 ohms, same outward appearance as the LISSEN Variable Grid Leak **2/6**

You just gently pull or push

LISSEN two-way switch, **2/9**

—and you hear these little switches "make" with a reassuring click. The contacts do not short when changing over—they are self-cleaning. There are no neater or handier switches. LISSEN ONE-HOLE FIXING, OF COURSE. Take up hardly any room.

LISSEN Series-parallel switch, **3/9**

Is this your nightly problem ?

Puzzling how to cut out your interference, so that distant stations may come in uninterrupted? How easy it is with LISSENCEPTOR, broadcasting and Morse, although there is some type of Morse which is more difficult to eliminate. Even this, however, can be so subdued that it ceases to be troublesome.

A separate tuning condenser should be used with the LISSENCEPTOR—diagram with each shows easy connections.

LISSENCEPTOR Mark 1 type for 600 metres **7/6**

" " 1 " " broadcasting **7/6**

LISSENCEPTOR Mark 2 type for broadcasting and 600 metres (combined with switch for more selective tuning)

The LISSENCEPTOR acts as a sentinel beside your Receiver. **15/6**

Why Use Mixed Parts ?

There is a LISSEN part for every vital place of a receiver. If you build with all LISSEN parts your finished receiver will be far above the average

The Text Book of LISSEN parts contains a lot of useful information. Post Free 8d. Free to the Trade.

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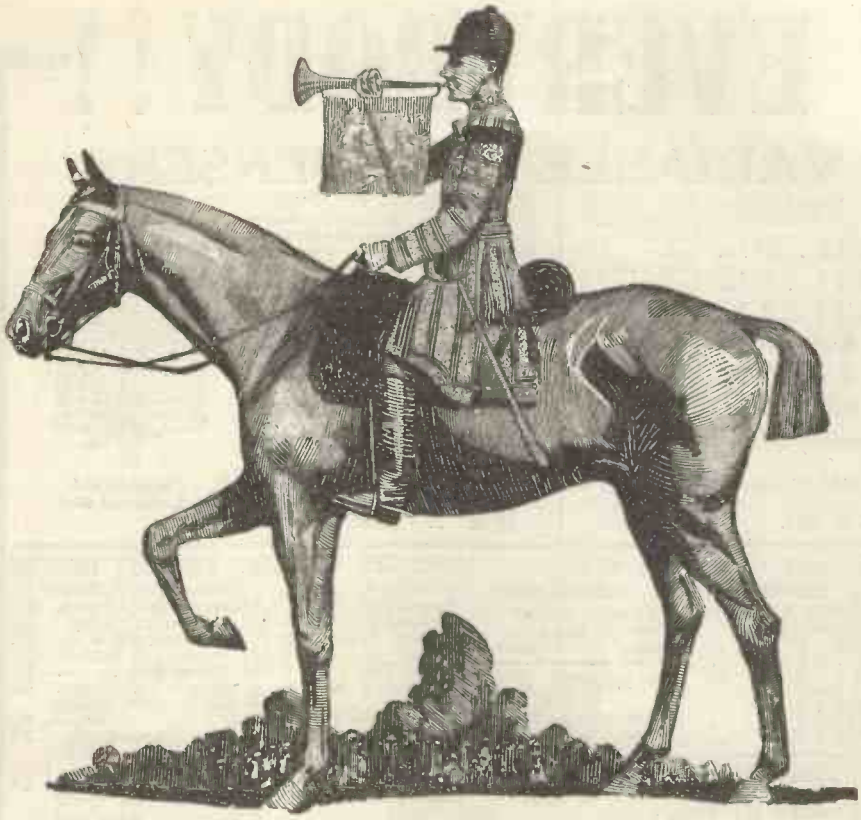

Marvellously fine tone

—*without a trace of blast or blare*

RADIO enthusiasts are gradually appreciating the fact that 75 per cent. of the responsibility for poor tone rendering is due to the Transformer, with the remaining 25 per cent. divided between the Valves and the Loud Speaker.

It has been a common fallacy to believe that the L.F. transformer merely amplifies and for this reason many of them are badly designed. Amplification in a transformer for Loud Speaker use must always be considered in relationship to tone purity. Any transformer can be made with a high amplification factor—that means merely a mathematical calculation as to the ratio between the number of turns on the primary winding and those on the secondary. But to eliminate distortion and yet retain the volume is entirely another matter.

The Eureka Concert Grand is such an exceptional Transformer because no money has been spared on its construction. For instance it is the only L.F. Transformer in the world that contains 2¼ miles of wire. It is the only one that will stand a 14-day total immersion in water test. It is the only one that can be bolted together in pairs without interaction. And it is the only one that will give twice the volume of an ordinary Transformer even when used with a standard Valve and not power Valve. In face of these outstanding advantages it is not surprising that our output has had to be trebled in an endeavour to keep pace with the demand.

Made in two types

Concert Grand	.. .. ..	**30/-**
Eureka No. 2	.. .. ..	**22/6**
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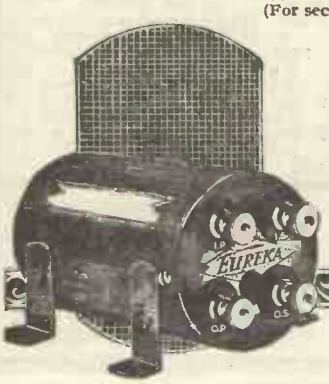

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THAT NEW SET

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"RADIOHM" BUS BAR ⅛th square copper wiring rod, as used on many "Wireless Weekly" sets, 2/- per dozen, 2 ft. lengths with tags, postage 3d.

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R.A.F. "C" Valves made by Osram G.E. Co., Ltd., and Ediswan Co., the finest H.F. and Det. valve ever offered under 13/-. Fit Mullard "Ora B" sockets. Adaptors for "R" Valves supplied at 1/- each.

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5 v. ¼ amp.

Four Electrode "R" Valves, 17/6 each.

Limited Number delivered from Stock. Trade Supplied.

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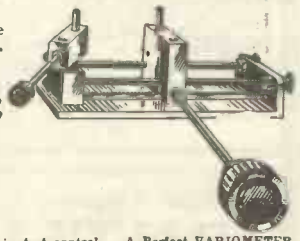
The "MIKROTUNE" MAKES TUNING SIMPLE & CERTAIN

Reversible Coil-holder.

Adds 50% value to any set.

12/6



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

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Telephone: MUSEUM 4192.

Hullo, Everybody! This is Uncle Fellows calling. I have not the pleasure of knowing you all personally, and yet we seem to be old friends.

Do you remember the days when the obliging gentlemen from Wr-r-rittle used to give us concerts? That was in the pre-B.B.C. days. Only a couple of years ago, but what a lot of water has flowed under the bridge since then! Even in those days the Fellows Works were manufacturing and experimenting hard—had been for some years.

No one could quite see how Broadcasting would turn out, or what type of set you would demand. It seemed fairly certain that you would need apparatus which would give really good results and be simple to operate, and yet we must, above all, keep the cost low by cutting out all "gadgets" or expensive finishing processes.

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"Quality apparatus at Low Cost."

We have been working on that policy for two seasons, and the job we are now having to keep pace with your demands proves that when we decided upon that policy we were building even better than we knew.

By the way, have you noticed what good value our Lightweight Headphones are? Write for the illustrated folder which gives full details of these and the other patterns we manufacture.

FELLOWS WIRELESS

THE LIGHTWEIGHT HEADPHONES.

Highly finished, good workmanship and extreme sensitiveness. They are very comfortable, headbands are duralumin and will not rust or tarnish. Weight with cord, 6 oz. Resistance 4,000 ohms.

Price 18s. 6d.

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A Valve for Every Wireless Circuit

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THE MULLARD P.A. VALVES are designed to give loud speaker volume without distortion. The P.A.1 is used chiefly for power amplification at wireless concerts and requires 200-400 anode volts. For general loud speaker purposes, however, the P.A.2 with a working anode voltage of 150, gives sufficient volume for large rooms. The P.A.3 is similar to the P.A.2, but only requires a normal H.T. battery of 70-120 volts.

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GOLD SEAL PLASTIC METAL

the best contact possible, and get LOUDER & CLEARER SIGNALS. Contains no mercury. Of all Wireless Stores.

Enough for 3 cups **6d.** per packet.

Wholesale enquiries (or sample packet 6d.) to

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WIRELESS WEEKLY. Vol. 4. No. 12. July 23, 1924.
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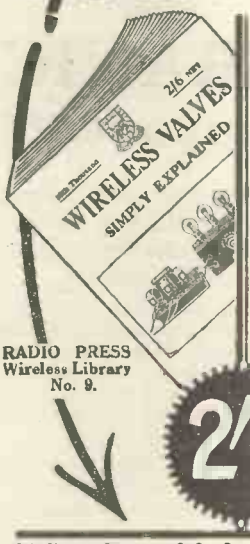

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IF you are at all keen and enthusiastic you will continually find little queries which will puzzle you. Exactly what is Reaction? How does a Valve oscillate? What is Tuning?

These are the sort of questions answered in this Book by the Editor of *Modern Wireless*. Get a copy to-day—master its contents and you will begin to make *real progress* at once.

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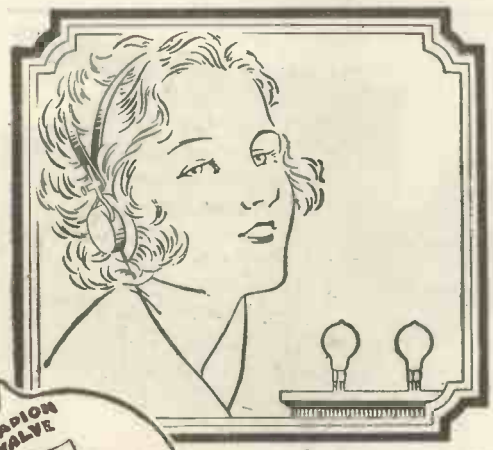
Wireless Valves simply explained

By John Scott-Taggart F. Inst.P.



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and fit Radion to the "lasting" benefit of your accumulator and your pocket. These valves use only a third of usual filament current.

Use only .25 amps. at 3.5 to 4 volts. Anode Volts 30 to 90.

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Two Types: A2 for amplifying. D4 for detecting.

Same price for each. Same filament and anode current also. If your dealer does not stock this efficient and economical valve, write direct to us and we will see that you are immediately supplied.

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Wireless demands vision and foresight, too. The ability to peer into the future, to decide the trend of coming developments, to discard ruthlessly that which is out of date comes only to the qualified. Every man on the Editorial Staff of Radio Press Ltd. is a technical expert able to anticipate future ideas and to differentiate between the new and practicable and the merely sensational.

Every day sees some new phase of Radio. Yesterday telegraphy—to-day telephony—to-morrow, maybe, television. Truly this newest of all Sciences requires vision and foresight if we are to remain in the van of progress.

