The Wireless Constructor

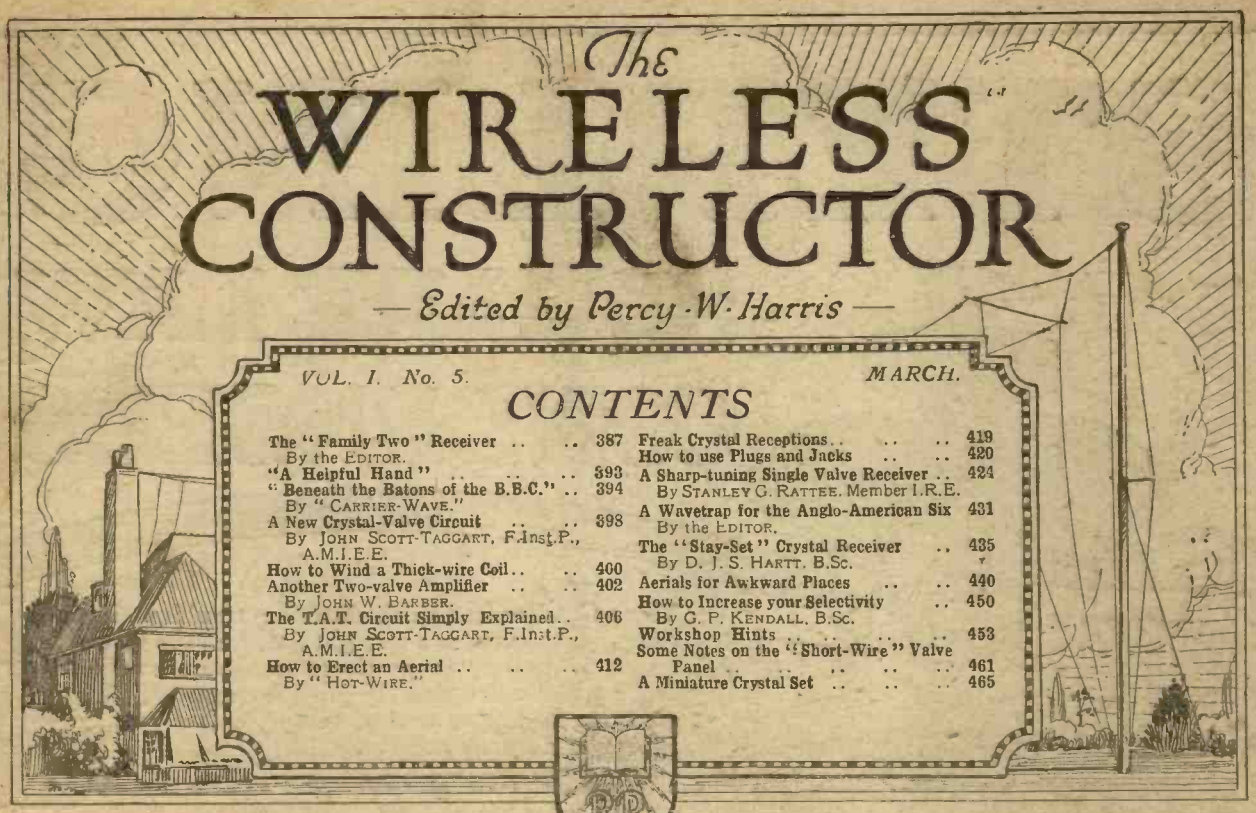
6D MONTHLY

EDITED BY
PERCY W. HARRIS

CONTENTS

Vol. 1. No. 5. MARCH, 1925

1/6 BLUEPRINT FREE INSIDE



The WIRELESS CONSTRUCTOR

— Edited by Percy W. Harris —

VOL. I. No. 5. MARCH.

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The WIRELESS CONSTRUCTOR

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Vol. 1. MARCH, 1925. No. 5.

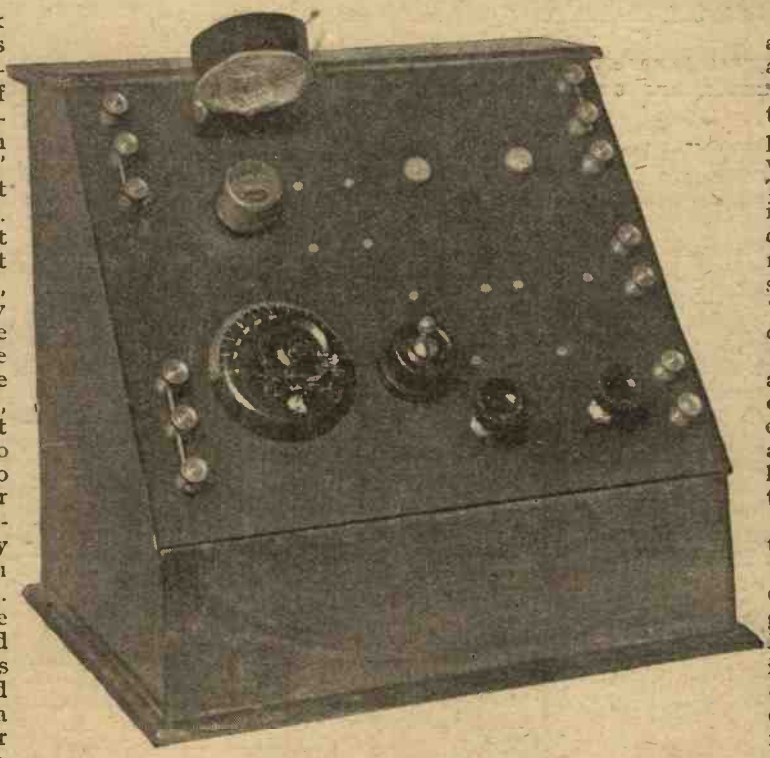
THE "FAMILY TWO"

A LOUD SPEAKER SET OF WONDERFUL PURITY

By THE EDITOR

Perhaps you are just entering the fascinating field of radio and are wondering what kind of set to make. The "Family Two" will probably suit you. All tuning is performed on one handle; once adjusted the set can be turned on and off by any member of the family, just as if it were the electric light, and lastly, it cannot possibly radiate and thus cause interference with your neighbours.

IF you were to ask me whether it is possible to receive all stations of the British Broadcasting Company on the "Family Two" I should tell you at once that it is *not*. This receiver was not designed for that purpose. If, however, you are like many people and are quite content to receive the local station on the loud speaker and if, above all, you want a set that is no more difficult to handle than your present crystal receiver, the "Family Two" will suit you down to the ground. Even the trouble usually associated with crystal detectors has been eliminated by the use of a special detector which is so simple to adjust that "a child can use it."

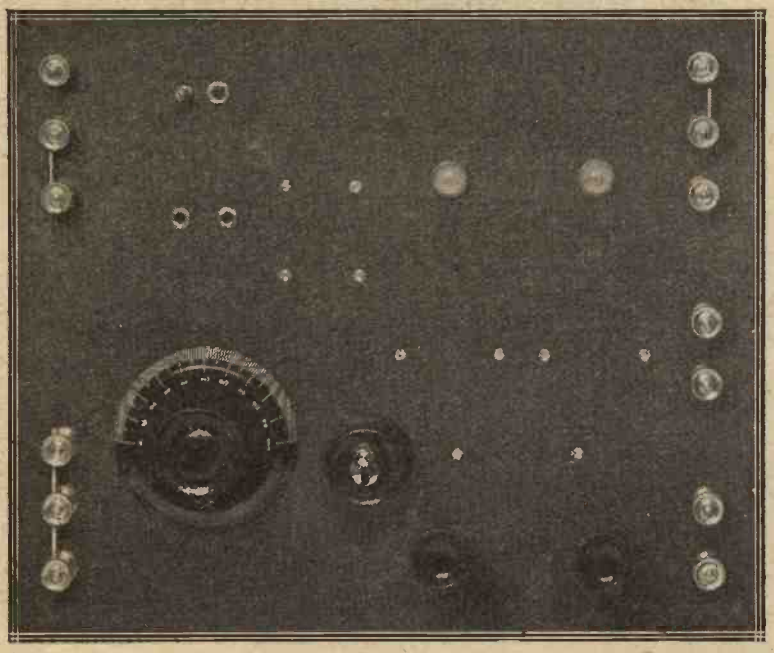


The "Family Two" reflects the modern tendency to place the valves behind the panel.

