Wireless Weekly, 6d. Net. Wednesday Mr Bird July 2nd, 1924.

Wireless Weekly

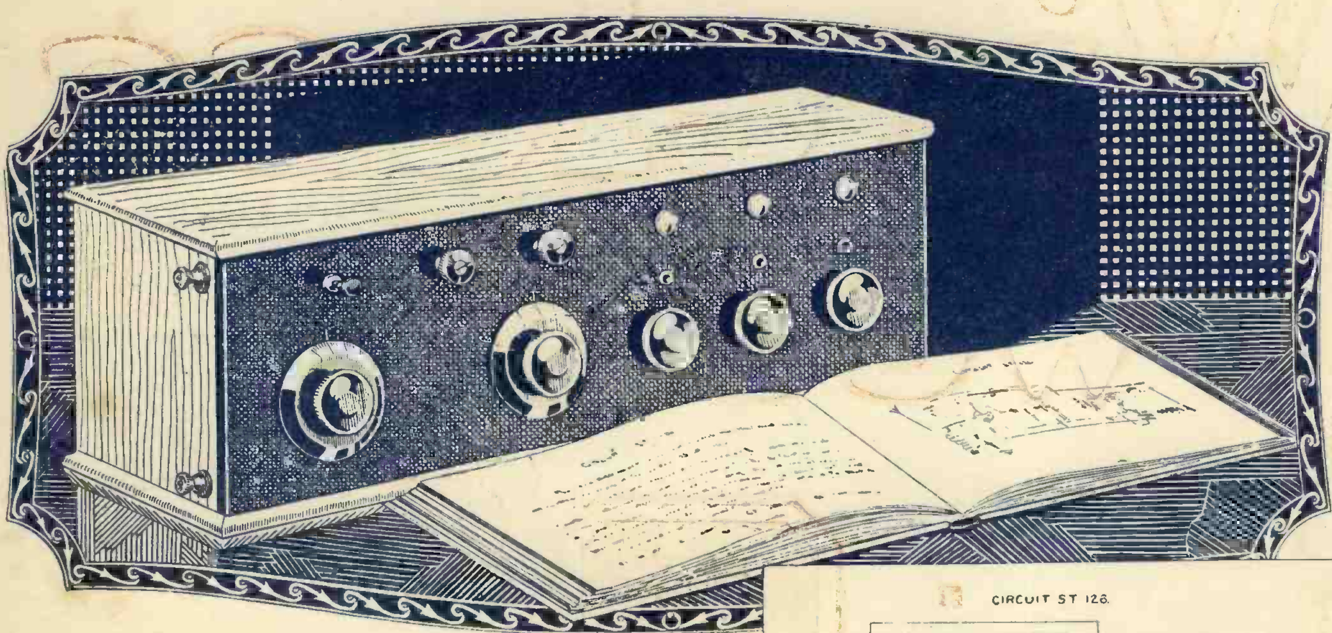
and the Wireless Constructor.

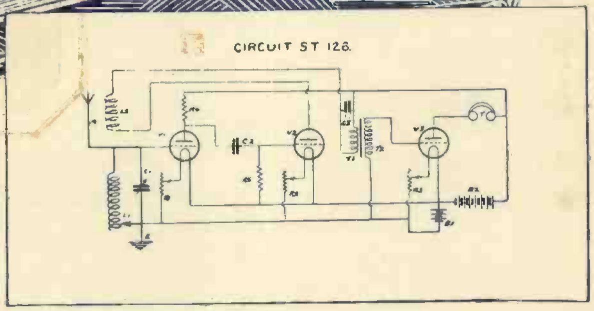
Vol. 4.
No. 9.

CONTENTS

Experiments with an Oscillating Crystal Set

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





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

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

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

MORE PRACTICAL VALVE CIRCUITS,

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

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

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

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

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

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

More Practical Valve Circuits

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

3/6 *in full cloth*

[illegible] Ad. 1025

Wireless Weekly

Vol. 4, No. 9
July 2, 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: SCHEFF PUBLICITY ORGANISATION, LTD., 125, Pall Mall, London, S.W.1
Tel.—Regent 2440.

Scientific Adviser:
Prof. G. W. O. HOWE, D.Sc., M.I.E.E.
Advisory Editors:
Prof. R. WHIDDINGTON, M.A., D.Sc.
Prof. C. L. FORTESCUE, M.A., M.I.E.E.

Staff Editors:
E. H. CHAPMAN, M.A., D.Sc.
A. D. COWPER, M.Sc.
G. P. KENDALL, B.Sc.
R. W. HALLOWS, M.A.
S. G. RATTEE, Member I.R.E.

RADIO PRESS

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

Nothing contained herein is to be regarded as permission or encouragement to infringe any patent rights.

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

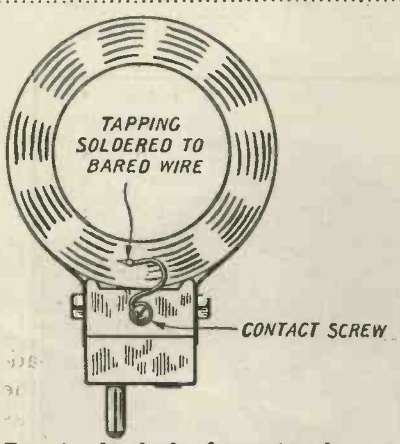


Fig. 1.—Method of tapping honeycomb coil.

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 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.

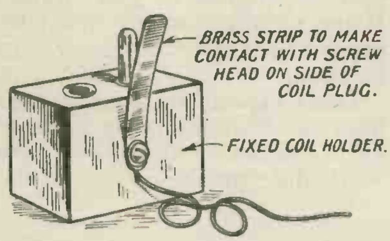


Fig. 2.—Contact strip on fixed holder.

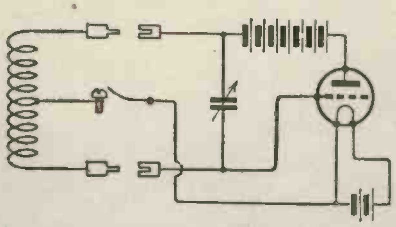


Fig. 3.—Heterodyne wavemeter or oscillator circuit.

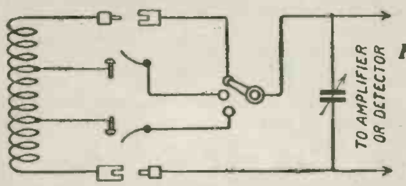


Fig. 4.—Tappings for a wide range tuner.

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 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.

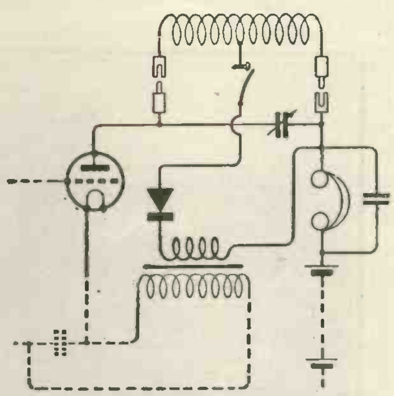


Fig. 5.—Crystal tapping in a reflex circuit.

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.