No. 2. of a Series of Advertisements for Radio Press Ltd., Devereux Ct., Strand, W.C.2

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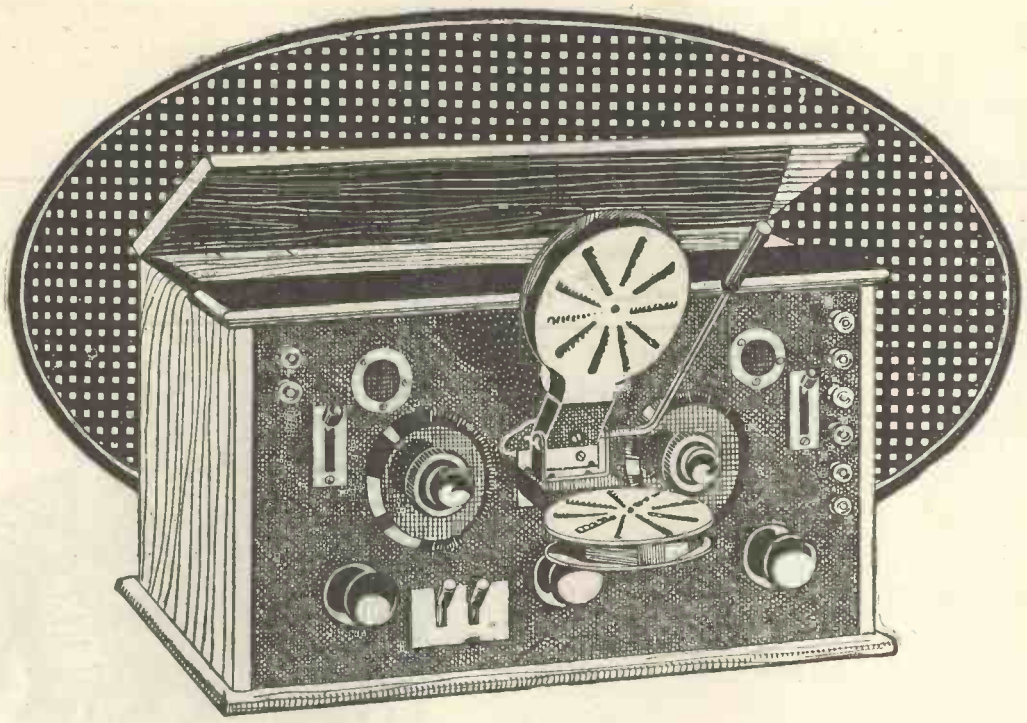

The Famous All-Concert Receiver

—designed by Percy W. Harris (Assistant Editor of this Magazine)

THE All-Concert Receiver was described in one of the first Constructional Articles ever written for MODERN WIRELESS by Mr. Percy W. Harris.

From the very beginning its undoubted merits—it was one of the earliest 3-Valve Sets—gripped the imagination of wireless enthusiasts and a very large number built it up and got excellent results.

Here, however, is the first opportunity of seeing it in its new guise—that of a superlative Receiving Set, beautifully designed and made up with plated fittings into a polished mahogany cabinet — truly an aristocrat among Sets and fit for any drawing-room.

This Receiver is astonishingly sensitive yet very simple to handle—to its credit stands a formidable list of Stations heard in North London on an average aerial—commencing with all the B.B.C. Stations (London, of course, in immense volume on a Loud Speaker) and continuing with all the better known Continental Stations and also K D K A — the well-known American Broadcasting Station, which operates on 100 metres.

The secrets of its construction are now available to all who purchase the Envelope containing full details, wiring diagrams, blue prints, etc.

If you are contemplating building a good all-round Set you can't beat the All-Concert de-luxe.

Published by Radio Press, Ltd., and sold by all Booksellers

2/6

or post free direct, 2/8.

How to build the All-Concert de-luxe Receiver

RADIO PRESS Simplified Envelope Series No. 4.

G.A. . 1154

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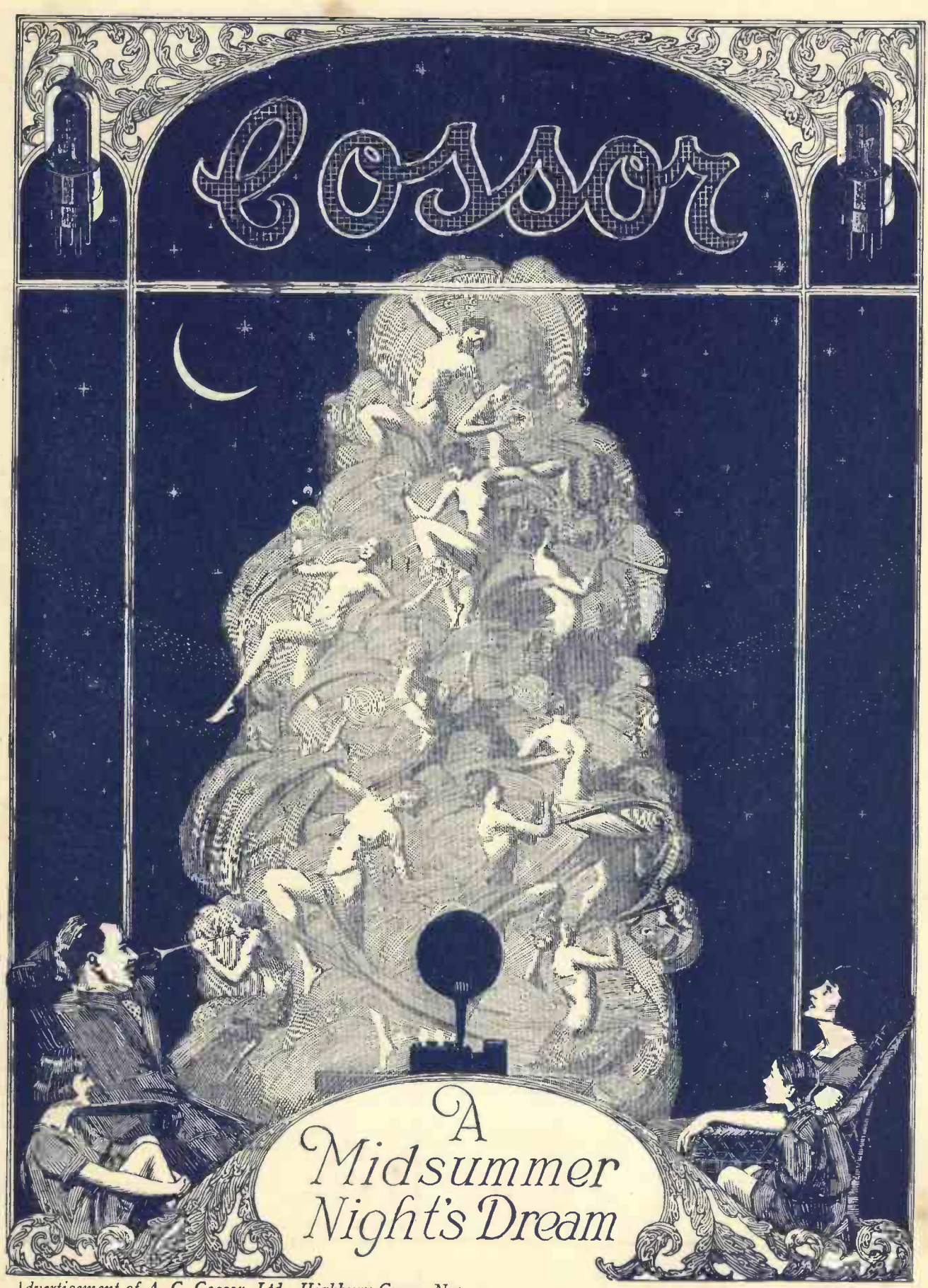

Advertisement of A. C. Cossor, Ltd., Highbury Grove, N.5.

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Wireless Weekly, 6d. Net. Wednesday. July 30th, 1924.

Wireless Weekly

and the Wireless Constructor.

Vol. 4.
No. 13.

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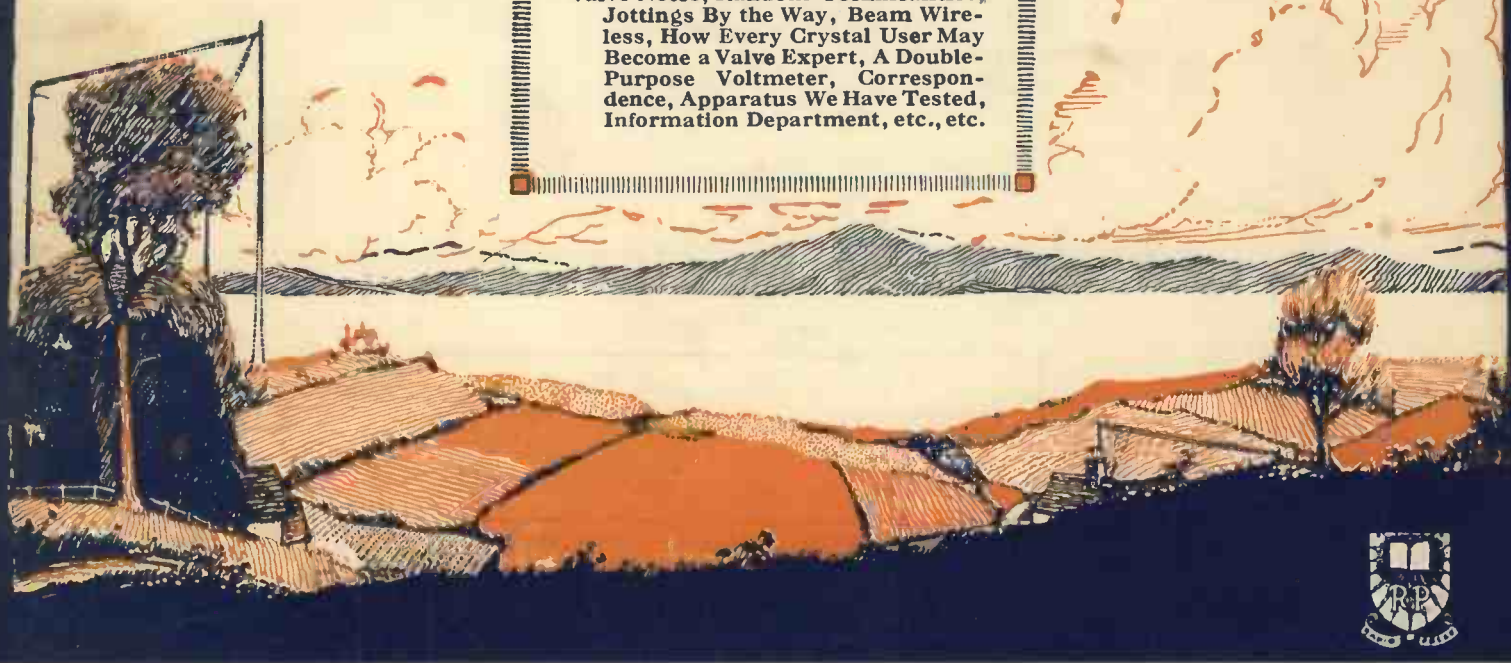

H.F. Transformers Explained

Every step fully explained—

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

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

In any case, we would emphasise that the reader will find every step fully described and explained in the clearest and most interesting manner.

SHOWS HOW TO BUILD:

Simple Crystal Receivers.
An inductively-coupled Crystal Set.
A two-valve Low Frequency Amplifier.
A two-valve Broadcast Receiver.
A three-valve Regenerative Receiver.
A single-valve Reflex Receiver.
A three-valve Broadcast Receiver.
A four-valve Universal Receiver.

Together with information as to the testing and operation of Receiving Sets

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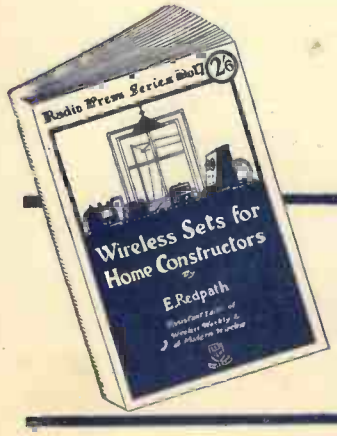

Wireless Sets for Home Constructors

By E. Redpath.

2/6

Radio Press Series No 17.

Order No. 1175.