Many people have asked me to design a simple set with "one-handle" control in which crystal purity is combined with valve volume. The "Family Two" is the result. For quality I have heard nothing to beat it, save perhaps the "Puriflex" Receiver, described in *Modern Wireless* some months ago. This latter, of course, is a more elaborate instrument, and as such is not likely to appeal to the beginner.

In case you may think that the "Family Two" is designed for beginners only, I would like to point out that it is just the kind of receiver that the expert often uses for receiving the local station. To those acquainted with the jargon of the game

it may be explained that the instrument consists of a special crystal detector in a direct-coupled circuit, this being followed by one stage of transformer-coupled note-magnification and one stage of resist-



With coil and crystal removed, showing tuning dial, resistance knobs, and on-and-off switch.

ance-coupled note-magnification. On a reasonable out-door aerial at five or six miles from a broadcasting station (at ten or twelve miles under favourable conditions) the volume of undistorted speech and music delivered by the instrument, is sufficient to operate a loud speaker as powerfully as any but a deaf person could desire. At Wimbledon (which is seven miles, as the crows flies, from the London station), using a good outdoor aerial, it easily operates two loud speakers in parallel (one in one room and one in another), while the purity of reproduction has been commented upon by all who have listened to it.

Simple Wiring

The free blue print included in this issue shows the wiring behind the panel to be extremely simple. All the components are mounted on the back of a single panel, the valves themselves being tucked away out of sight, save for the tiny opal windows which serve to show whether the filaments are burning. On the front of the panel you have but one tuning dial and a socket to take any of the well-known makes of plug-in coil. The glow

of the filaments is controlled by two filament resistances, terminals are provided to give separate high tension connections on the two valves, and separate grid bias on both where necessary. The beginner need not use these special terminals, but the more experienced reader will like to experiment in varying grid voltages to suit his own taste.

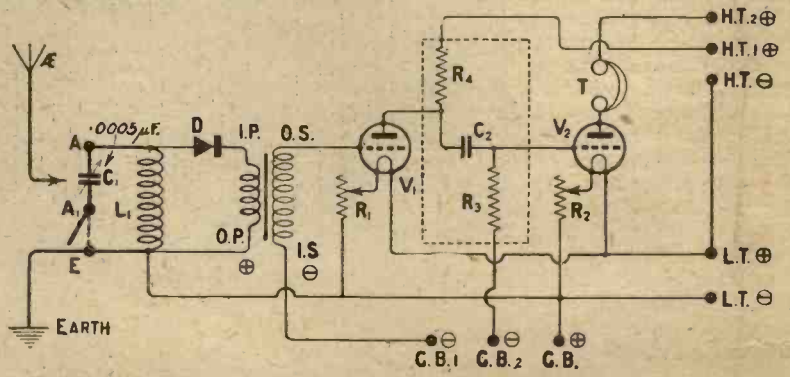
The crystal detector deserves a paragraph to itself. Known as the "Harlie," it is completely enclosed in a little case through the top of which protrudes the edge of a knurled disc. This disc serves to turn a small cylinder of a special crystalline material, against which the point of a springy cat-whisker bears. The sensitive spots are found by rotating the cylinder until good signals are heard. In practice there are a large number of spots on the cylinder surface which give excellent signals, and I have found the reproduction quite equal to that given by the average crystal in the ordinary form of mounting. The adjustment seemed quite stable, and I have usually found it sufficient to adjust the crystal only at the beginning of the evening's programme. When the station closes down, the adjustment is as good as ever.

On-and-Off Switching

On the front of the panel there will also be found a little ebonite-covered tumbler switch, such as is used on the dashboard of a motor car to control the headlamps. By switching this to the "On" position the valves light up and the set starts work, if, of course, the loud speaker, aerial and earth, and other wires are properly connected, and the set correctly adjusted. At the end of the programme, or at any time when so desired, the set can be switched off simply by turning this tumbler switch to the "Off" position, no disconnection of wires or other adjustment of filament resistances being necessary. This will be appreciated by by those who like to keep a set at home for family use.

Terminals

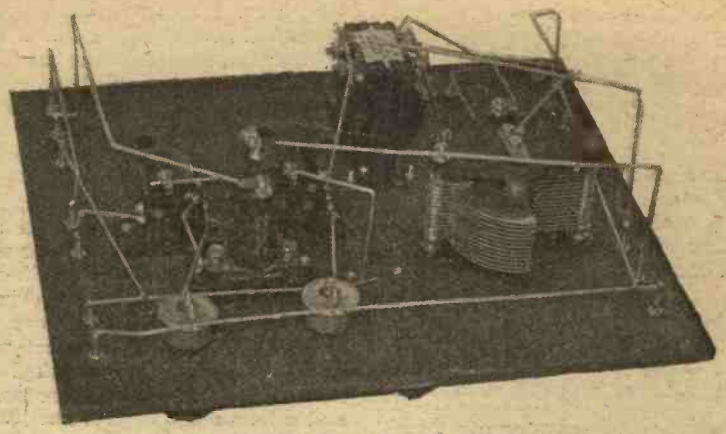
Looking at the front of the mahogany cabinet on which the panel is mounted, you will see on the left six terminals. The three upper terminals are for aerial and earth connections. Normally the two lower of these three are joined by a piece of wire, the aerial being connected to the uppermost terminal and the earth to the lowest of the three. In this position the



For the more advanced reader: The theoretical diagram.

variable condenser (by which the tuning is effected) will be placed in parallel with the plug-in coil. In nine cases out of ten this is the best method, but occasionally you

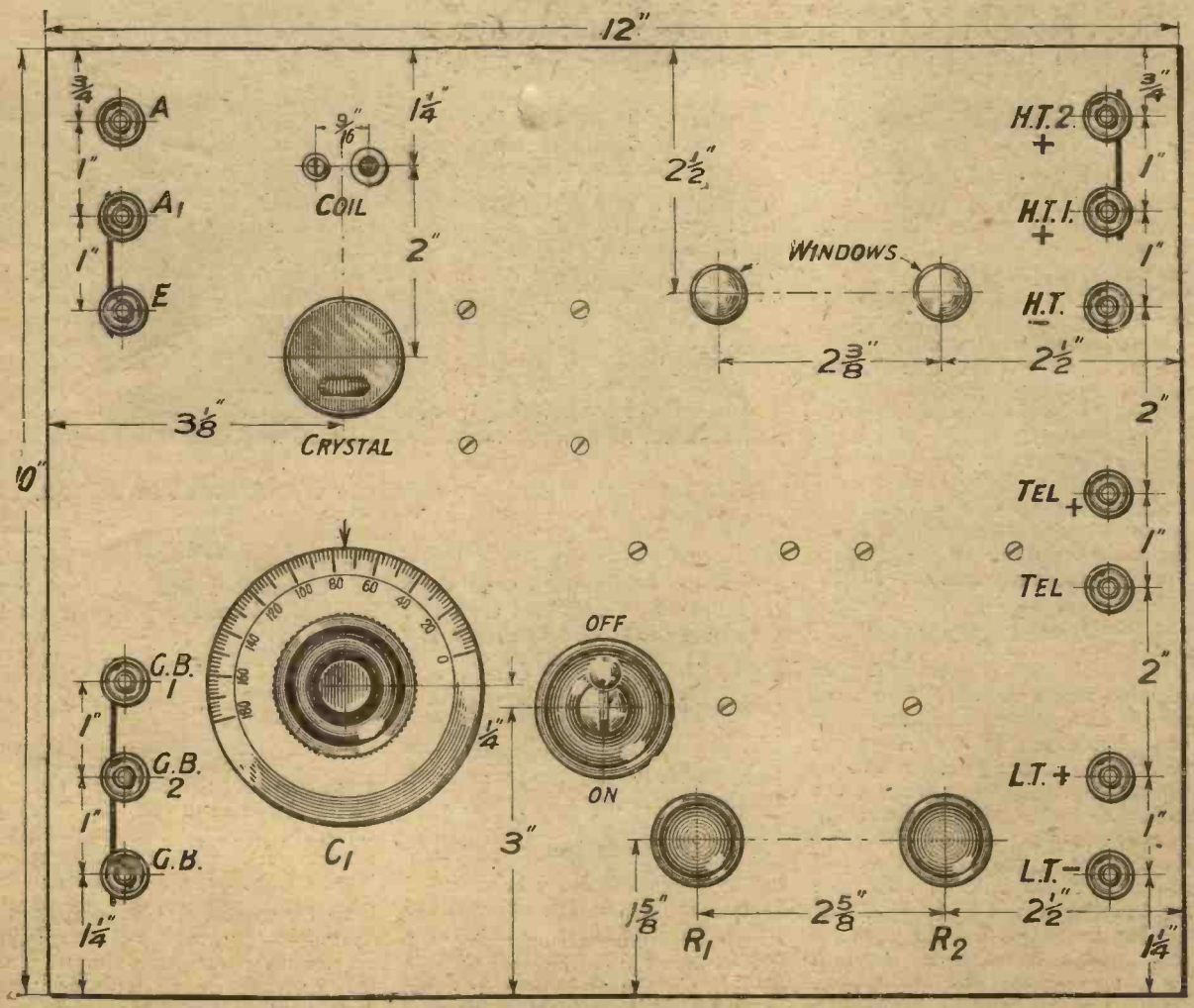
will find an aerial which gives much better results when the condenser is connected in series, which is done by opening the link joining the two lower terminals, connecting the aerial to the middle terminal of the three, and placing the earth connection on the lowest terminal, as before. On the same side of the panel and immediately beneath the aerial and earth terminals, will be found three others, called " grid bias terminals." If you do not understand the purpose of grid bias do not worry about these terminals, but join them together with a single piece of wire. Later on when you may find it desirable to use a grid bias battery, you can remove the connecting wire, and join up the terminals in the usual way.