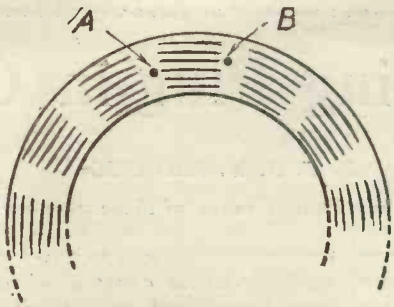


Fig. 6—Position of Tapping for Electrical Centre of Coil.

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.

JOTTINGS BY THE WAY

GOOP-WAYFARER No. 761

Synopsis of Previous Chapters

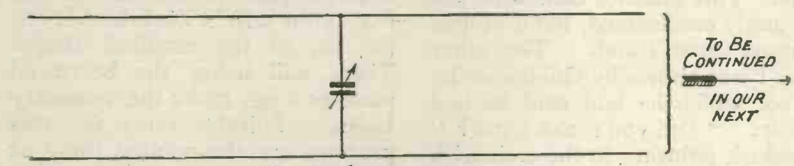
YOU CAN BEGIN NOW!

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

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

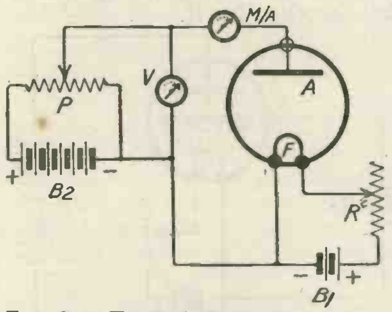


Fig. 3.—Typical arrangement apparatus for obtaining anode voltage. Characteristic curve of a 2-electrode valve.

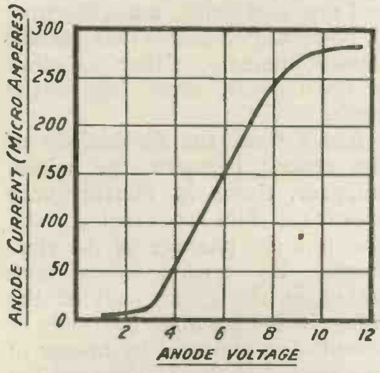


Fig. 4.—Typical characteristic curve of a 2-electrode valve.

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.

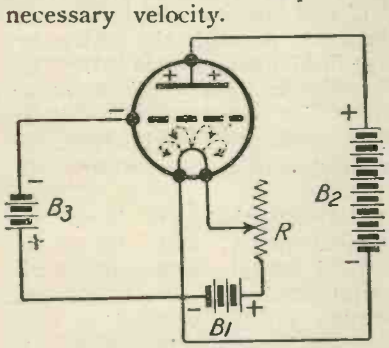


Fig. 5.—Showing repelling effect of a negatively charged grid.

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.

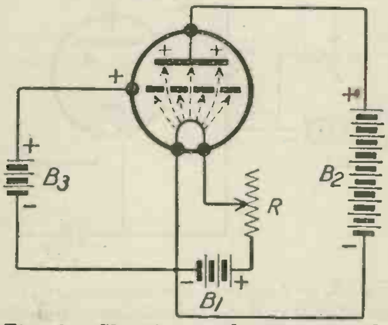


Fig. 6.—Showing the positively charged grid permitting, and even assisting, the flow of electrons.

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

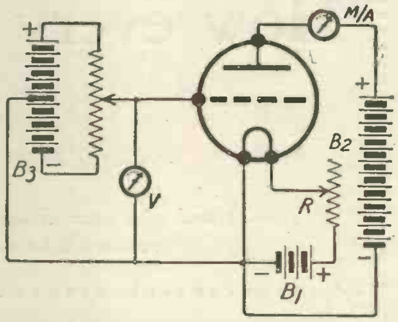


Fig. 7.—Arrangement for obtaining " Grid Voltage - Anode Current " characteristic curve.

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 anode voltage or filament current.

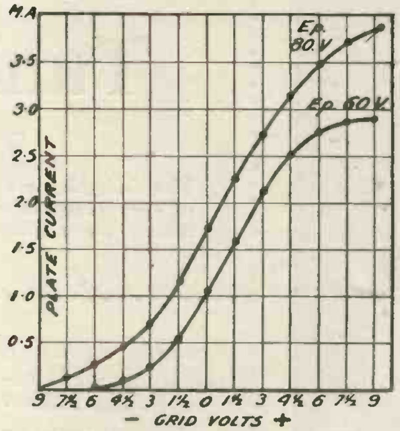


Fig. 8. Characteristic curves. The lower one shows the effect of "softening," due to usage.

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.

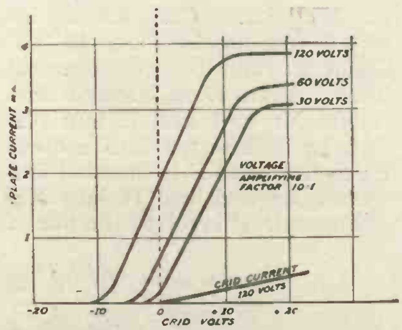


Fig. 9.—The characteristic curve of the Xtraudion valve.

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.

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.

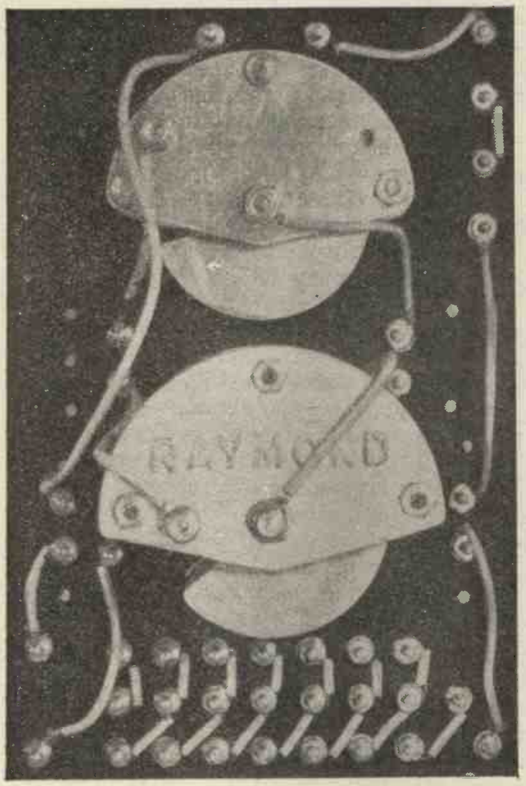


Fig. 9.—A view of the underside of the panel showing the simplicity of the wiring.