Wireless Weekly

Vol. 4, No. 13
July 30, 1921

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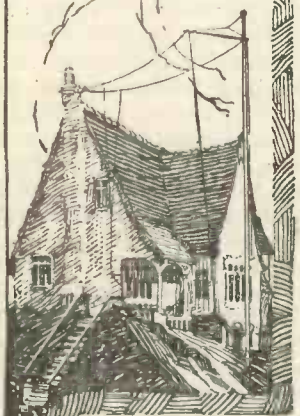


Editorial

Imperial Wireless and the "Beam"

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

The Rugby Station

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

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

The Question of Cost

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

The Dominions and the "Beam"

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

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

A Gratifying Feature

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

Garden Aerials

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

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

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

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

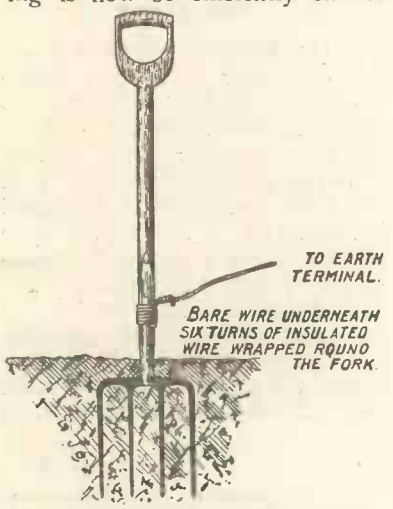


Fig. 1.—A quick and convenient method of making a temporary earth connection.

Some Recent Experiments

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

Earth Connections

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

Testing the Earth Connection

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

The First Aerial

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

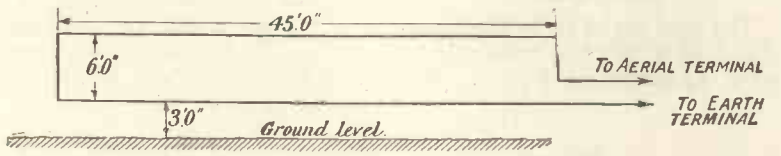


Fig 2.—Illustrating a type of aerial which was tried, the relative heights and lengths being given.

Another Aerial

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

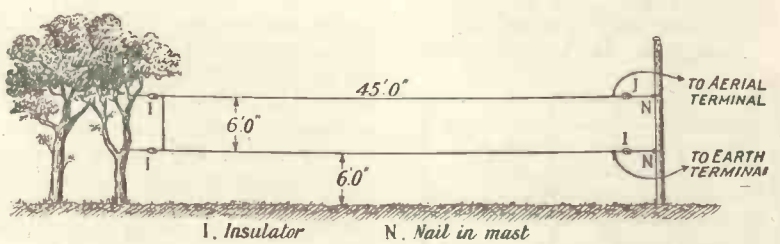


Fig 3.—A form of garden aerial which can be recommended.

Further Trials

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

Best Results

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

Stations Received

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

Fixed Condenser Capacities

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

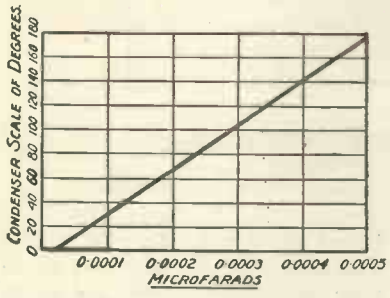


Fig. 1.—Curve showing relation of capacity of .0005 condenser to scale of degrees.

Guaranteed Capacity

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

Wiring Up

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

Indications

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

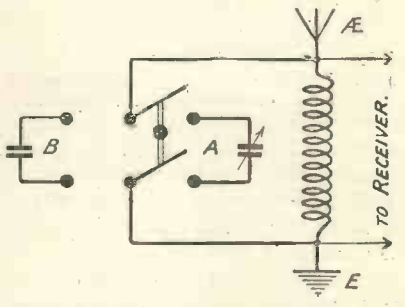


Fig. 2.—The method of connecting the switch for comparison of condenser capacities.

R. W. H.

GOOP-WAYFARER No. 761

Synopsis of Previous Chapters

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

BEGIN THIS GREAT NEW SERIAL NOW!

The Telephone Receiver

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

Making Receivers Comfortable

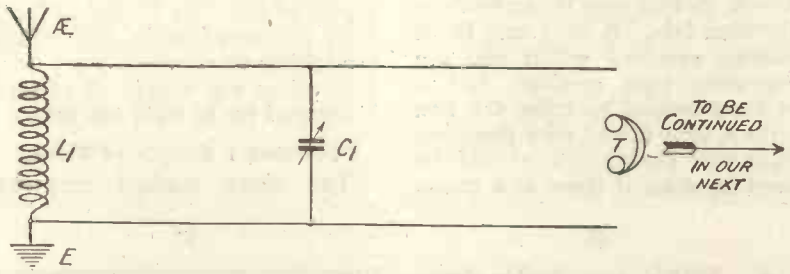
You may discover when you first don the headbands that your head is adorned with peculiar bumps. Should this happen the best thing is to take your seat in the armchair wearing the phones, and to get a friend to hammer the bands gently but firmly until they are shaped to the contours of your cranium.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

A New Headgear

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

Method of Use

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



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

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

Acquiring the Receiver

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

Abolish discomfort by wearing this fashionable type of receiver.

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

Obtaining a Supply of Valves

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

WIRELESS WAYFARER

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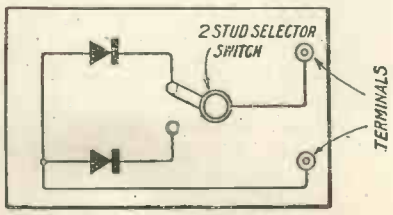
A USEFUL DOUBLE DETECTOR

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

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



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

R. W. H.

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Beam Wireless

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

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

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

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

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

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

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

Oil-Cooled Valves

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

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

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

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

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

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

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

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

Use of Reflectors

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

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

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

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

(A slide was here shown.)

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

General Laws

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

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

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

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

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

Energy Capacity of Aerials

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

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

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

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

Further Tests

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

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

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

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

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

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

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

A Prophecy

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

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

Comparative Privacy

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

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

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

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

(Finish)

□

The Harkness Circuit and Some Claims.

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

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

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

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

Valve Notes

By

JOHN SCOTT-TAGGART,

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

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

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

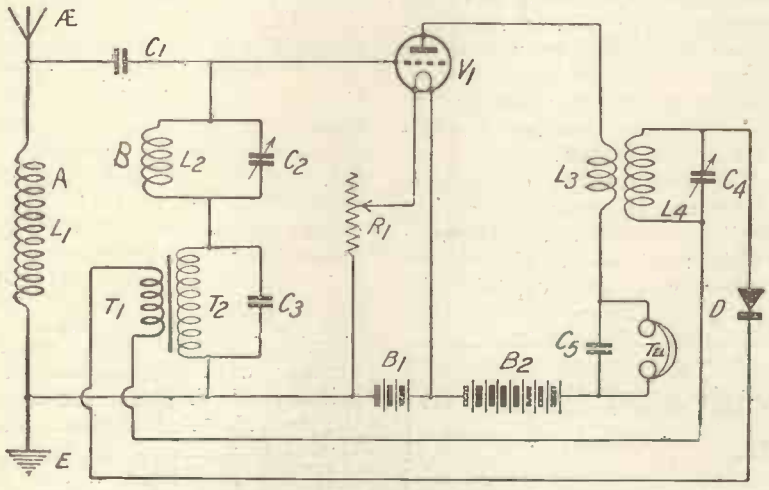


Fig. 1.—A circuit for eliminating A.C. hum.

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

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

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

Details of Circuit

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

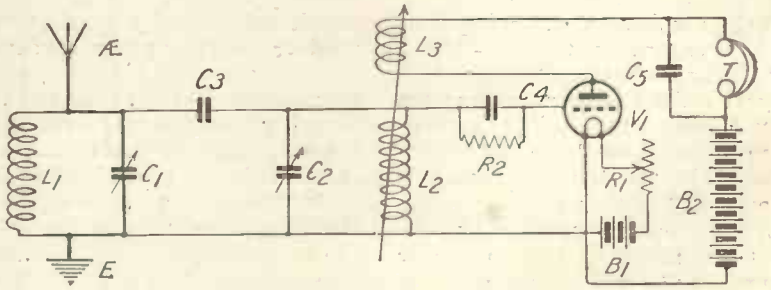


Fig. 2.—A circuit which is not quite what it appears to be.

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

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

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

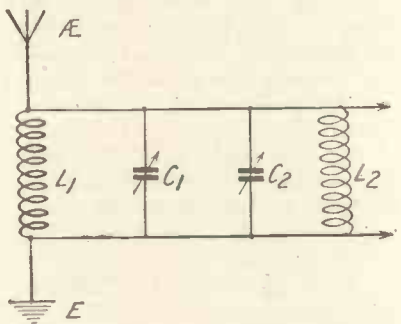


Fig. 3.—A circuit which acts similarly to that of Fig. 2.

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

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

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

Size of Coils

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

A Useful Example

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

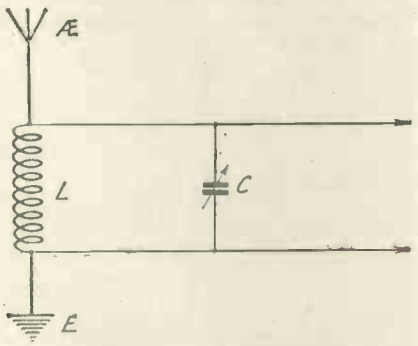


Fig. 4.—Simplified form of Fig. 3.

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

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

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

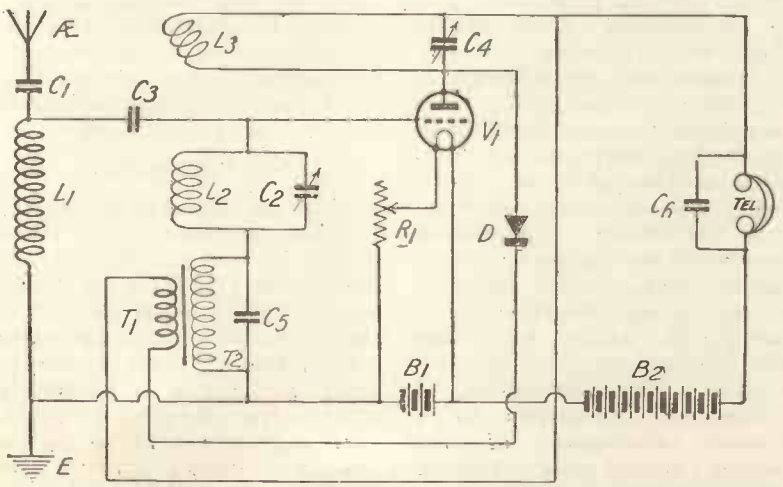


Fig. 5.—A useful circuit with constant aerial tuning embodying the feed-back system of Fig. 1.

Dame Clara Butt at the microphone.