Wiring is exceedingly simple.

Further Connections

On the right-hand side you will see seven more terminals. Three of these at the top are for the high-tension battery, the two immediately beneath these are for your telephones, and the pair at the bottom are the connecting points for the low-tension battery, which may be an accumulator or, with dull emitter valves, perhaps, dry cells. The beginner can join the two uppermost terminals together (those marked H.T. 2 and H.T. 1), for they are only used separately when additional voltage is required on the last note magnifying valve such as when you use a power valve in the last stage.



Terminal markings and drilling diagram of panel front. Blueprint No. C 1008A.

Components Needed

Now let us see how to build the set. I am assuming that you have not built a receiver before, so I must ask the pardon of the more advanced readers if some of the details given seem rather obvious to them.

First of all you will want a collection of component parts, which you can obtain from any reputable dealer. Let us set them out in detail:—

One sloping front cabinet, to take a 12 in. by 10 in. panel (this is a standard size of cabinet, and you will have no difficulty in obtaining it if you look through the advertisements in our columns).

One ebonite panel, 12 in. by 10 in. by ¼ in. thick. This must be of guaranteed ebonite free from surface leakage. There are a number of good reliable makes now available. The panel shown was purchased from "S. A. Cutters."

Thirteen brass terminals with securing nuts.

One variable condenser (preferably of the square-law pattern), having a capacity of ·0005 mfd. That shown is a Bowyer-Lowe. There are several other good makes which will do just as well.

One panel mounting socket for plug-in coil.

One Harlie crystal detector complete.

One low-frequency intervalve transformer of good make. I have used a Burndept.

One Polar resistance capacity-coupling unit.

Two valve windows.

Two filament resistances (I have used Microstats here).

Two Aermonic valve sockets.

A few lengths of No. 16 square-section tinned copper wire for wiring up.

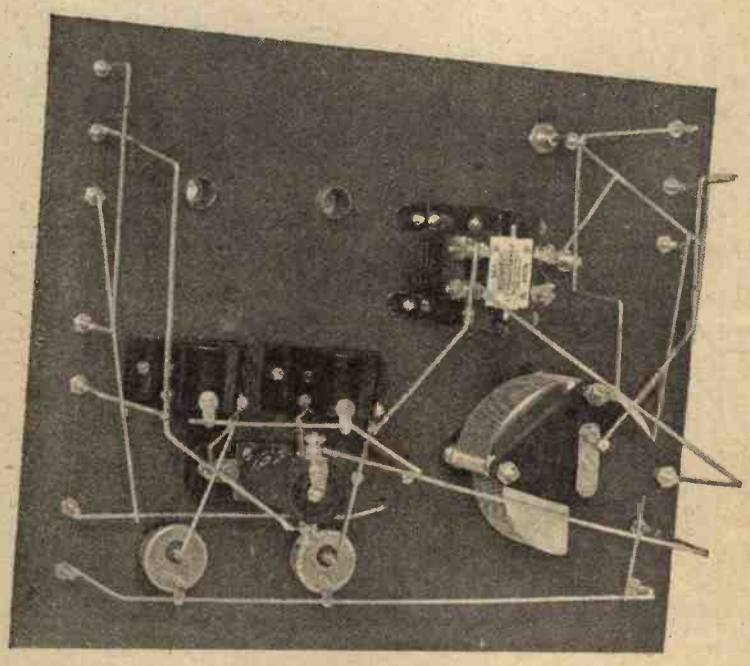
Small quantity 6 B.A. ⅝ in. countersunk brass screws for holding the components to the panel.

One on-and-off tumbler switch.

Tools Required

You will need comparatively few tools to make this set. The most useful of all tools in building your own apparatus is an American twist drill of a size sufficient to take up to ⅜ in. drills. You will see the kind of twist drill I mean by referring to No. 1 of THE WIRELESS CONSTRUCTOR, page 42. You will also need a few drills of which the most important are a ⅛ in. for drilling the holes for the spindles of variable condensers, &c., a ¼ in., a clearance drill for 4 B.A. metal screws, and a clearance drill for No. 6 B.A. metal screws.

You should also obtain a small counter-sinking tool which fits into the brace and cuts a bevelled hole into which the countersunk head of the brass screws will fit neatly. Another very useful tool is a pair of 8in. wire-cutting pliers. A soldering-iron is another requisite. We have already published full particulars of how to solder (humorous and otherwise), so that I need not refer to that subject here. A scriber (a substitute can be made by driving a sharp needle into a cut off wooden pen holder), a steel rule, with straight edge marked in fractions of an inch, a centre punch and a hammer complete the list of essential tools. The first task is to mark out on the *back* of the panel the positions of all screw holes. If you are using exactly the same components as described then you will have little difficulty, for the diagrams show what to do. If, however, you have varied the makes of components (which you can do in a number of cases without any sacrifice of efficiency) you will have to be careful that you mark off the special holes correctly.



One transformer and one resistance unit are used in this set.

The Detector

The crystal detector is mounted in two sockets which fit into the panel. The distance between the centres of these sockets is easily found by measuring the distance between the pins which fit into the sockets. The positions of the holes of any other components can be settled by placing the components themselves in the correct positions and marking through the holes which are to take the fixing screws.

The "Aermonic" valve sockets are each secured to the back of the panel by two screws. In the wiring diagram you will see a dotted representation of the top of each of these sockets drawn immediately above the sockets themselves. Do not think that these dotted diagrams are put there for you to mark anything upon the panel. They merely serve to show what the top of the socket will look like if you are looking down upon it.

Be particularly careful that the leads which go to the valve sockets are correctly joined and do not touch other leads. Where two leads are joined together a small square is shown. Where wires cross without joining no square is indicated.

The Transformer

The Burndept transformer has its terminals marked G (grid), and so forth, as shown in the wiring diagram. This is the correct wiring up for the Burndept transformers. Most other makes have, instead of grid, plate, positive, etc., markings such as O.S., I.S., O.P., I.P. If you are using a transformer with these markings, the O.S. terminal should be connected to the wire which now goes to the G terminal

of the Burndept transformer. The I.S. lead goes to the grid-bias terminal. I.P. should go to the crystal and O.P. to earth.

The Resistance Capacity Unit

The Polar resistance-capacity-coupling unit has four terminals marked respectively H.T., Anode, Grid and L.T.—.

One of the telephone terminals is marked positive. This means that if you are using a pair of telephones or loud-speaker in which one lead is marked with a cross or in red, then this should go to this particular terminal. If your telephones or loud-speaker leads are not marked, then you will have no means of knowing which is the positive terminal. It will not make much difference to signal strength which lead from the telephones or loud-speaker is connected to the + terminal, but in one direction the steady flow of current in the plate circuit of the last valve will tend to demagnetise the telephone or loud-speaker-magnets.