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

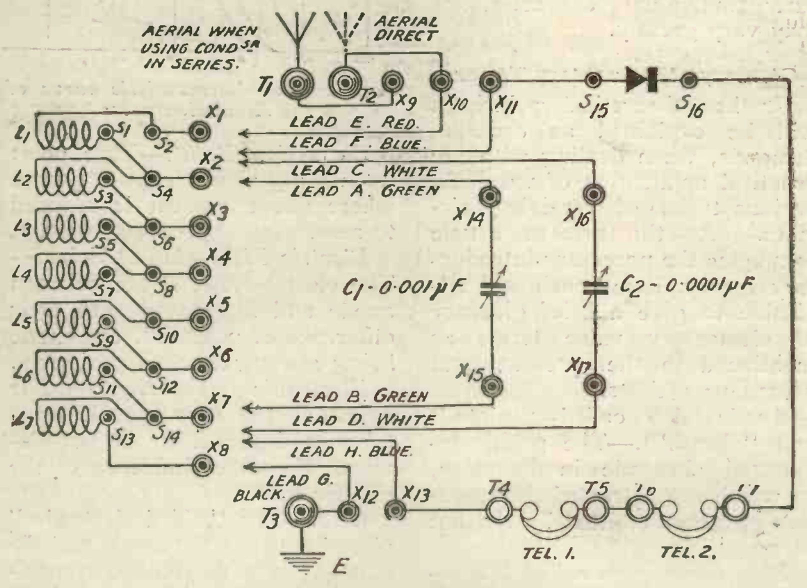


Fig. 10.—The circuit arrangement of the receiver.

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.

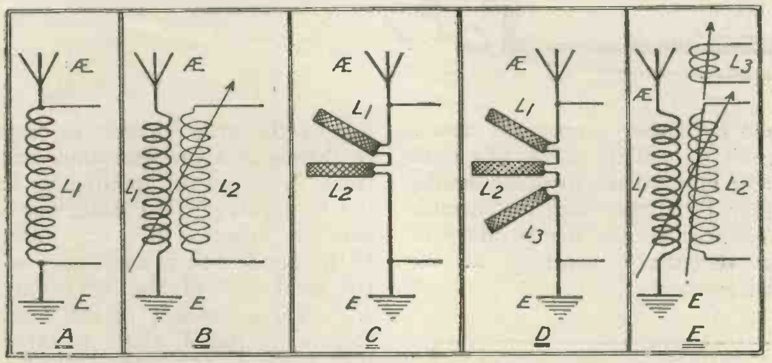


Fig. 11.—Possible arrangement of the coils by interchanging the clip plugs.

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 wave-trap. 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.

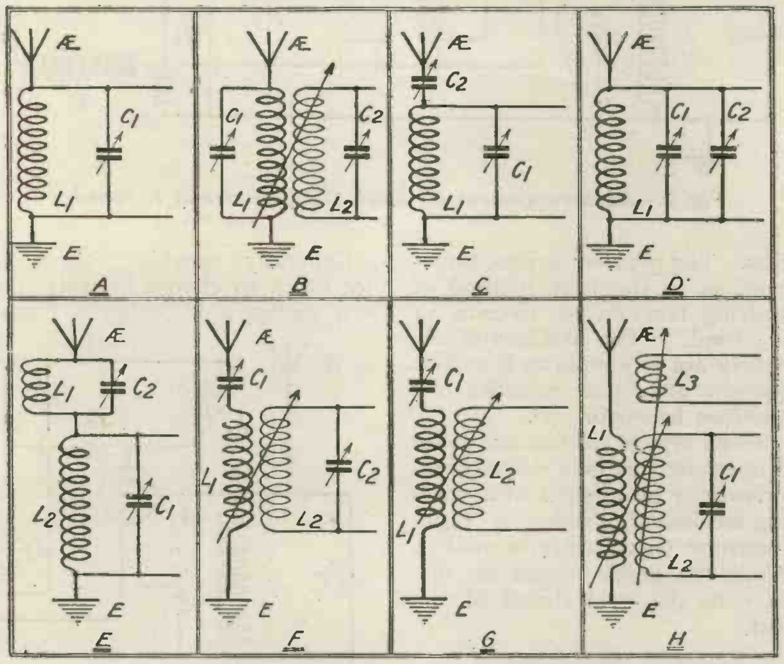


Fig. 12.—Showing a variety of tuning circuits which are obtainable.

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.

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.

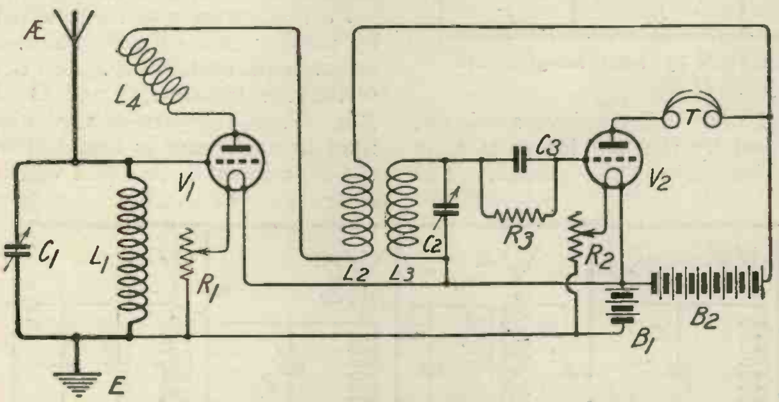


Fig. 1.—An arrangement in which the grid circuit is tuned.

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.

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.

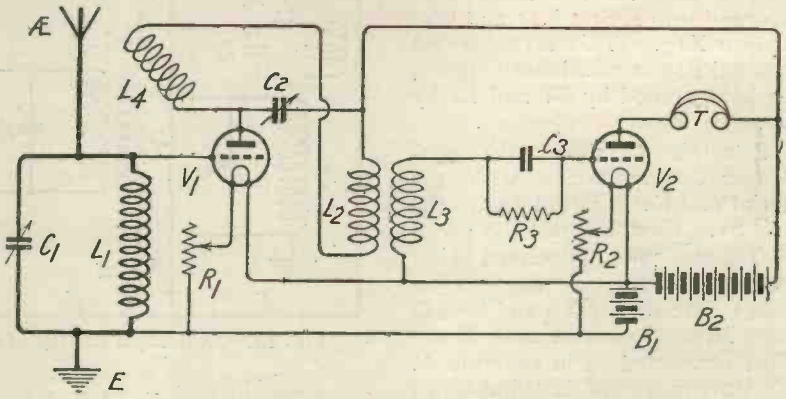


Fig. 2.—Here the primary of the transformer is tuned.

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, particularly 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.

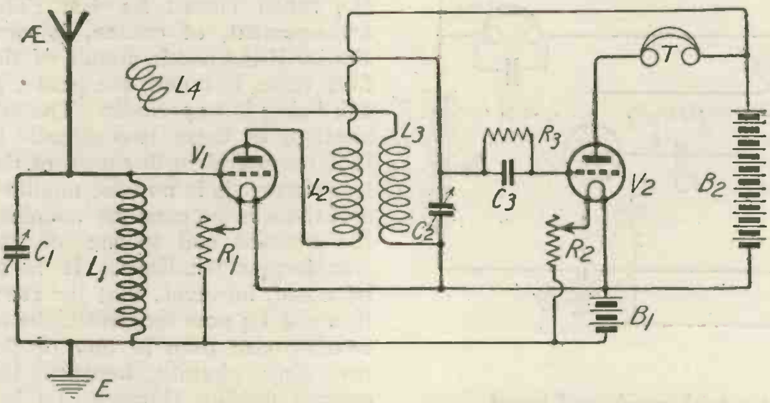


Fig. 3.—Circuit with reaction coil included in secondary circuit.