5XX AT WORK

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

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

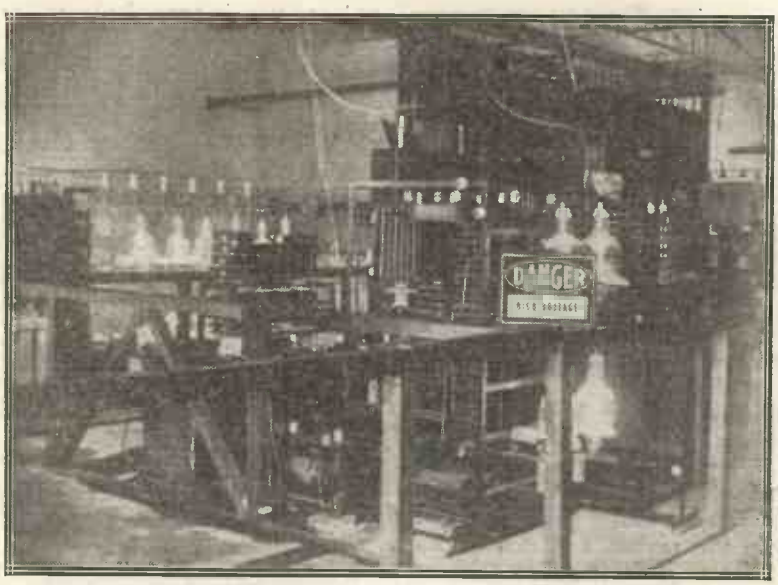
The Transmitter

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

A Startling Incident

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

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



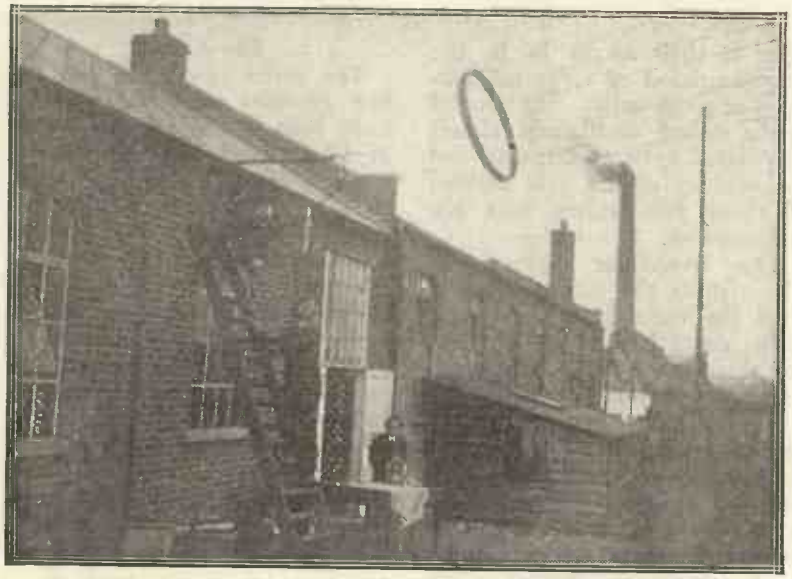
In the foreground is the drive oscillator (bearing the word danger). The main bank of rectifying valves and the closed circuit condenser are visible in the background.

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

The Studio

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

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



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

The Control Room

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

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

The Transmitter

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

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

The Circuit

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

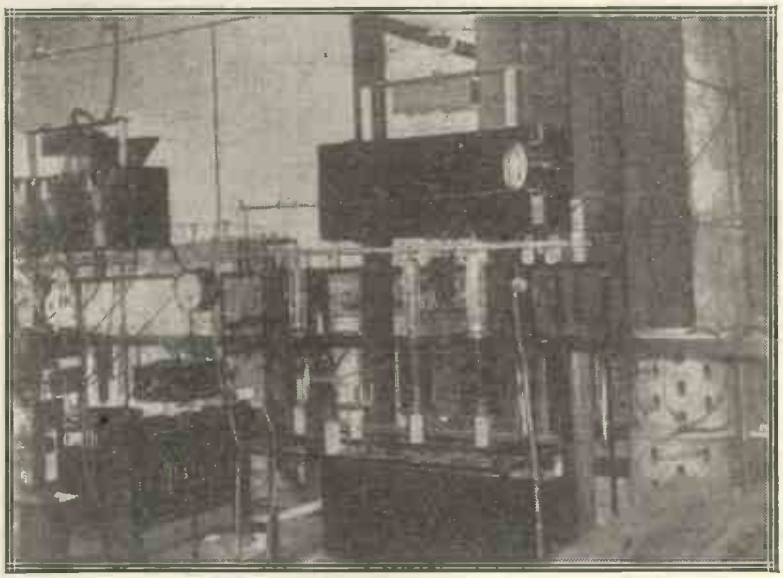
The output from the drive is taken to the two magnifier valves, which are of the water-cooled type. These two valves together then increase the high-frequency energy to between 15 and 16 kilowatts, transferring it to a closed oscillatory circuit, whose condenser consists of a great bank of plates separated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

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

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

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

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



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

The Aerial

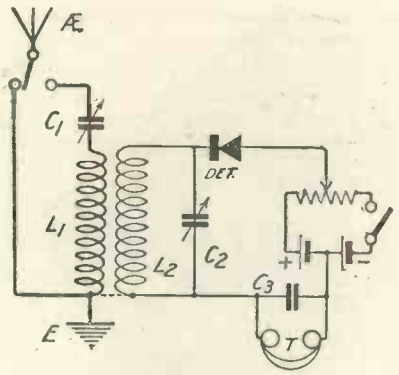
The aerial is carried on the two 450-foot steel masts which have been in use for some time at Chelmsford, and consists of a single cage of the "L" type, its natural wavelength being between 1,300 and 1,400 metres. The actual length of the horizontal span is considerably less than the distance between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

G. P. K.

Practical Back-of-Panel Wiring Charts

A Carborundum Crystal Receiver

By OSWALD J. RANKIN



The Circuit.

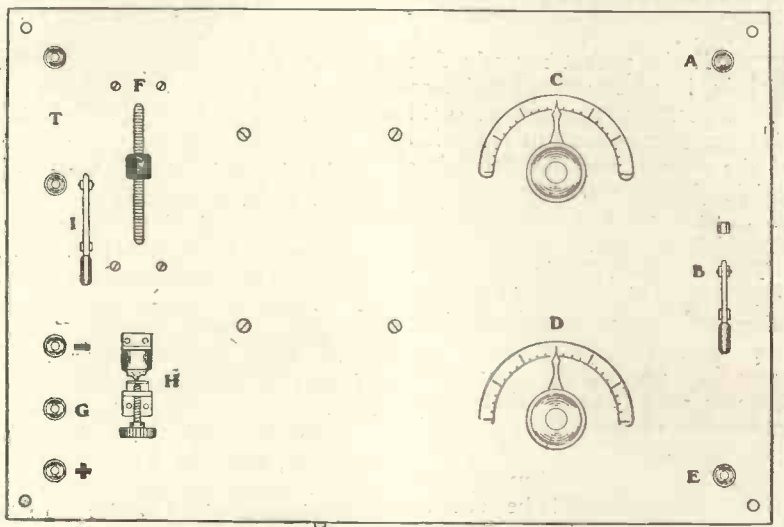
THIS is a simple crystal receiver employing a loose-coupler, vario-coupler, or basket coils. B is a single pole, double throw switch for earthing the aerial direct when the receiver is not in use. The variable condenser C has a capacity of 0.001 μF, and is connected in series with the aerial tuning inductance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

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

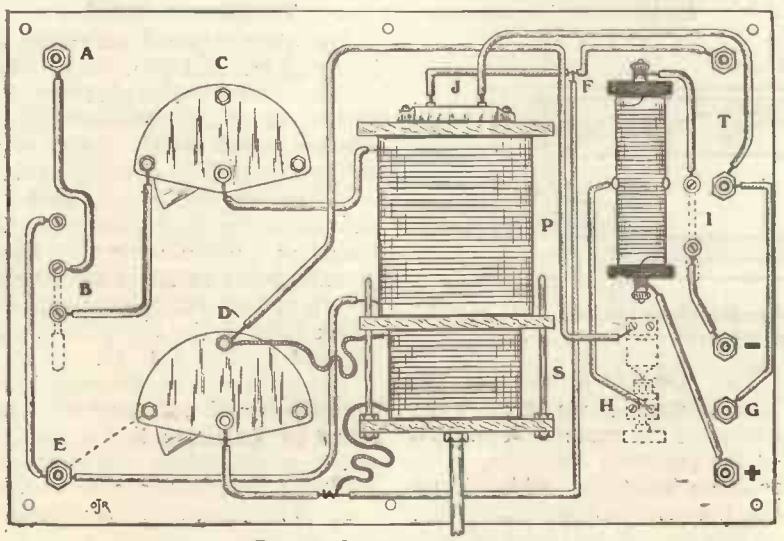
Tuning is carried out by adjustment of the variable condensers C and D, and by variation of the coupling between P and S. The simplest method is to couple the two coils closely to commence with, and tune first on C, and then on D, the coil coupling being varied when interference is experienced.

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

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



The lay-out of the Pahel.



Practical wiring diagram.

□ □ □

PERSONAL

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

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

HOW TO MAKE A USEFUL GRID BIAS UNIT.

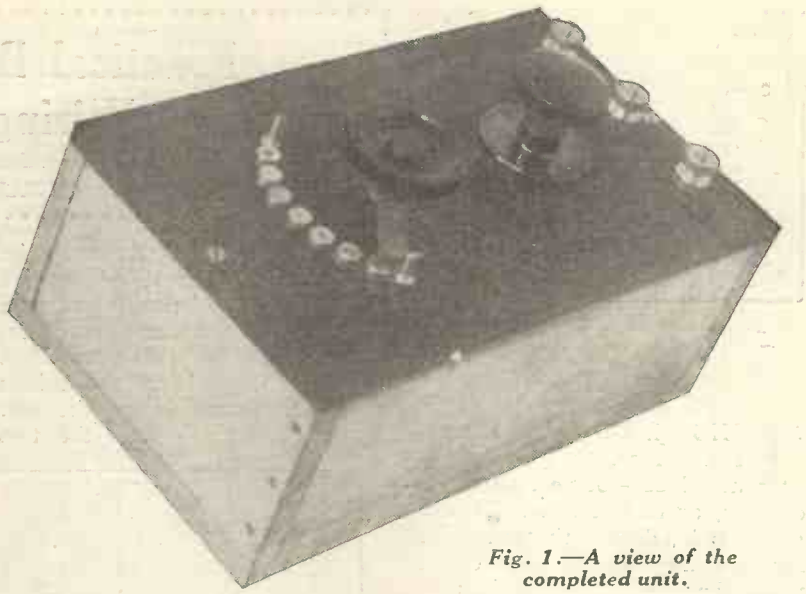


Fig. 1.—A view of the completed unit.

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

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

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

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

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

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

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

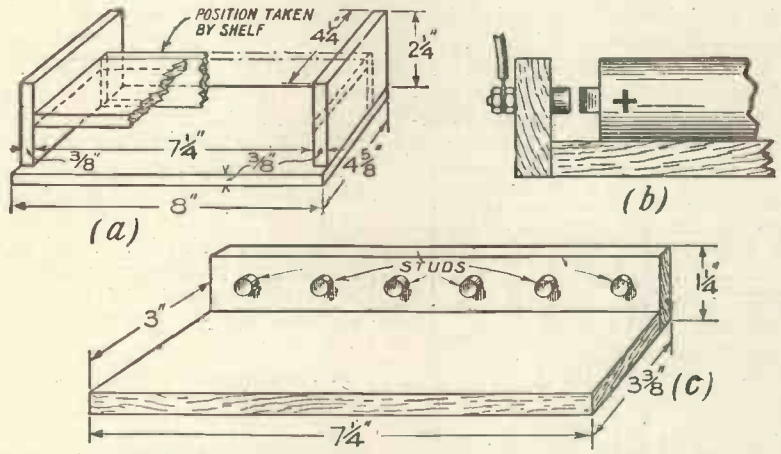


Fig. 2.—Details of the containing box, showing the positions of the studs, and the method of making contact with the batteries.