Valves

The valves you use will depend largely on your own taste. Any of the good general-purposes valves will do here, and particularly those designed for low-frequency amplification. Best of all, use, in the first case, one of those valves designed specially for resistance-capacity-coupling (Marconi-Osram D.E.5B. or Mullard D.F.A.4). In the last stage the best valve to use is the D.E.5, B.4, or the D.F.A.1. The two types of valves referred to are more expensive than the ordinary bright emitters, but, if you can afford them, you will find the results obtainable in both purity and amplification well warrant the additional expenditure.

Correct Voltages to Use

These will be found by consulting the makers' figures published on the boxes in which the valves are packed.

Coils

You can use a No. 25 or 35 below 400 metres, and a 35 or a 50 if the wavelength is above this. It is not possible to specify exactly which coil you will need, for this depends to some extent upon your aerial. It would not be a bad plan to buy a set of "concert" coils of any of the well-known makes, as among these there will be one which will suit your station, and, later on, you will be able to use the other coils in different work.

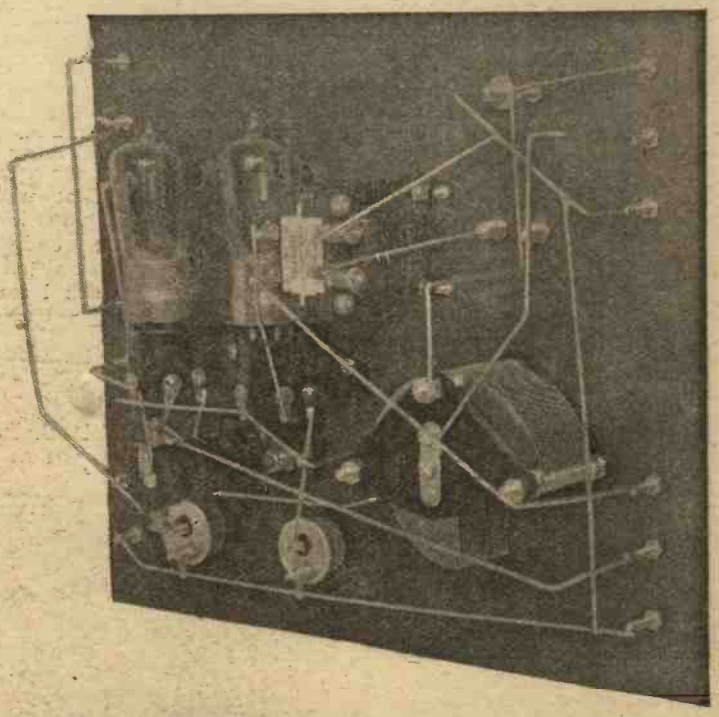
Accessories

In addition to the components specified in the list above, you will need certain accessories. You must have a battery to light the filaments of your valves. If these are of the bright emitter variety, then I recommend you to obtain a 6-volt 30-amp. hour (actual) accumulator. This will give with two bright emitter valves approximately 20 hours of continuous working. If you use a D.E.5.B and a B.4 (or similar valves as explained above), this accumulator will give 60 hours' continuous working. If you are using valves of the ·06 ampere type, a smaller accumulator will do, and should be of the 4-volt variety. A pair of 2-volt 10 amp. hour accumulators connected in series will give about 80 hours continuous running with a pair of ·06 ampere valves.

A 66 or 72 volt tapped high-tension battery should also be obtained, together with a pair of plugs and connecting wires. If you desire to use dry cells to light your filaments, remember that the only valves which will run satisfactorily from dry cells are those of the ·06 ampere variety. You will need three dry cells in series to run these valves. In loud speakers you have a wide variety of choice.

Instructions for Operation

Join on your aerial, earth and phone leads, and connect up your L.T. battery to the two terminals shown. Put the on-and-off switch to "on," and turn the filament resistances in a clockwise direction till the valves light up. Connect a pair of telephones or a loud speaker to the two telephone terminals, connect your high-tension battery, and plug in a suitable voltage according to the valves you are using, one lead from the two joined H.T. terminals going to the positive socket and the lead of the negative H.T. terminal to the negative socket. Plug into the aerial coil socket a suitable coil (try first with a number 35 or the second of the concert coils), and turn the condenser dial backwards and forwards. When you hear the concert, note the position on the condenser where the signals are loudest, and make sure by trial that your valve filaments are bright enough to give good volume. Now with your thumb slowly turn the knob of the crystal detector until the best results are obtained.