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.

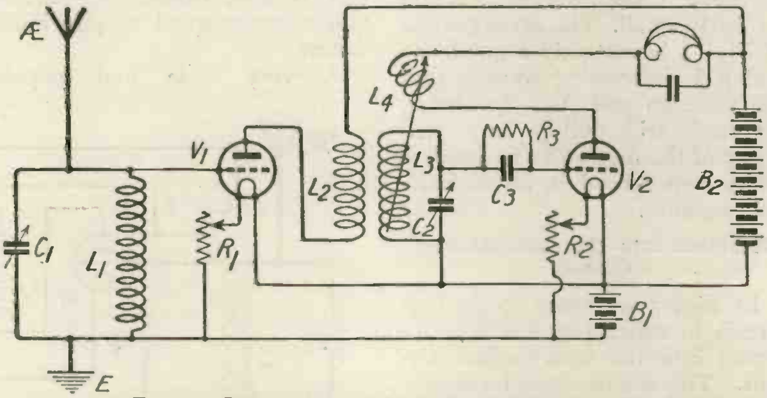


Fig. 5.—Reaction into the intermediate circuit.

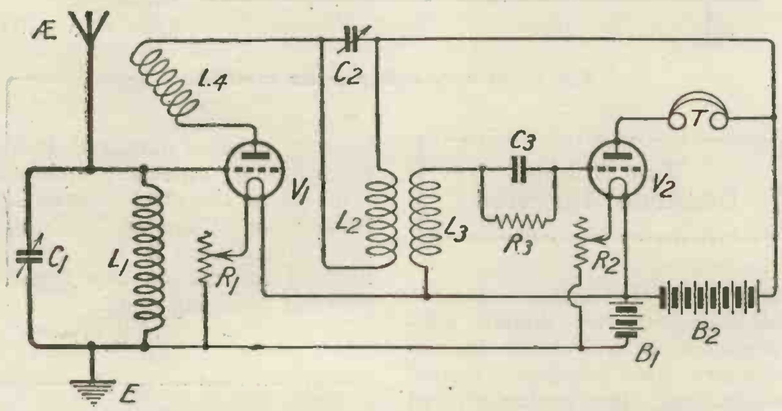


Fig. 4.—An interesting but little employed method of introducing reaction.

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.

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.

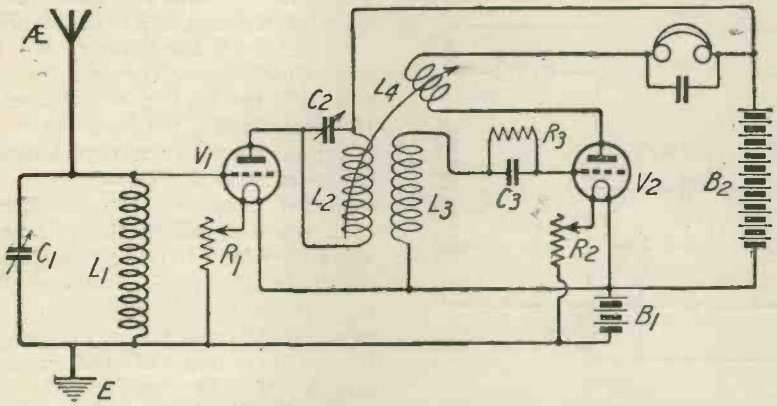


Fig. 6.—An alternative arrangement with anode coil tuned.

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.

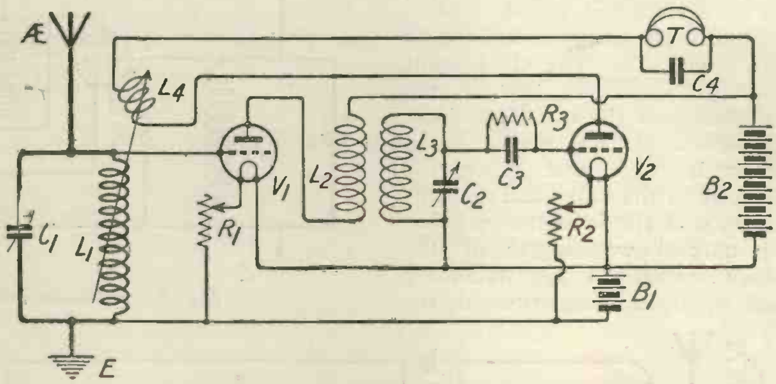


Fig. 7.—A very safe popular method.

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.

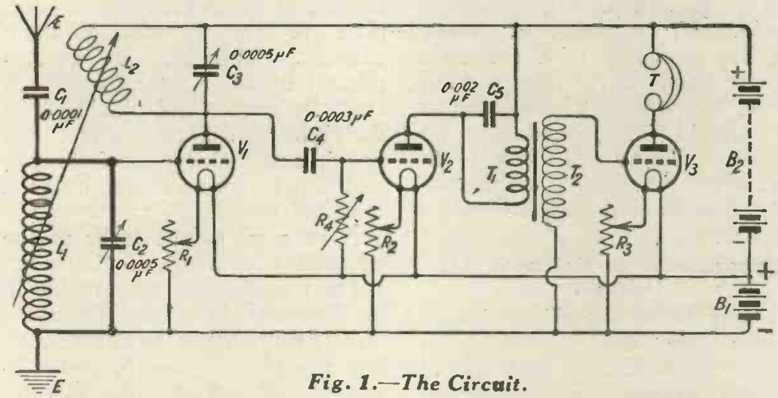


Fig. 1.—The Circuit.

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

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

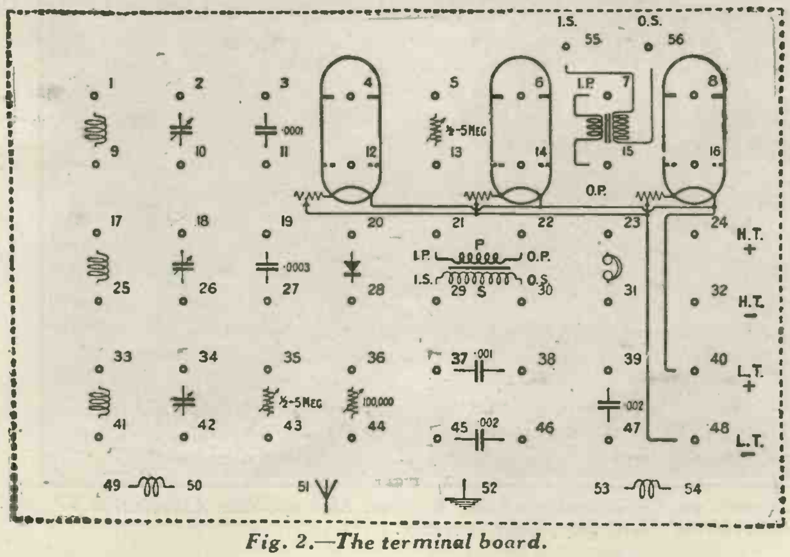


Fig. 2.—The terminal board.

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 intervalve 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.