Contact Studs

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

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

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

The Ebonite Panel

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

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

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

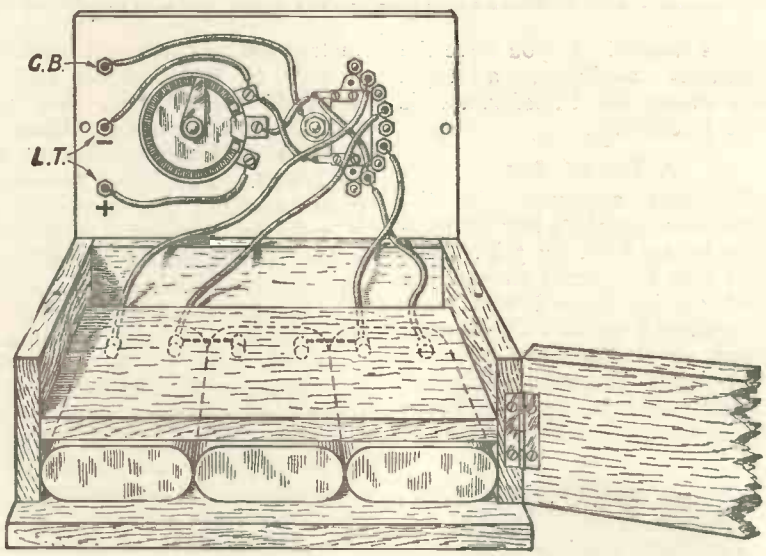


Fig. 3.—The internal wiring of the unit, showing connections to the batteries. Note the dead studs of the selector switch.

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

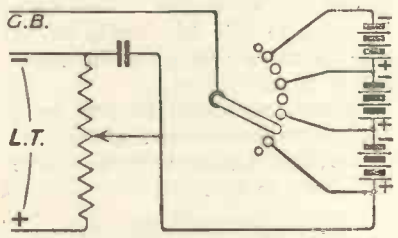


Fig. 4.—A circuit diagram showing how to wire the unit.

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

Dead Studs

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

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

Fitting the Panel into the Box

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

Securing the Batteries

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

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

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

Alteration to Existing Amplifier

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

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

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

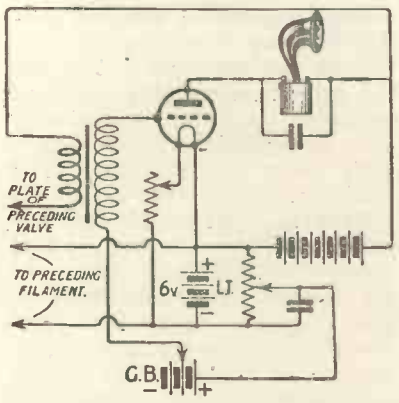


Fig. 5.—A diagram showing how the unit is connected up to an existing amplifier.

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

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

Random Technicalities

By PERCY W. HARRIS, Assistant Editor.

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

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

Practical Tests

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

Transformer Data

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

A Testing Box

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

The experimental D Coil.

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

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

Single Stage Work

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

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

An Important Difference

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

A Novel Crystal Detector

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

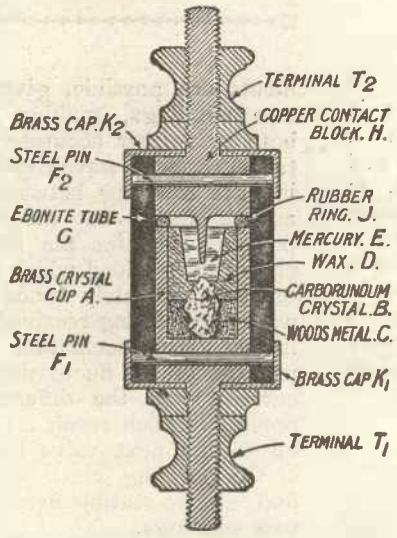


Fig. 1.—A sectional view of the detector, showing the construction.

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

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

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

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

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

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

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

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

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

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

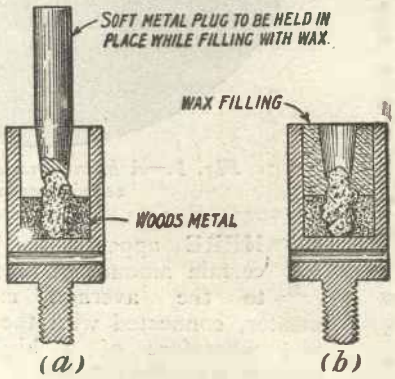


Fig. 3.—The crystal cup, showing method of fixing the crystal.

in conjunction with carborundum detectors to secure maximum sensitivity.

T. A. LEDWARD.

ERRATUM.

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

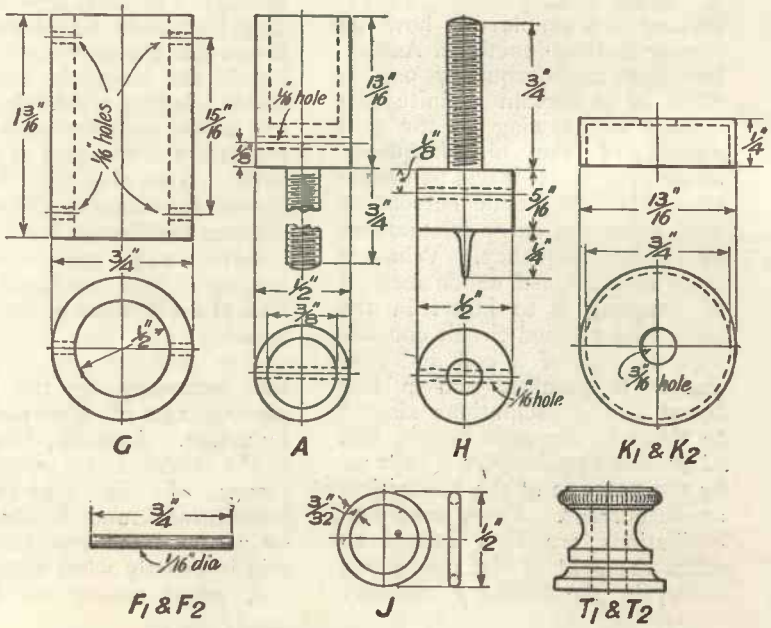


Fig. 2.—A detailed diagram showing the construction of the necessary parts.

High-Frequ

By G. P. KENDAL

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

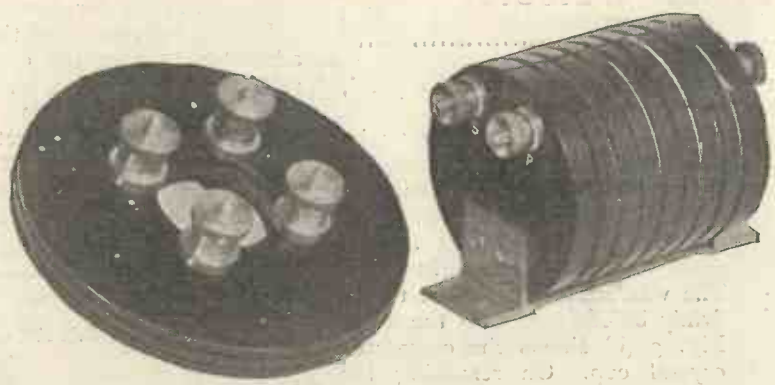


Fig. 1.—A home-made transformer of the disc type, and a semi-aperiodic "barrel" transformer.

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

The Tuned Anode Method

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

Action of a transformer

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

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

Types of High-Frequency Transformers

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

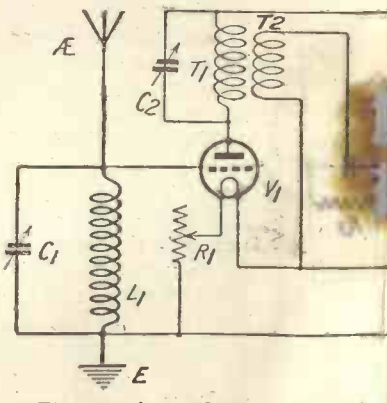


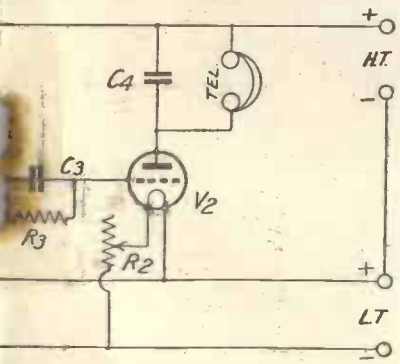
Fig. 3.—A 2-valve circuit with a

ency . . .
Transformers

L, B.Sc., Staff Editor.

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

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



"tuned primary" transformer.

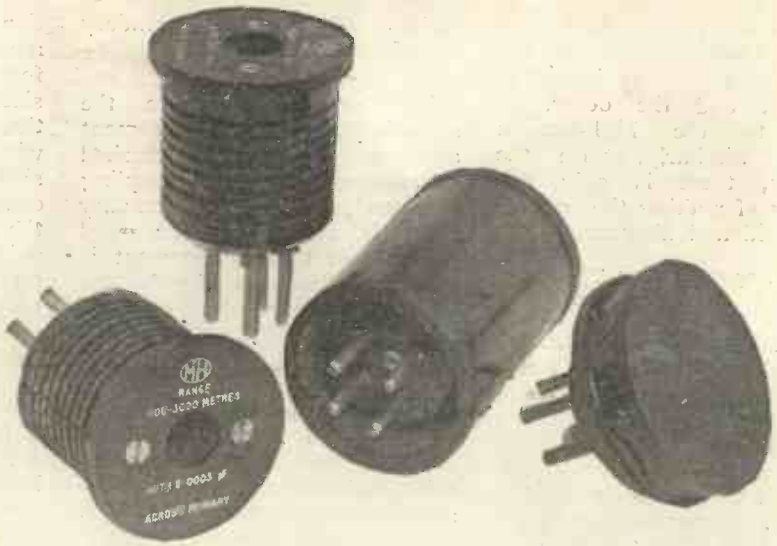


Fig. 2.—Various types of tuned transformers with plug-in mountings.

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

Later Improvements

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

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

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

The Separate Slot Type

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

Tuning Arrangements

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

Loose Coupling

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

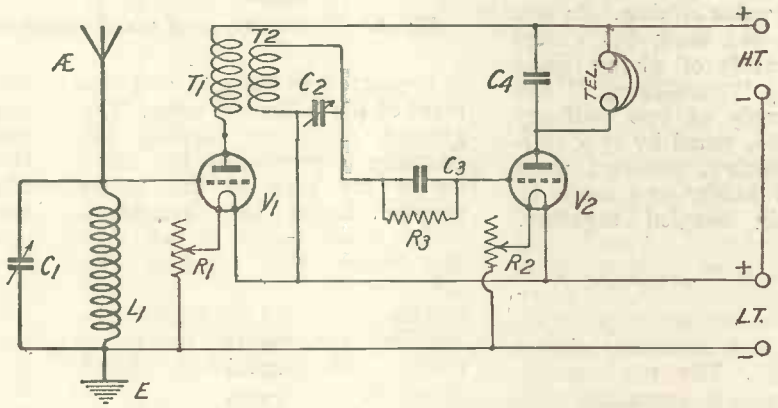


Fig. 4.—The connections of a "tuned secondary" H.F. transformer.

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

Construction

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

(To be continued)

A Double Purpose Voltmeter

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

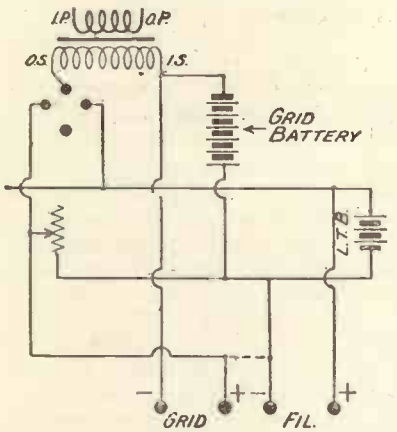


Fig. 1.—The internal wiring necessary when a voltmeter is used outside the set.