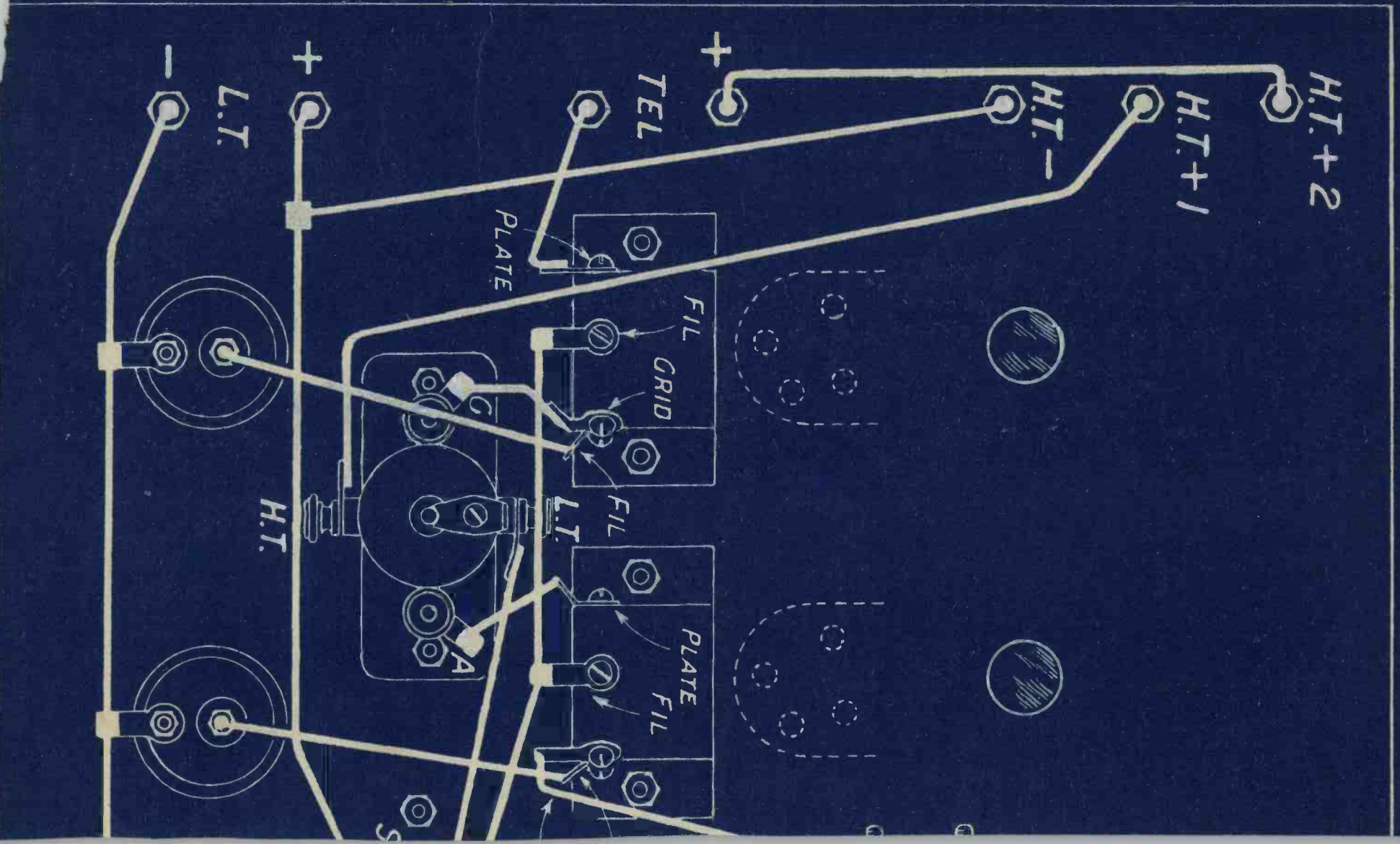


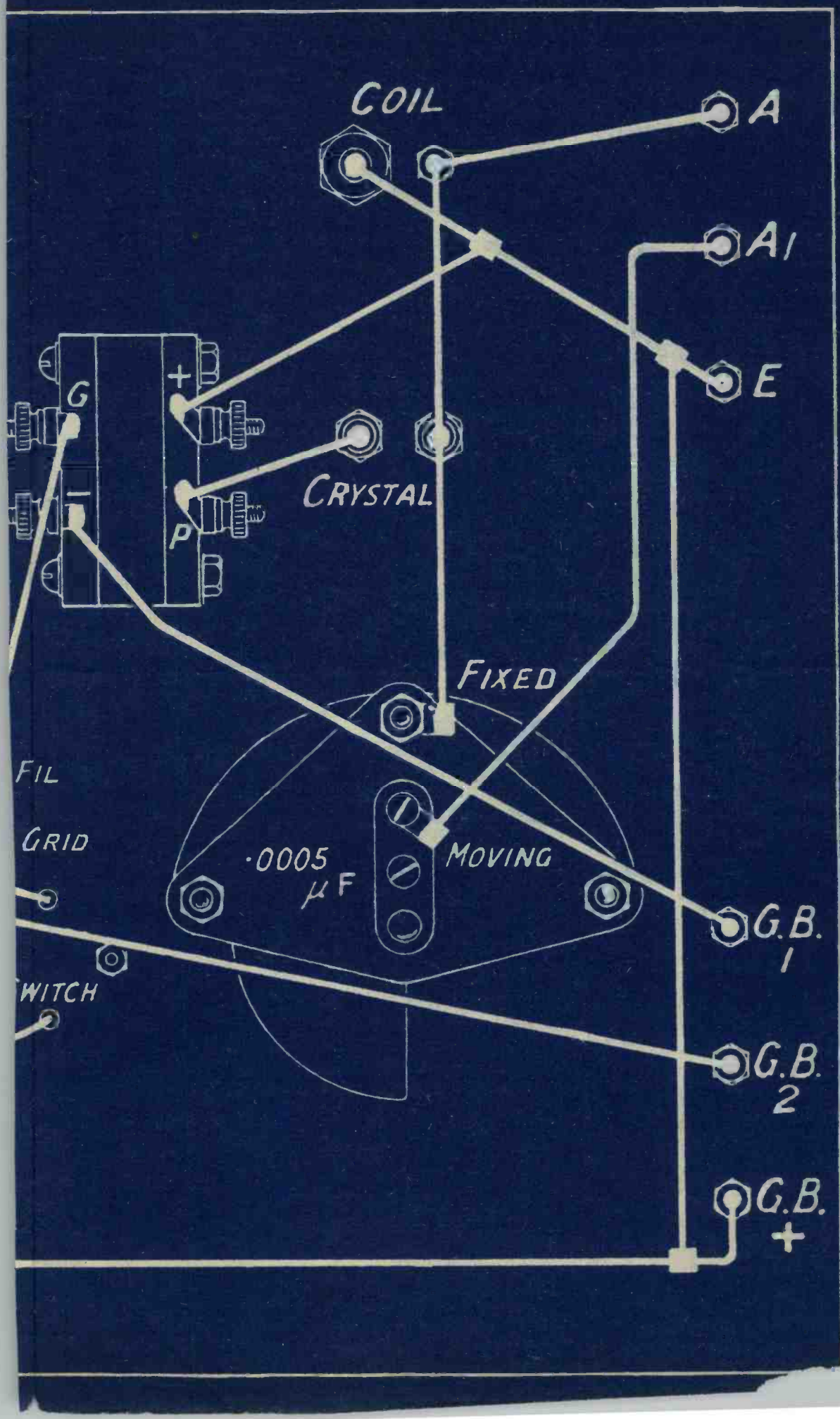
This photograph shows the position of the valves behind the panel.

NEXT MONTH:

How to use Grid-Bias and Separate High Tension

THE WIRELESS CONSTRUCTOR "FAMILY TWO" RECEIVER.





RADIO PRESS LTD., BUSH HOUSE, STRAND W.C.2. BLUE PRINT No 1008B PRICE 1/6

What Our Readers Say

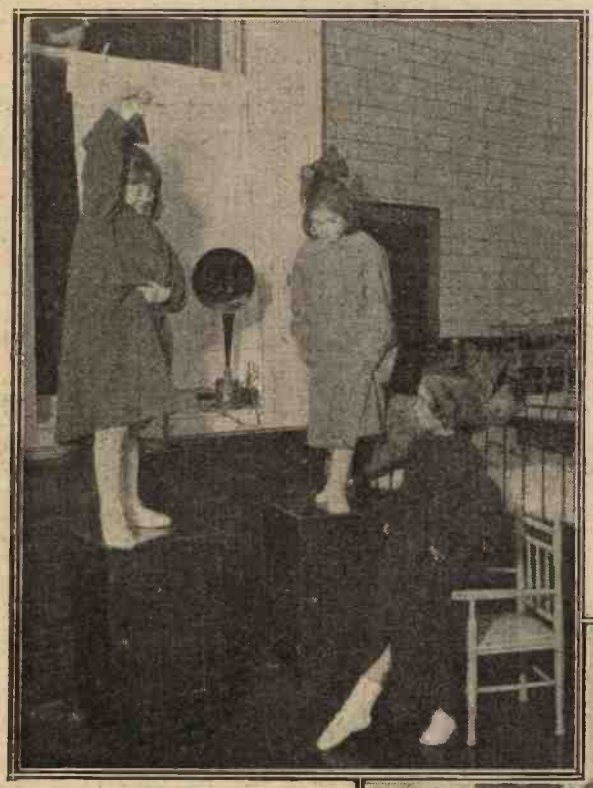
THE SEVEN-CIRCUIT CRYSTAL SET.

SIR,—With reference to your Seven-circuit Crystal Set, December Number of THE WIRELESS CONSTRUCTOR I consider this set the best possible that can be made. As you say, one particular set cannot suit every aerial. With this circuit arrangement it supplies all requirements.

I obtain really loud reception, and after making about a dozen, given in the weekly papers, claim that yours is excellent. If anyone is thinking of making it I can strongly recommend it.

W. H. GENTRY.

Hammersmith.



Children dancing to the wireless music at the Children's Hospital in Gt. Ormond Street.

WGY ON S.T.100.

SIR,—You will no doubt be interested to know that I tuned this station (WGY) in on S.T.100 at first attempt. This was at 12.15 a.m. on the morning of December 19, 1924. Speech and music were quite clear, and atmospherics almost absent. As my aerial is only very moderate, I think this speaks wonders for this very well-known circuit. I did not wait for the entire programme, being quite satisfied with getting their call sign. I know this has been done many times on S.T.100, and I am satisfied in as much as this has proved my set is quite up to the usual efficiency of the S.T.100.

Best wishes for continued success of your papers (all of which I read).

—Yours faithfully,

J. R.

Wolverhampton.

THE TWIN-VALVE RECEIVER.

SIR,—Just a line in haste to tell you I have converted my "Tri-Cell" set to the new Twin-Valve of THE WIRELESS CONSTRUCTOR. The former set was highly successful. The first station I tuned in was Madrid about midnight.

The Twin-Valve is giving *splendid* results on Sterling "Dinkie" loud speaker, though I badly need a square law ·0003, as Hull and Leeds come on at 3° and 5° (40° on A.T.C. 50 coil), using slight reaction with a very inactive Dutch D.E. detector and D.E.3 dual valve, 130 volts. Have introduced a 2 mf. reservoir condenser on H.T. (1). *Much* prefer the new type of drawing straight wires without loops. More details later, and very best wishes for 1925 and congratulations.

Yours sincerely,

JOHN F. W. HALL.

Yorks.

S.T.100.

SIR,—Some time ago I received your R.P. Envelope No. 1 for the S.T.100 circuit; the results obtained could not have been more satisfactory. From Betansos (Galicia) we listened-in to British stations and to Madrid distinctly.

In the centre of Spain (Avila) we obtained the same results without being troubled in any way by telegraphic stations. I send these results so that you can easily communicate them to Mr. Scott-Taggart, for his satisfaction.—Yours faithfully,

Madrid. FAUSTINO RINON.

In a "grown-ups'" hospital wireless is equally appreciated. Patients listening-in at the Royal Devon and Exeter Hospital.