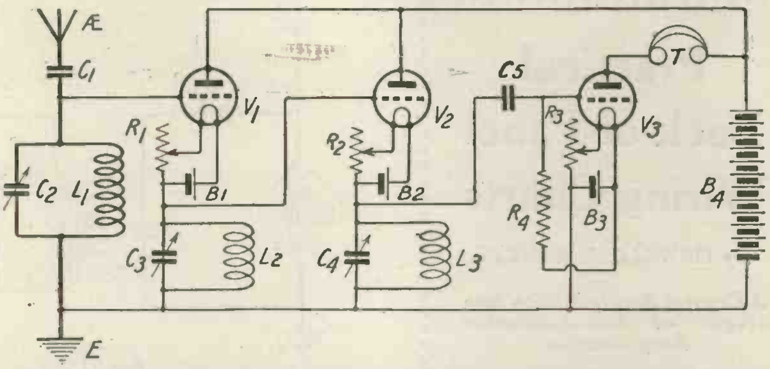


Fig. 1.—A simple arrangement with two stages of high frequency. Notice that the circuits C4 L3, and C3 L2 are both in the grid circuit of V2.

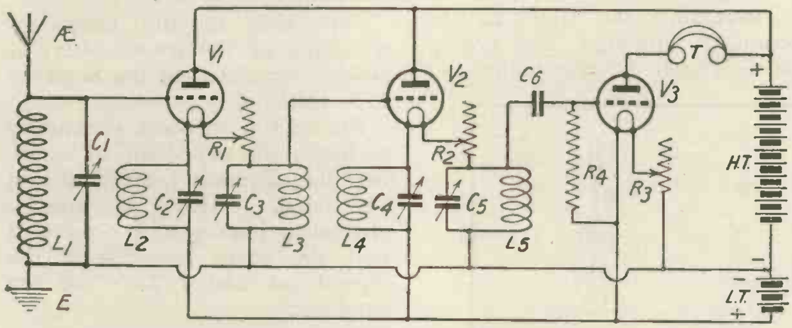


Fig. 2.—Another arrangement. The condensers C2 and C4 can be dispensed with under suitable conditions.

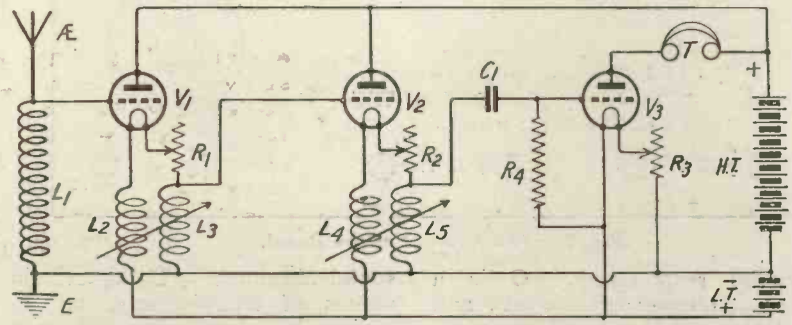


Fig. 3.—An arrangement with variometers, the two windings of each being connected separately.

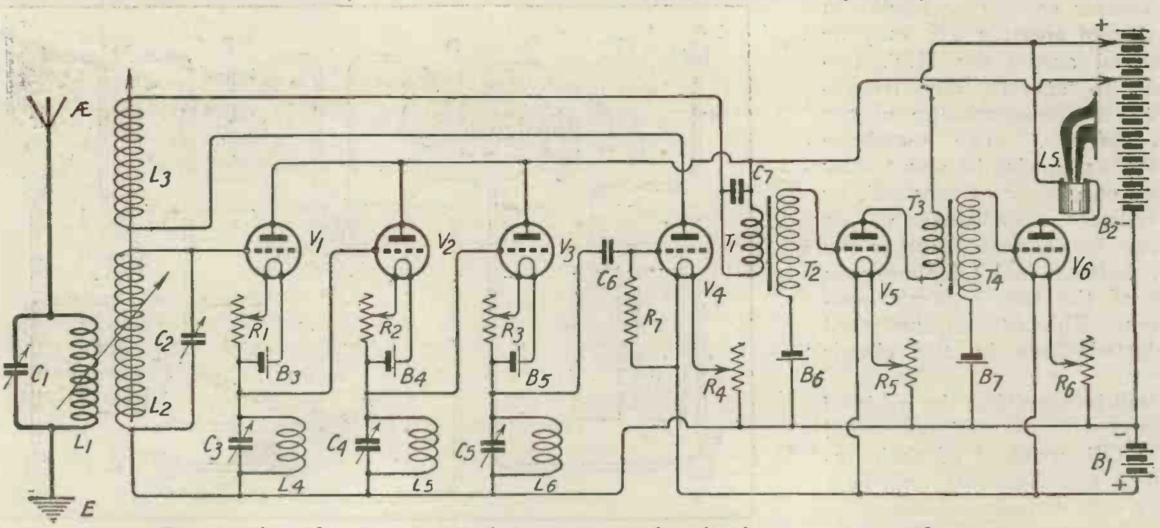


Fig. 4.—A multi-stage set with two stages of audio-frequency magnification.

Practical Back-of-Panel Wiring Charts

By OSWALD J. RANKIN

A Crystal Receiver with two stages of Low-Frequency Amplification

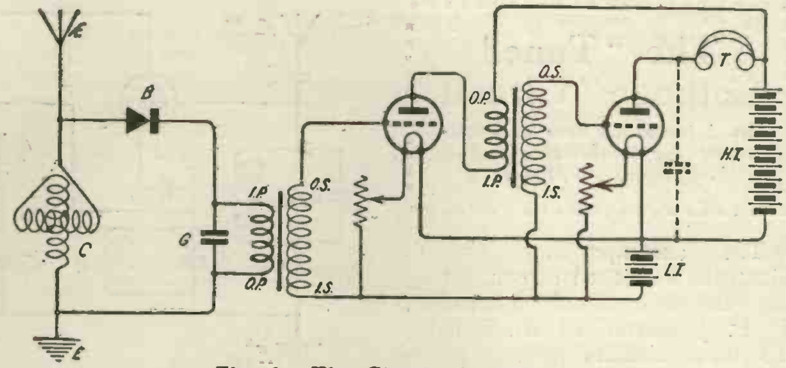


Fig. 1.—The Circuit Arrangement.

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.

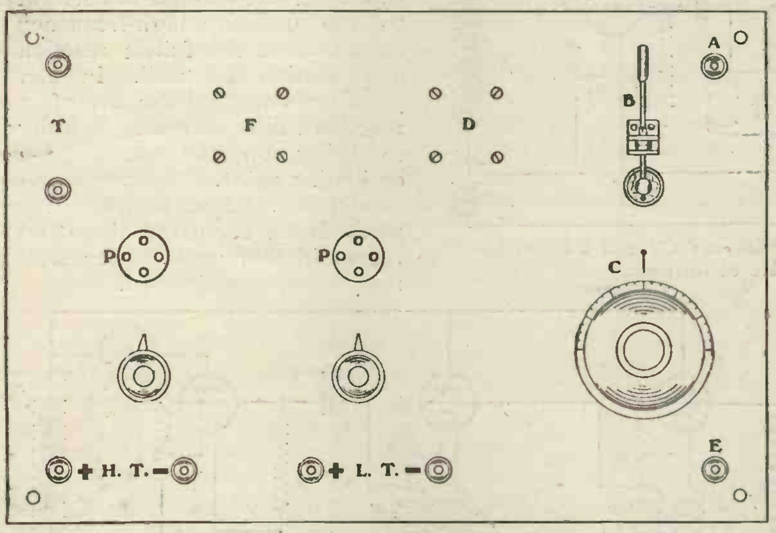


Fig. 2.—The Lay-out of the Panel.