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

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

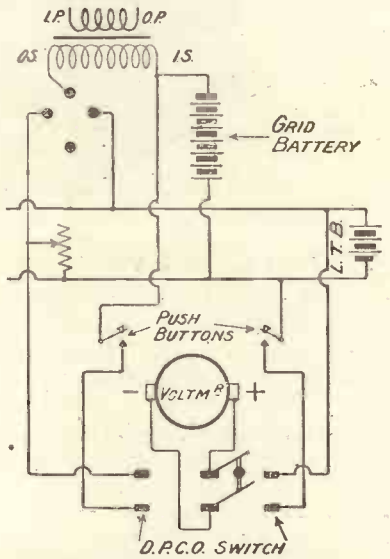


Fig. 2.—Showing how to wire up when the voltmeter is mounted upon the panel of the set.

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

R. W. H.

Utilising Valves to Best Advantage

Continued from page 413.

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

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

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

How Every Crystal User may become a Valve Expert

By E. REDPATH,
Assistant Editor.

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

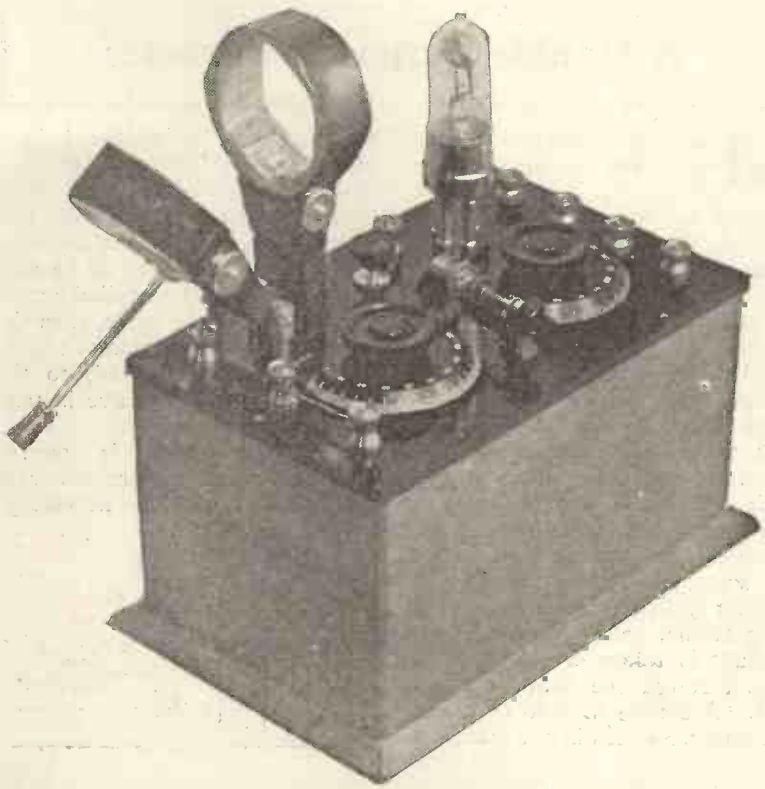


Fig. 1.—A photograph of the complete receiver described in this article.

Introducing Reaction

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

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

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

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

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

A Precautionary Rule

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

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

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

A Complete Receiver

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

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

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

The Results Obtainable

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

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

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

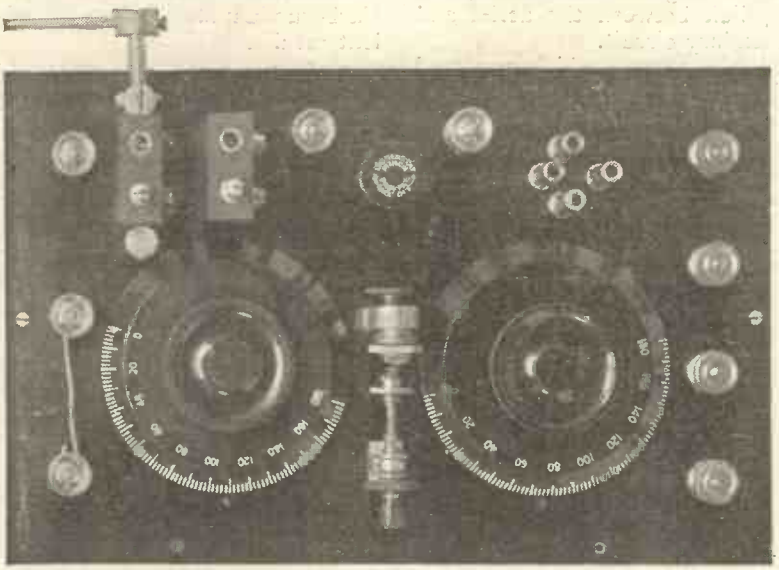


Fig. 2.—A close-up view of the top of the panel, with coils and valve removed, to show the layout of the parts.

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

Circuit Arrangements

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

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

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

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

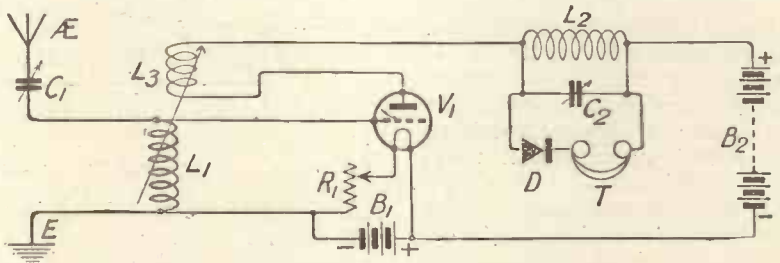


Fig. 3.—A circuit similar to that given in Fig. 3 of our last issue, but with a two-coil holder to enable reaction effects to be obtained.

Capacity of Variable Condenser

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

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

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

Rectification

The amplified oscillations in the closed circuit L2 C2 are then

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

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

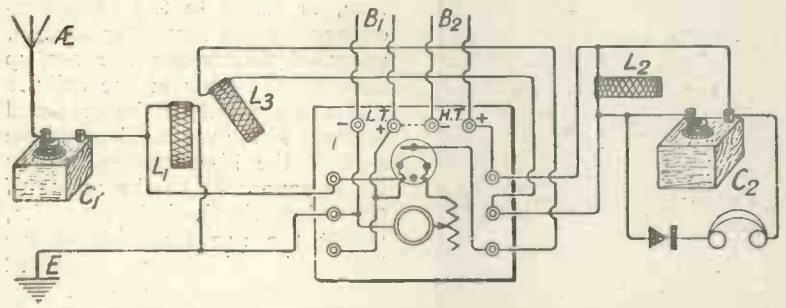


Fig. 4.—A pictorial representation of Fig. 3. The coil L2, condenser C2, crystal detector and telephones being those of any crystal receiving set.

As a Crystal Receiver

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

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

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

Components Required

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

Nine terminals.

Four valve legs and nuts.

One filament rheostat (Lissenstat).

One 2-coil holder.

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

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

(Further constructional details will be given next week.)

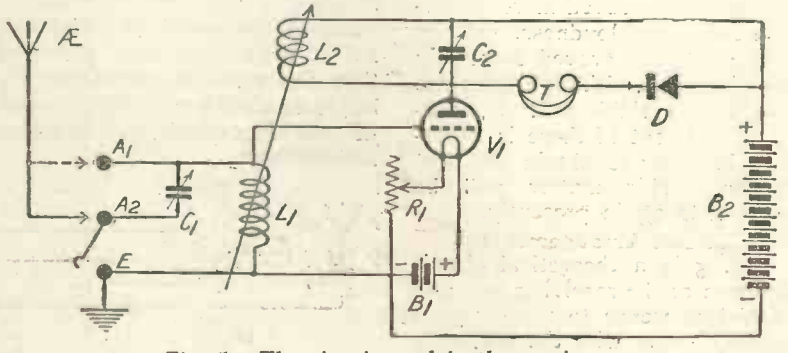


Fig. 5.—The circuit used in the receiver.

Handy Pliers

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

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

Time Signals

SOME INTERESTING CORRESPONDENCE

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

VALVE NOTES

(*Continued from Page 407.*)

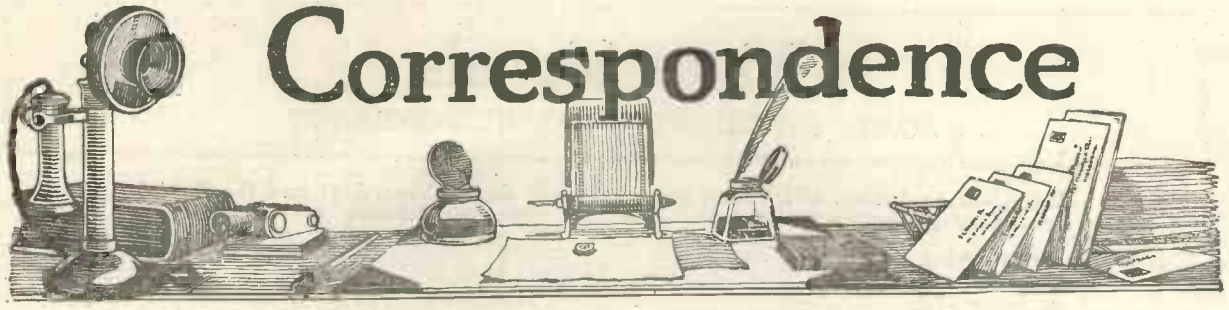
length, although a No. 50 will do, the best size is probably No. 75. The condenser C4 may conveniently be a .0005 μF variable condenser, or one of .0003 μF capacity. The telephone condenser C6 has a capacity of .002 μF.

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

BINDING CASES

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

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



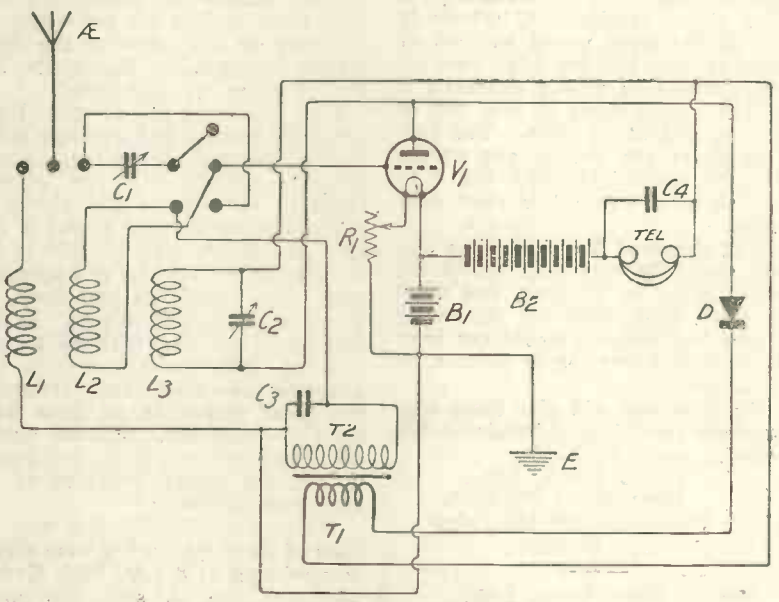
A ONE-VALVE REFLEX CIRCUIT

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

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

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

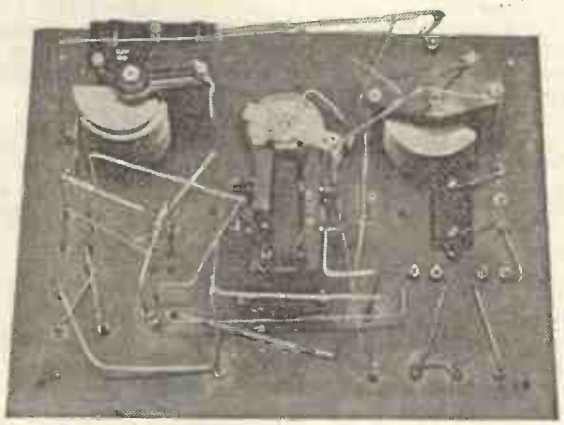
It will be seen from the diagram that the usual "tune-stand-by" switching has been simplified and the DPDT has been replaced by a SPDT switch; but, what is more important from the financial point of view, the same condenser with vernier is used both for "tune" and "stand-by" positions. A cheap variable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



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

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

A photograph of Mr. Naunton's receiver.