Write and tell us about your results. We are always pleased to publish letters from our readers

A HELPFUL HAND.

Mr. L. Stanton Jefferies, now Deputy Director of the B.B.C.

"BENEATH THE BATONS OF THE B.B.C."

By "CARRIER-WAVE"

Mr. T. H. Morrison, the Musical Director of 2ZY.

IT is greatly to be feared that the average member of the public regards the musical conductor of any orchestra as the man who—to quote Louie Freear in the dear old "Chinese Honeymoon," "waggles the stick and goes, one, two, three"; or else as an animated metronome. The idea that it takes a great artist to be a great conductor is very hard for him to realise. There are, of course, one or two who are so constantly in the public eye that a concert is not complete unless conducted by him. Who would enjoy a "Prom" concert at Queen's Hall without Sir Henry Wood, or a Symphony concert at Albert Hall without Sir Landon Ronald? Again, in the provinces one cannot picture the Bournemouth Municipal Orchestra without Sir Dan Godfrey, or the Halle Orchestra of Manchester without Mr. Hamilton Harty. Equally important British names are Albert Coates, Julius Harrison, Dr. Adrian Boult, Aylmer Buesst, and perhaps best known of all, Mr. Percy Pitt.

When it comes to matters wireless, a far more serious problem arises, for here is wanted not only a conductor, but a practical musician, who knows whether he is making just the right kind of "noise," and not merely "waggling the stick."

Here the B.B.C. has realised from the beginning the magnitude of its task in getting concerted music successfully "over the aether," and has taken care to get the highest expert advice.

The London Station

Naturally, London occupies chief place in public attention, and was fortunate in securing a talented musician, Mr. Stanton Jefferies. He might indeed be called the pioneer of radio music, for he was conducting broadcast concerts long before the B.B.C. came into existence, and he was the first conductor of the London Orchestra. To his powers of manipulation of orchestral forces was due the early success of 2LO. An ex-student of the Royal College of Music, he was also for some time organist at the Royal Chapel, Windsor, and this probably accounts for the difference made in the organ recitals at the National Institute of the Blind last year, when he was organist, when the music came over with true organ effects. To him also from the beginning fell the task of auditions, and when one remembers the hundreds, I should not be far wrong, I think, if I said thousands, of people in every branch of musical, theatrical and literary art that Mr. Jefferies has "heard" in the course of this two years, it is not surprising that he has had to relinquish some of his work. He is now Deputy Director of the B.B.C., while the Controller of Music to the Company is the famous conductor, Mr. Percy Pitt.

Mr. Warwick Braithwaite, Musical Director of the Cardiff station.

Mr. Percy Pitt

Few musicians have a wider or more varied experience, and he has long been a power in the operatic affairs of this country, by reason of his posts as Musical Director of the Royal Opera, Covent Garden, and later of the British National Opera Company. As organist, pianist and composer, too, he has a long list of triumphs behind him. Amongst his compositions may be mentioned the fine incidental music to Tree's Shakespearean productions, as well as his "Flodden" and "Paolo and Francesca" music. His works have been performed at every great orchestral concert and festival, and comprise solo songs, choral works, cantatas, chamber music, pianoforte works, and other instrumental concertos, so there is no doubt as to his particular fitness for the task of controlling the music of the B.B.C.

The famous conductor, Mr. Percy Pitt, is the Controller of Music to the B.B.C.

A chat about the Musical Directors who have contributed so much to the success of the programmes

Mr. Dan Godfrey, Junr., the Musical Director of 2LO

Director of Music at 2LO

The Musical Director of 2LO is now Mr. Dan Godfrey, junr., who was transferred from Manchester. With four successive generations of famous conductors behind him, conducting may be said to be in his blood. His great-grandfather was Bandmaster of the Coldstream Guards in 1825, his grandfather took the first English military band to America after the Declaration of Independence, was Bandmaster of the Grenadier Guards, and had his own band on Brighton Pier for forty years, while his father is Sir Dan Godfrey, Director of the Winter Gardens Municipal Orchestra at Bournemouth.

Mr. Dan Godfrey is a practical musician, being a capable violinist, as well as being able to relate experience with that fearsome jazz instrument, the alto saxophone, which he played when in the Band of the Coldstream Guards. During the war Mr. Godfrey saw plenty of active service, but afterwards resumed his musical career, organising concerts in Bonn, Cologne and Belgium, and becoming later Conductor of the Municipal Orchestra, St. Leonards, as well as Station Director at Manchester for the B.B.C.

Birmingham

Here we have Mr. Joseph Lewis, also the son of a famous father, a conductor known throughout the Midlands, and for which reason Mr. Lewis is affectionately dubbed "Young Joe" to distinguish them. His reputation is well known for his conducting of all the great Midland choirs since 1910, and since the war he has conducted the Wolverhampton Musical Society, a body of some three hundred singers, who gave their big recital up in London, at Queen's Hall, and the City of Birmingham Choir. He is an ex-student of the Midland Institute, amongst his fellow pupils at the time being Miss Rosina Buckman and Mr. Frank Mullings. At Birmingham Mr. Lewis has founded the Birmingham Station Repertory Company, with huge success, by reason of the high standard set by him.

Mr. Joseph Lewis, the well-known conductor of the great Midland Choirs, is Musical Director at the Birmingham station

Manchester

At Manchester, the big musical centre is now under the direction of Mr. T. H. Morrison, who was leader of the orchestra there while Mr. Dan Godfrey, junr., was Director. Mr. Morrison may be regarded as one of the finest violinists in the provinces, playing in public at the early age of 7. Studying in London following his father's tuition, he went to Auguste Wilhelm, and at the age of twenty was leader of the Queen's Hall Orchestra. Subsequently he became leader of the Covent Garden Orchestra under Richter until the outbreak of war. He has played all over the world, in Japan, China and the Continent, and is one of the few musicians who had the honour of playing before Queen Victoria. Now at Manchester, he upholds the traditions of true music and some of the biggest of classical works. The members of the 2ZY Orchestra are almost all drawn from the Halle Orchestra, and for the big symphony concerts it is augmented to thirty-two members.

Cardiff

A clever all-round musician is the musical director of 5 WA, Mr. Warwick Braithwaite. Like so many of our great artists, he hails from "down under," having been born in Dunedin, New Zealand. Studying at the R.A.M. he won the Goring Thomas Scholarship for composition, and made his first professional

plunge as conductor of the O'Mara Opera Company, with whom he stayed three years. Then he joined the British National Opera Company where he did fine work not only in conducting, but as "Coach," a task which I should imagine requires the wisdom of Solomon and the patience of Job combined.

Operatic Work

To perfect his own art, Mr. Braithwaite went to Munich to study under Bruno Walter, and then, later, after the war, he re-joined the B.N.O.C., and after doing a season with the Carl Rosa, joined the B.B.C., making Cardiff one of the most prominent musical stations. He is keenly interested in British music, and his exposition of Gustave Holst's opera "Savitri" in a contemporary. was one of the clearest and most brilliant pieces of literary work.

The Director of Music at Newcastle. Mr. Edward Clarke.

Newcastle

Here, too, is a clever son of a clever father; Mr. Edward Clarke, the son of James Clarke, who was one of the principal supporters of music up in the North. Mr. Clarke, the popular Musical Director of Newcastle, has travelled all over the Continent, during the last ten years, studying under the most celebrated conductors. Amongst some of his countless achievements may be mentioned his season with the Russian Ballet at the Empire Theatre, London, his own four great orchestral recitals, two of them at Queen's Hall, and which he made unique by his introduction of works of some of the new European composers. His other work has been in Symphony, Chamber Music, Ballets, and Musical Comedy, while one has only to take but a brief glance at the programmes of 5 NO to realise the extent of his knowledge and experience.

Bournemouth

6 BM has long been made a great musical centre under the direction of

Formerly Organist at St. Mary's Cathedral, Mr. Herbert Carruthers is now Musical Director at Glasgow.