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.

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.

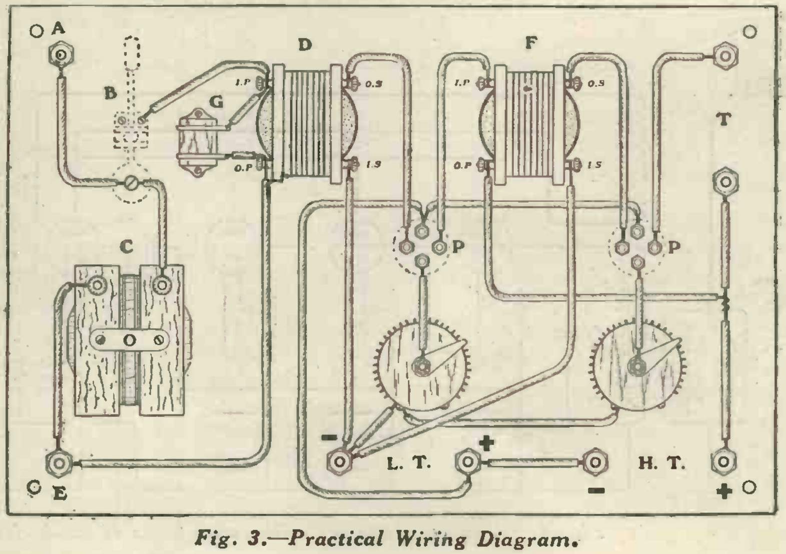
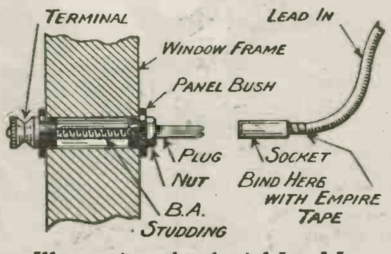


Fig. 3.—Practical Wiring Diagram.

A Handy Aerial Fitting.

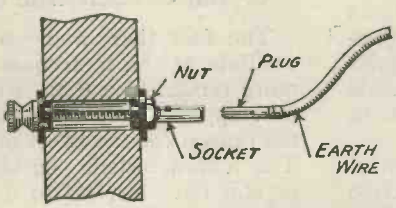
ONE wants to be able to earth the aerial by some quick and easy method and to bring it into use when required without trouble or waste of time. Aerial switches, if properly arranged, are all very well in their way, but they have the disadvantage that, as they must be placed out of doors, they soon begin 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 wave-lengths.

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[...]
O[...]

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

IN 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.

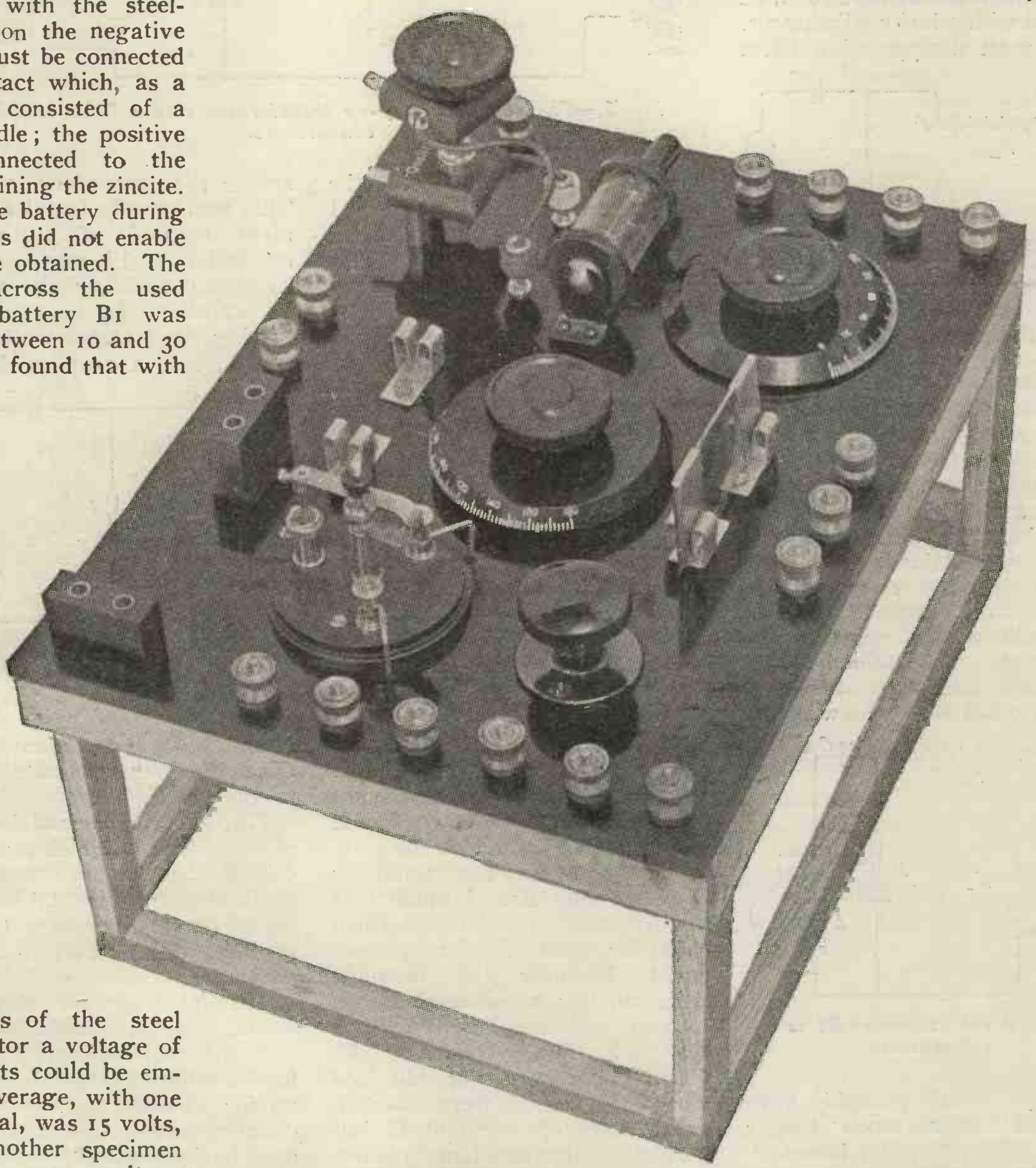
Steel-Zincite Combination

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

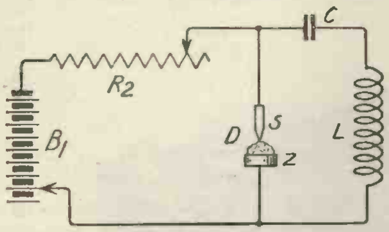


Fig. 1.—The circuit used for producing oscillations.