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

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

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

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

A PECULIAR EFFECT

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

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

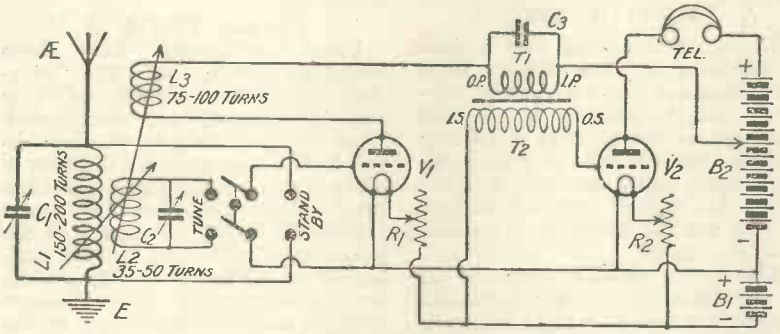
FREAK RESULTS

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

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

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

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



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

RECEIVING 5XX

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

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

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

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

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

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

S. E. LLOYD.
Goodmayes.

Apparatus we have tested

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

An Automatic Crystal Detector

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

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

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

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

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

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

Radio Construction Tools

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

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

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

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

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

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

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

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

Valve-Windows

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

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

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

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

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

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

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

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

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

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

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

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

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

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

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

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

LISSENIUM

How to tell good parts—

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

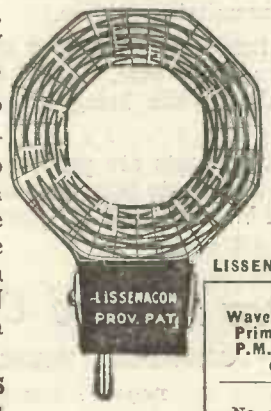
THOSE who use **LISSEN** PARTS sooner or later all realize how continually improving results seem to keep pace with one's better understanding. Though initially quite easy to use, **LISSEN** Parts have been designed and made so that for even the most skilful experimenter there is wide enough scope in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

PARTS WITH HIDDEN POWER—LISSEN PARTS

The function of an inductance—

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

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



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

HOLD A LISSENAGON COIL UP TO THE LIGHT

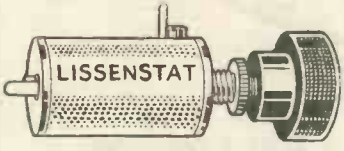
LISSENAGON TUNING CHART. Note the Intermediate Coils, 30,40, and 60

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

The Key to fine detection—

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

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



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

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

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

Have you got an unreliable Grid Leak?

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

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

Tone so Pure—

every instrument of an orchestra can be identified.

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

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

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

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

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

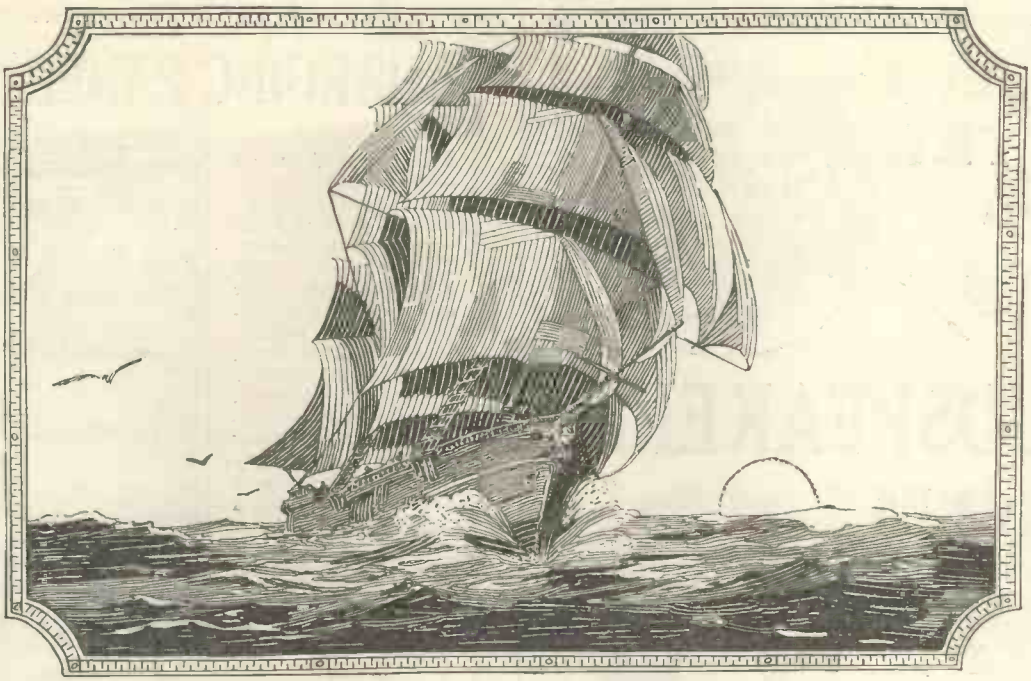
A POPULAR TRANSFORMER. Money cannot buy better transformer value than the **LISSEN T3.** Because of its skilfully balanced design, this transformer actually compares with many other transformers sold at nearly twice the price **16/6**

FIT EITHER TYPE OF LISSEN TRANSFORMER—and make sure

Don't Use Mixed Parts—

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

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



Voyages of Discovery

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

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

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

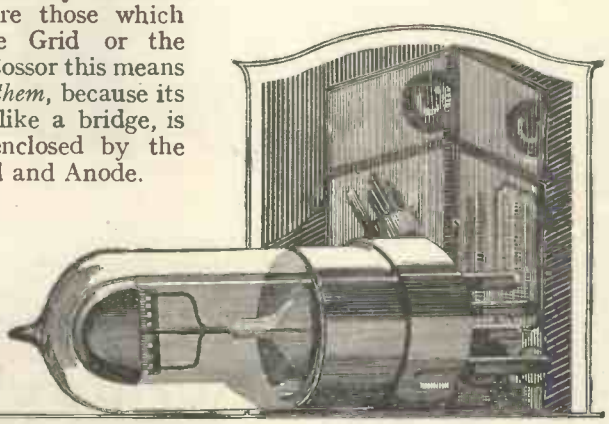
Amplification and rectification is dependent upon the efficient use of the electron stream given off by the heated filament. These electrons shoot off at a tremendous velocity at all angles. In a Valve with a tubular Anode, and long, straight filament, a large proportion of the stream escapes from the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

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

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

Prices:

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



Cossor

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

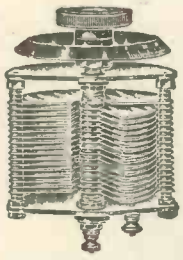
Valves

Gilbert Ad. 1157

HULLO EVERYBODY!!

RAYMOND'S VARIABLE CONDENSERS

NEW MODEL.



INCLUDING KNOB.

Nat. Phys. Lab. Certificate for Guaranteed Capacity.

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

EBONITE DIAL 8d. extra.

POST 6d. SET.

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

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

POST 6d. PER SET PLEASE.

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

Complete with 2 Knobs and Dial.

POST FREE COLUMNS (except where marked).

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

BASKET COILS.

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

Post 4d. each.

LISSEN—

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

IGRANIC—

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

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

DUBILIER CONDENSERS.

Type 600A.

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

GOSWELL ENGINEERING CO.—

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

VALVES.

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

All Valves stocked Post 6d. each.

N. & K. HEADPHONES GENUINE STAMPED

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

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

EBONITE ⅜ in.

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

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

ACCUMULATORS.

BEST MAKES.
UNDER MY OWN LABEL.

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

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

HEADPHONES.

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

Post 6d. pair.

VARIOMETERS.

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

EBONITE COIL STANDS.

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

3-way, 1/6 each extra.

Franco:

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

Cam Vernier:

2-way	8/6 & 9/6

L.F. TRANSFORMERS.

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

EDISON BELL FIXED CONDENSERS.

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

Raymond—Fixed

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

Post 3d. each.

WEST END DEPOT FOR

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

CALLER'S COLUMN. NO POST ORDERS.

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

TERMINALS.

(With Nut and Washer).

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

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

Right Opposite
DALY'S
Gallery Door

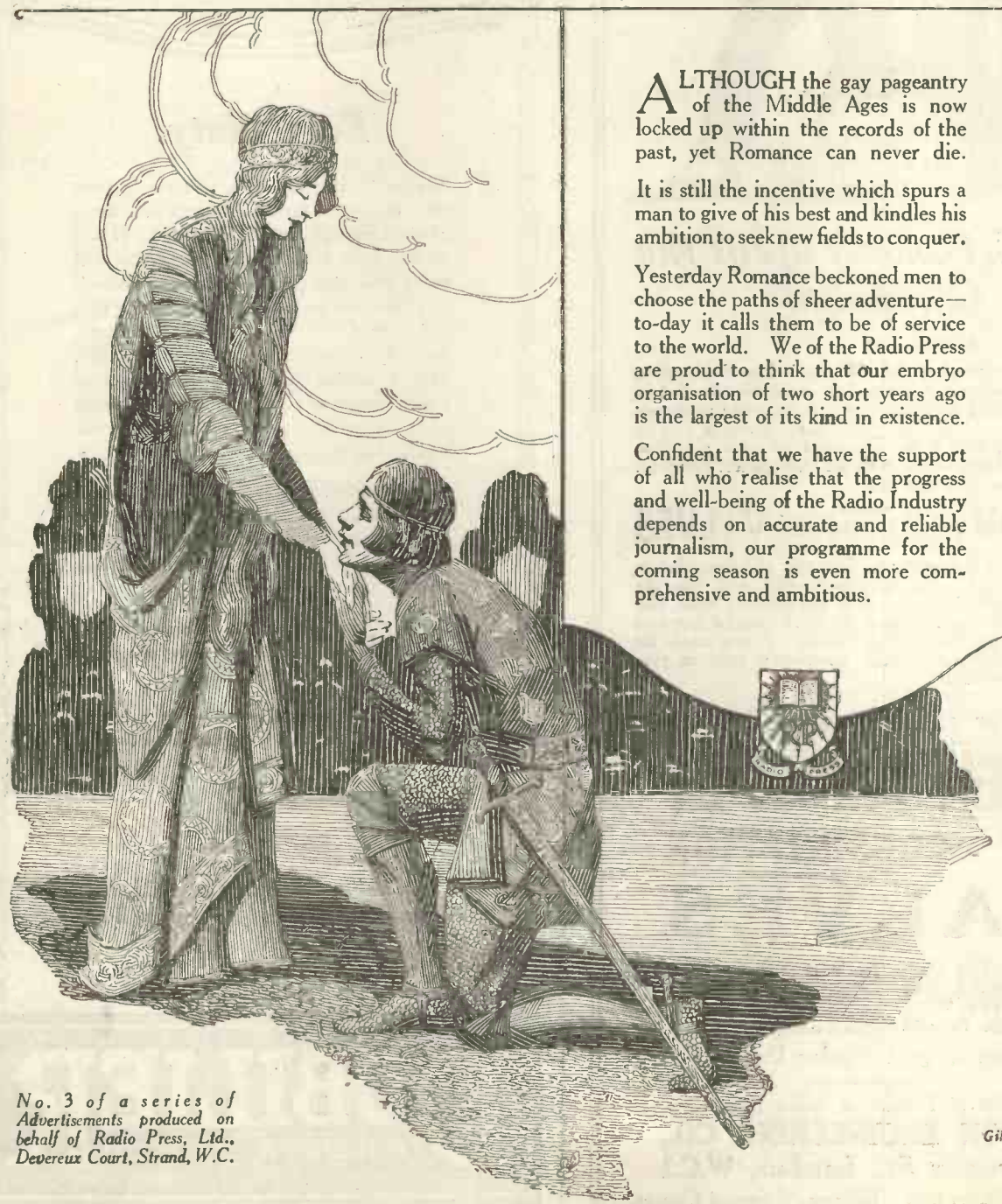
K. RAYMOND
27, LISLE STREET, W.C.2

'Phone: Gerrard 4637.