Captain Featherstone. He has had a long musical and military career behind him, having spent twenty-two years abroad, in Malta, Singapore and two extended periods in India. In the 1st Battalion of the Buffs, he went through the Chitral Campaign, the North-Western Frontier Campaign, as well as in the Great War. He has been bandmaster of the 2nd Battalion Royal Irish Rifles as well as the 2nd King's Shropshire Light Infantry. His musical experiences date from the time when at Kneller Hall he was awarded the Barrington-Foote prize for composition, for his overture "Majestic," and in addition to his countless arrangements of works for band purposes, Captain Featherstone has composed church services for choir and orchestra, incidental music,

Miss Nancy Lee, the celebrated Violinist, is Director at Aberdeen.

marches, &c., but his *chef d'œuvre* may be said to be his musical comedy produced in India, entitled "The Rani of Rupiabad," and for which he wrote libretto, lyrics, music, and produced the whole. Another great musical success was the Curragh Revue "Keep Your Eye on the Ball," and was produced at the Gaiety Theatre, Dublin. As conductor of the Military Band on Bournemouth Pier, Captain Featherstone had long been famous, and his work with the B.B.C. is too well known to need further comment.

Glasgow

This is naturally one of the great Northern centres, and here is to be found one of the most able of musicians, Mr. H. A. Carruthers, one who has been associated with music all his life. Commencing his professional career as an organist, from his boyhood upward as choir boy in St. Mary's Cathedral, his musical grounding has been of the finest. Following his appointment as organist to the Cathedral, war broke out, and Mr. Carruthers enlisted in the Royal

Captain Featherstone, the composer and producer, controls the music at Bournemouth.

Scots, later obtaining his commission in the Royal Marines, and gained the rank of Captain. He served with them in the famous (63rd) Royal Naval Division, and after the war resumed his duties at St. Mary's Cathedral, later being appointed to the principal church in the city, The Park Church, and remained here for over three years. His musical appointments include Conductor of the Glasgow Symphony Orchestra, the Paisley Philharmonic Society, and amongst many others, the symphony concerts at St. Andrew's Hall, which have been broadcast. He is one of the most earnest of musicians, and bent on making his station maintain the high standard set by him.

Aberdeen

The distinction of being the only lady Musical Director belongs to

Miss Nancy Lee, and it is doubtful whether a better choice could have been made. Miss Lee is a violinist who has gained highest honours. Studying under the eminent Belgian, Henri Verbrugghen, a great conductor as well as violinist, Miss Lee admits that she had a "thorough grounding" in all the orchestral classics. She is a Diplomee of the Athenæum School of Music and a Licentiate of the Royal Academy, while she has studied under the most noted conductors in the kingdom. She is known throughout the kingdom as a soloist, and she has certainly gained fresh lustre for the Aberdeen Station. I fancy that the secret of her success lies in the fact that she thoroughly enjoys broadcasting and does her best, therefore, to make it enjoyable.

Belfast

This, the furthest of the B.B.C.'s Stations, has already gained for itself a very prominent place in the hearts of listeners in, both sides of the water. Firstly, the programmes are wonderfully varied and arranged by a master-hand. The musical director is that well-known musician, E. Godfrey Brown. Twelve years conductor of the leading musical society in Ireland, the Belfast Philharmonic Society, as well as of the Belfast Symphony Orchestra, it is not to be wondered at that he has made such outstanding effect on the orchestra at the Station. He himself hails from Lancashire, and after studying at the Royal College of Music, in the course of his career, has conducted most of the leading orchestras in England. It is safe to say that 2BE is in highly capable hands.

An experienced musician, Mr. E. Godfrey Brown is now Musical Director at Belfast.

How to Add Extra H.T. Voltage to Your Note Magnifiers

MANY of the commercially-made receivers incorporating a low-frequency valve do not make any allowance for the addition of extra H.T. should the user desire to substitute a power valve in the last stage. This point would at first appear to show the design to some disadvantage, yet, on the contrary, the adding of extra H.T. to the last valve of such a set is as simple to perform as is the connecting of the H.T proper.

The simple connections to be explained apply only to the last stage, that is to say, if two low-frequency valves are used in the set then only one of those valves, namely, the last, receives any benefit from the extra voltage applied.

The reader will remember that the two telephone terminals of any straight circuit receiver using an L.F. stage go to the plate of the last valve and H.T. positive respectively. Now by connecting one side of the telephones to the 'phone terminal which is joined to the plate of the last valve, the other side of the telephones to the positive terminal of a battery, and the negative terminal of the battery to the remaining 'phone terminal, the voltage applied to the plate of the last valve is that of the H.T. battery proper, plus that of the extra battery. To make these points perfectly clear Fig. 1 shows a typical three-valve circuit consisting of one H.F. valve, detector and note magnifier with reaction applied to the tuned anode circuit.

Normally, that is without any extra H.T., the telephones would be connected directly between the points A and B, when the H.T. proper would apply to all three valves. By introducing the extra battery in the manner described above we place it in series with the H.T. proper and use the total voltage for our last stage, the telephones being connected as shown.

The actual battery connections for a set into which this arrangement is desired to be introduced is given in Fig. 2. The positive of the extra battery is connected to one side of the telephones, whilst the negative side is connected to one of the telephone terminals. The remaining telephone terminal is connected to the telephones.

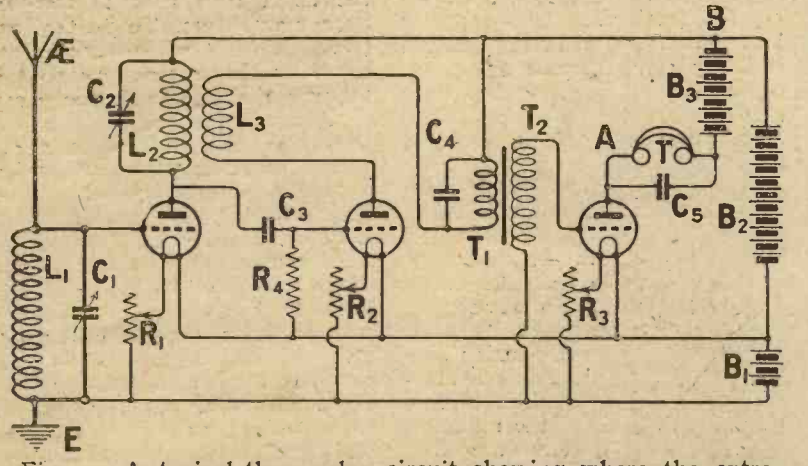


Fig. 1.—A typical three-valve circuit showing where the extra battery is to be included.

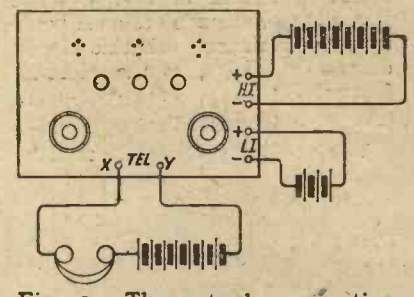


Fig. 2.—The actual connections to be made.

Upon making these connections it may be found that signals are considerably weaker instead of louder, in which case it is necessary to reverse the two connections (X and Y) to the telephone terminals of the set.

S.G.R.

NEXT MONTH:

HOW TO ADD GRID BIAS TO AN EXISTING NOTE MAGNIFIER.

A New Crystal-Valve Circuit

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

An interesting experimental circuit for the "single valver"

Fig. 1.—The new circuit is very fascinating to operate.

THERE is a type of circuit for which I recently obtained a patent, which is neither a reflex circuit nor an ordinary circuit. It does not involve high-frequency amplification, but only reaction, so that the valve does not amplify the high and low-frequency currents, as does the reflex valve in the ordinary way, but the valve is used simply as a low-frequency amplifier, and also as a means of introducing reaction into an oscillatory circuit.

A good example of this type of circuit is shown in Fig. 3, while Fig. 2 is a photograph of a set made up in accordance with this circuit diagram. Fig. 4 is the pictorial form of Fig. 3.

How it Works

The ordinary crystal receiver circuit does not, of course, involve any reaction, nor does the common type of circuit, in which the crystal is followed by a note amplifier—*i.e.*, a valve working as a low-frequency amplifier for strengthening the signals obtained from the crystal receiver. This popular latter arrangement does not, in the ordinary way, increase the range of the crystal receiver, but only strengthens the signals which already can be heard. If we could improve on this arrangement by introducing reaction into the aerial circuit, longer ranges would be obtainable and also stronger signals.