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

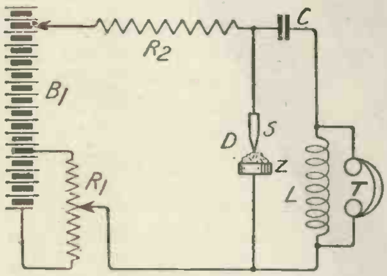


Fig. 2.—A potentiometer R1 is a refinement.

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.

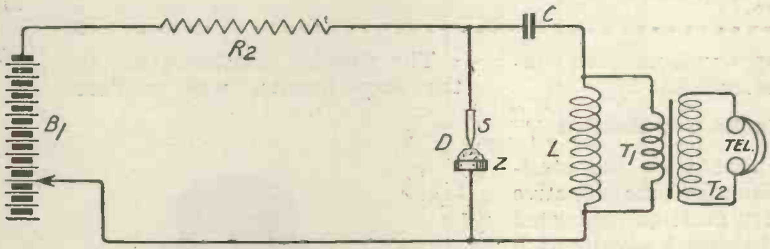


Fig. 3.—The use of a step-up transformer across L for telephone connections.

Fig. 4 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.

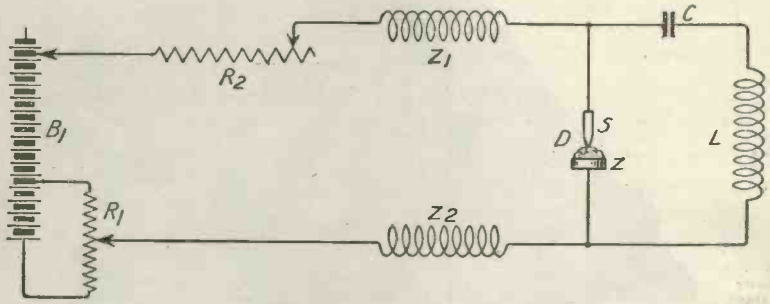


Fig. 4.—A modification using chokes.

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.

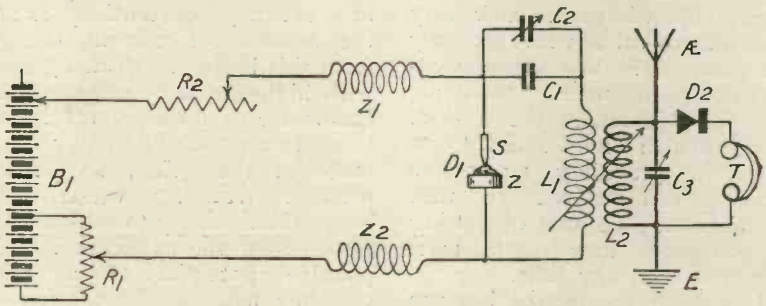


Fig. 5.—The actual circuit employed in the experiments.

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 loudspeaker, 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.

□ □ □

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.

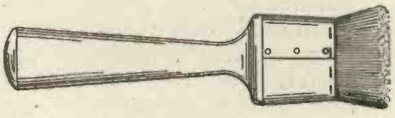
The Radio Society of Great Britain

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 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.



The cleaning brush suggested in this article.

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.

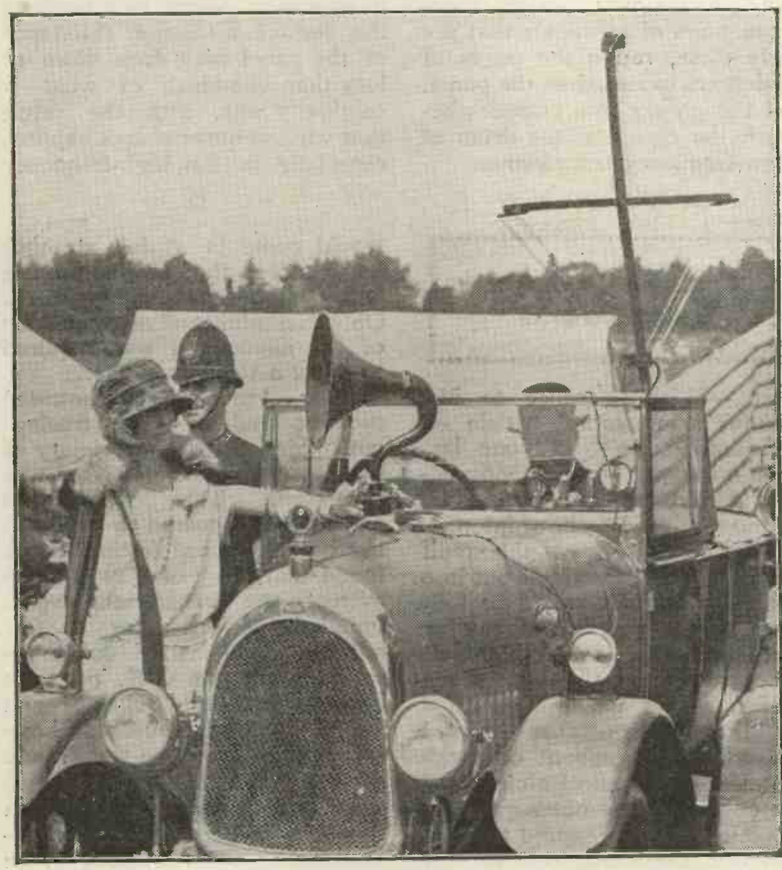
I test a lot of transformers and loud-speakers and valves, and I find that there are at least a dozen loud-speakers that give excellent results, but there is an enormous difference in transformers. A good transformer will give good results, which to the ordinary ear are hardly distinguishable from resistance 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

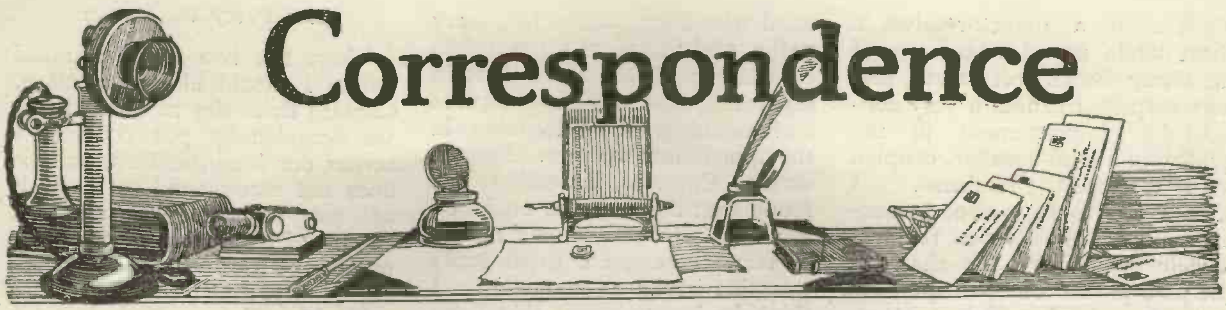
I have been very greatly interested bv this lecture because Captain Eckersley has dealt with the matter in a manner only possible on the part of those who have been deeply immersed in the subject for months. The subject has become so vast, and is so largely unexplored, that to the ordinary person it 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*)

Correspondence



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 headphones 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.