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

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

ROMANCE



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

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

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

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

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

Gilbert Ad. 1189

Wireless Weekly Small Advertisements

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

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

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

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

WHOLESALE ONLY.

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

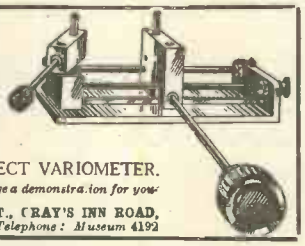
COMPLETE SETS, ACCESSORIES & COMPONENT PARTS

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

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

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

EL-BE UTILITIES
The "MIKROTUNE"



Makes Tuning Simple & Certain.

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

Coils under minutest control. A PERFECT VARIOMETER.

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

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

CABINETS YOU WANT

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

EBONITE

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

WE CAN TURN ANYTHING IN EBONITE.

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

FINEST WORK & PROMPTITUDE.
INCOMPARABLE WHITE FILLING.

HAND AND MACHINE
ENGRAVING
ON ANY MATERIAL.

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

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

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

The Peto Panel Service

—an entirely new departure in Radio

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

Types A and B.

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

Guaranteed Ebonite.

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

Service Department free to users.

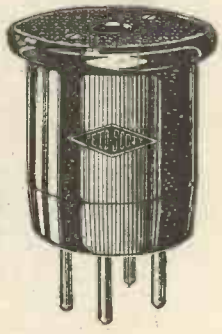
If, after completion, the Instrument does not work correctly it may be returned to us for testing—should the fault be traced to a component purchased from us it will be immediately replaced and the Instrument put in working order without charge. Should the fault, on the other hand, be due to incorrect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

List of Sets available.

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

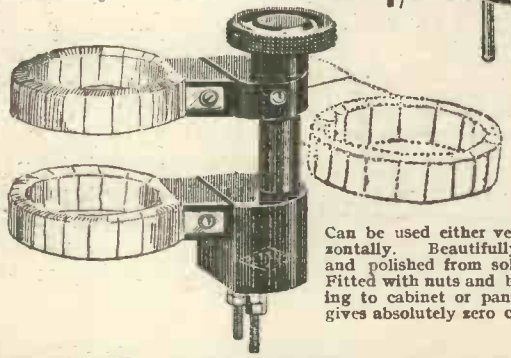
The Transatlantic V
The Puriflex
The S.T. 100
The 3-Valve Dual
The Omni Receiver
The All Concert de luxe
The S.T. 100 (3-valve).

Improved H.F. Transformers.



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

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



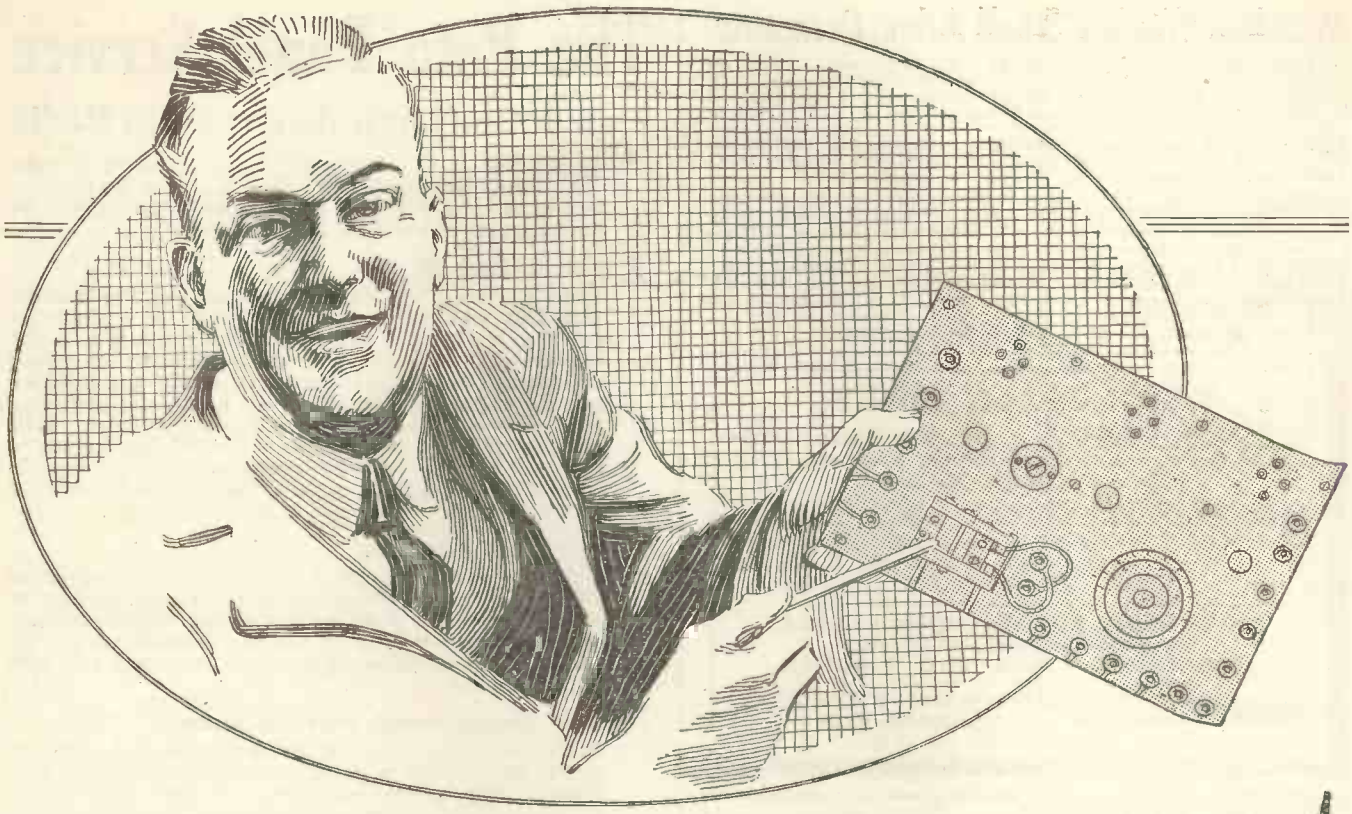
Rotary Coil Holder.

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

PETO-SCOTT CO. LTD.,

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

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



Why, it's as plain as a pikestaff!

Panel Card No. 1

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

1/-

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

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

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

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

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

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

RADIO PRESS PANEL CARD SYSTEM

Gilbert Ad. 1127.

STEPPING STONES TO SUCCESS

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

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

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SIMPLEX WIRING CHARTS.

No. 1.	For 2-Valve Set	1/-
No. 2.	For 3-Valve Set	1/-
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From all Booksellers, or post paid 2d. per book or 3d. per envelope extra direct from Publishers.

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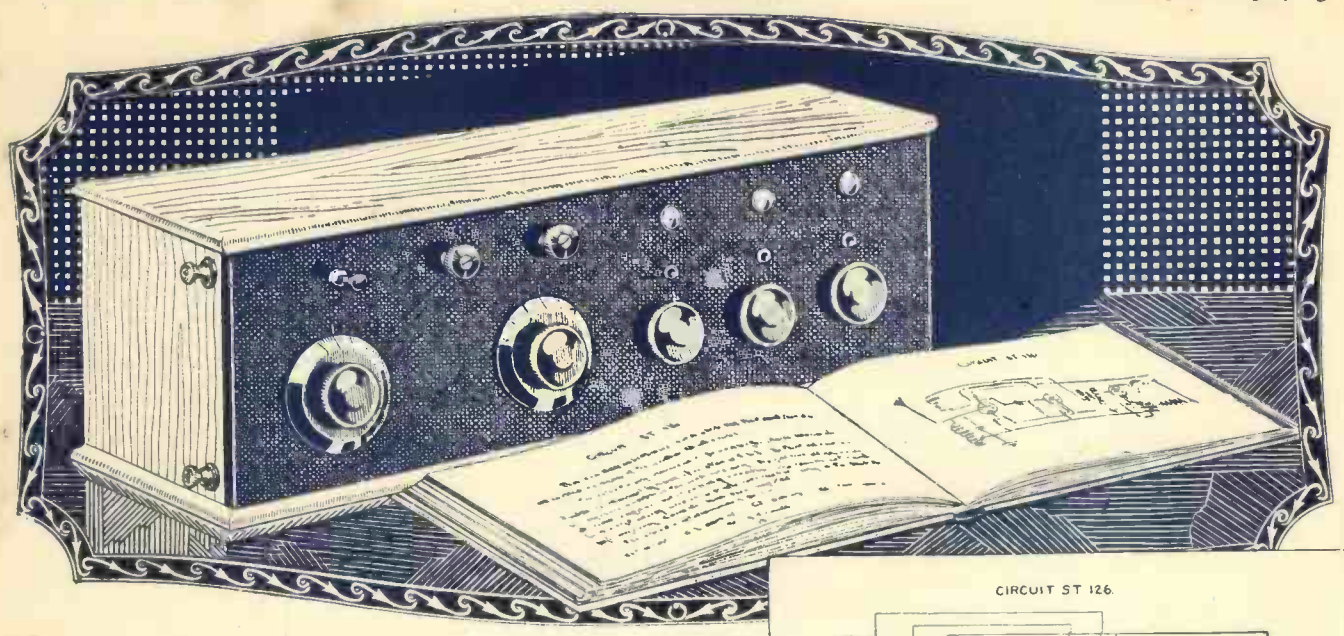

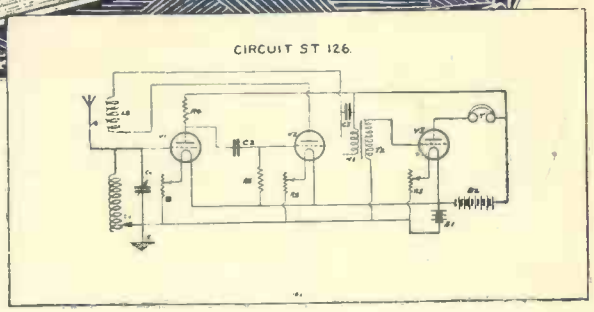

Yes! you, too, need this fascinating Book of Circuits.

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

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

MORE PRACTICAL VALVE CIRCUITS,

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

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