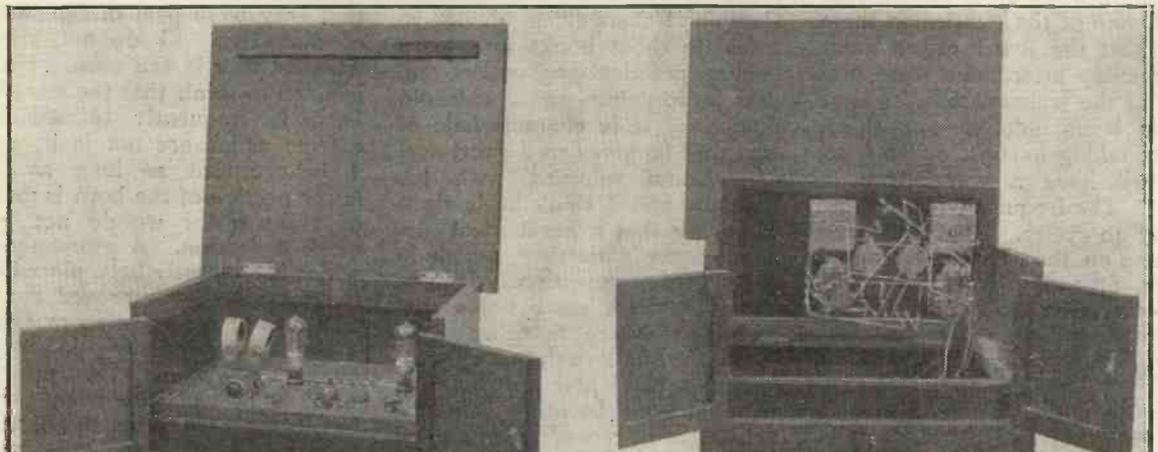
The object in making the receiver is to enable the educational talks from 2LO to be heard from a loud-speaker by the school, and also to illustrate science lessons, some of the elementary principles of wireless telegraphy and telephony being included in the scheme of science instruction.

Results obtained are excellent. 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.

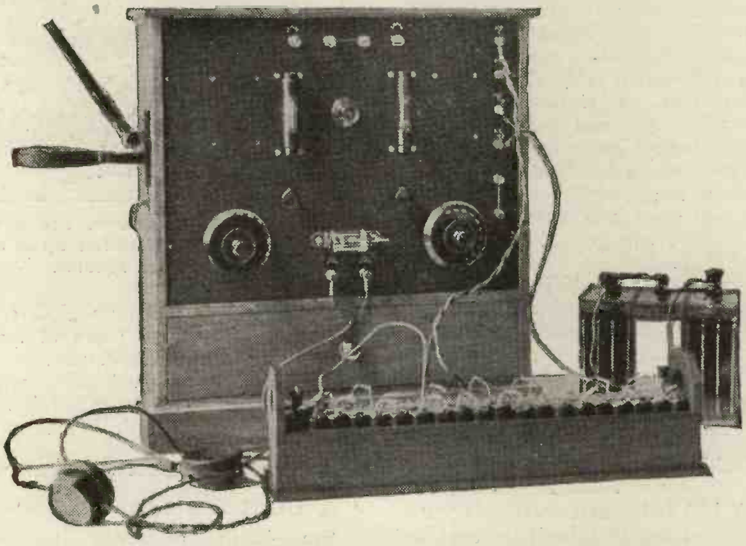
London, N.

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.

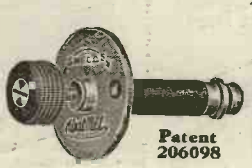
R. H.

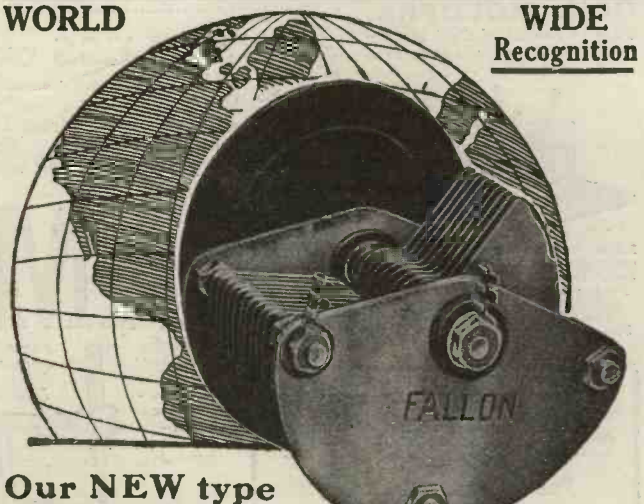
STRAY COUPLING

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.

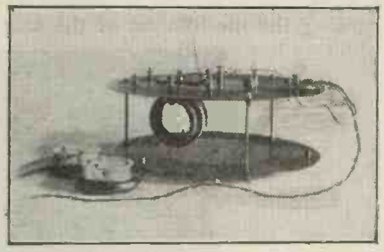
Dublin.

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 $2\frac{1}{2}$ in. high and $2\frac{5}{8}$ 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 $2\frac{5}{8}$ in. by $2\frac{1}{4}$ in. by $1\frac{3}{4}$ 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.

LEADERSHIP CREATES RESPONSIBILITIES.

We realise ours, and appreciate that our duty to the ever increasing number of readers of *MODERN WIRELESS* and *WIRELESS WEEKLY* lies in maintaining the high standard of quality prevailing at their inception.

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

Turn your Wireless knowledge into cash

We are always pleased to receive interesting articles for our various publications, and those accepted will be purchased at good rates. Articles can be submitted with or without diagrams or photographs. Where constructional articles are submitted, evidence of the actual working of the apparatus described must be forwarded if required.

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

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 Trans-atlantic 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 Trans-atlantic 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

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

RADIO PRESS PANEL CARDS.

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

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 P. W. Harris.*	2/6
No. 4.	How to Build the All-Concert de Luxe Receiver ... ... *By P. W. Harris.*	2/6
No. 3.	How to Build the "Simplicity" 3-Valve Set ... ... *By G. P. Kendall, B.Sc.*	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. 1924.

Printed for the Proprietors, RADIO PRESS, LTD., Devereux Court, Strand, W.C.2, by THE AVENUE PRESS (L. Upcott Gill & Son, Ltd.), 55-57, Drury Lane, London, W.C.2. Published on Wednesday of each week at 3, Bolt Court, Fleet Street, London, E.C.4. Address for Subscriptions and Editorial Communications:—Devereux Court, Strand, London, W.C.2. Advertisement Managers:—THE SCHEFF PUBLICITY ORGANISATION, LTD., 125, Pall Mall, London, S.W.1. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—32/6 per annum, 16/3 for six months, post free. Sole Agents for Australasia: GORDON & GOTCH, (Australasia), LTD. For Canada:—IMPERIAL NEWS, LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD. For Japan:—SALE & FRAZAR, LTD.