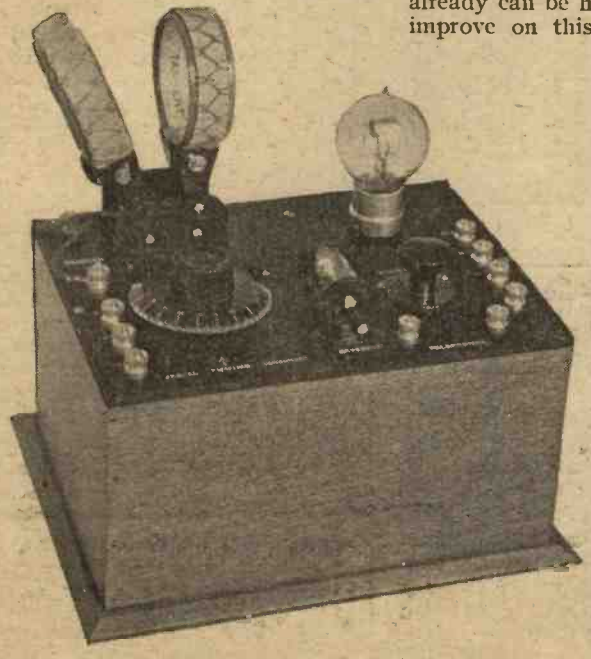


Fig. 2.—Details of a receiver built on the new circuit.

A circuit which does this is illustrated in Fig. 3, and the reference letters are the same in Fig. 4. The principal part of the aerial circuit consists of the inductance L_1 shunted by the variable condenser C_1. For ordinary broadcast wave-bands L_1 may be a No. 35 coil, or, in some cases, a No. 50, while C_1 is a variable condenser which usually has a maximum capacity of ·0005 microfarads (μF). The crystal detector D is of the usual type, while T_1 is the primary of the step-up transformer T_1 T_2. This iron-core transformer is of the usual type used in low-frequency amplifiers. To get the best results it will be necessary to try reversing the connections to the primary, and also to the secondary of this transformer. Across the secondary is the condenser C_3, which should have as low a value as possible, and certainly not more than ·0003 μF, and not less than ·0001 μF. If a sufficient reaction effect can be obtained without the condenser C_3, so much the better, but usually it will be found necessary to have such a condenser. The coil L_2 is a reaction coil coupled to the inductance L_1. The anode of the valve is connected to the aerial, and the bottom of the circuit L_1 C_1 is connected to one side of the telephones T, which are shunted by a condenser C_2 of ·002 μF capacity. The high-tension battery B_2 is connected in the position shown. It will usually be shunted by a condenser of 2 μF capacity, but this is not essential.

Operation of Circuit

The operation of the circuit is as follows: The incoming oscillations in L_1 C_1 are rectified by the crystal detector D, and produce low-frequency currents, which are passed on by the transformer T_1

T_2 into the grid circuit of the valve V. This valve acts as a low-frequency amplifier, and the low-frequency amplified currents now pass round the anode circuit, which includes the coil L_1 and the telephones T. The fact that these low-frequency currents pass through L_1 makes no difference, but when they pass through the telephones T, the latter, of course, will respond to the signals.

So far the circuit is working simply as an ordinary crystal detector followed by a note amplifier, but when we bring the coil L_2 close up to L_1 reaction will be introduced into the aerial circuit, because we have a coil now both in the anode circuit of the valve (L_1) and also one in the grid circuit of the valve (L_2). By bringing L_2 up to L_1 and retuning on the condenser C_1 louder signals should be obtained, and further ranges covered by the receiver.

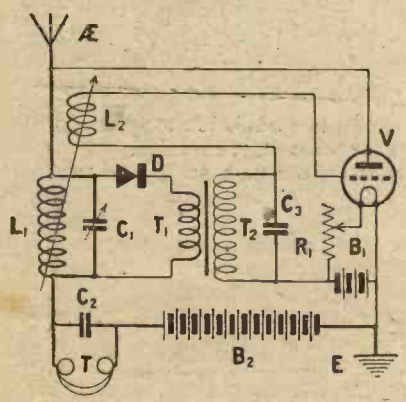


Fig. 3.—The circuit used.

It is important, of course, to see that the connections to the coil L_2 are the right way round and if an increase in signal strength is not noticed then the leads to L_2 should be reversed.

The battery B_2 may have a value of 80 volts, but this depends to some extent on the type of valve used. The circuit works well with practically any kind of valve, dull emitter or bright emitter, but different filament voltages and high-tension voltages may be required with special valves.

Advantages of the Circuit

The circuit possesses considerable advantages over the ordinary crystal and note magnifier arrangements, because of the reaction effect. It is possible to work a loud-speaker up to 5 miles from a broadcasting station with this circuit, which is very simple to operate, and gives a good volume. The results are not quite as loud as those from a well-designed single-valve reflex set, but, on the other hand, the tuning is very much easier, because there is only one variable condenser and there are fewer things to go wrong.

It is hoped that readers will send in their experiences of this circuit for the benefit of others, who are always interested in the results obtained with circuits under varying conditions.

The coil L_2 in Fig. 3 may be a No. 75 plug-in coil, but full constructional details are not given, because the results obtainable are not quite as loud as those given by a single-valve reflex set of good design. There is, however, sufficient in the circuit to justify experiments with it, and many a simpler set can easily be converted to try out the circuit with the simple addition of an extra coil L_2, which, in many cases, will already be on hand.

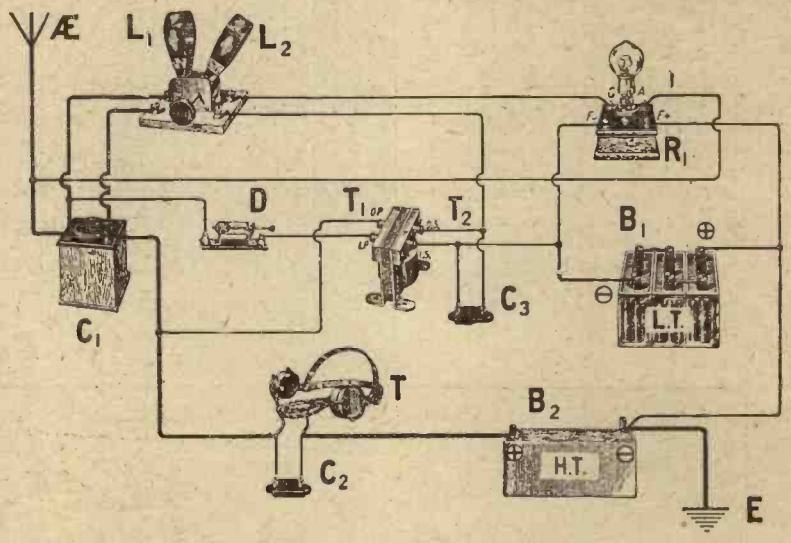


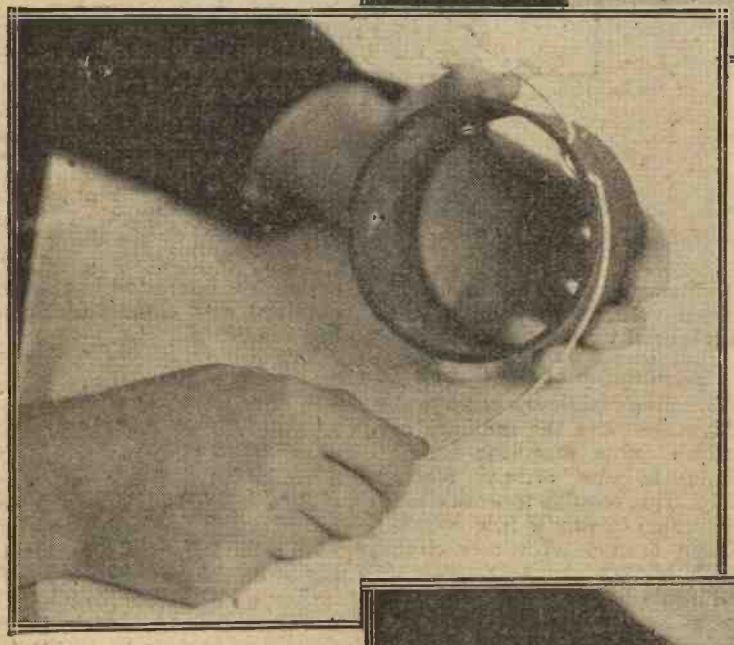
Fig. 4.—A pictorial representation of Fig. 3.

THE NEW ZEALANDERS MUST WAIT!

Hector's outlook is "All-Black."

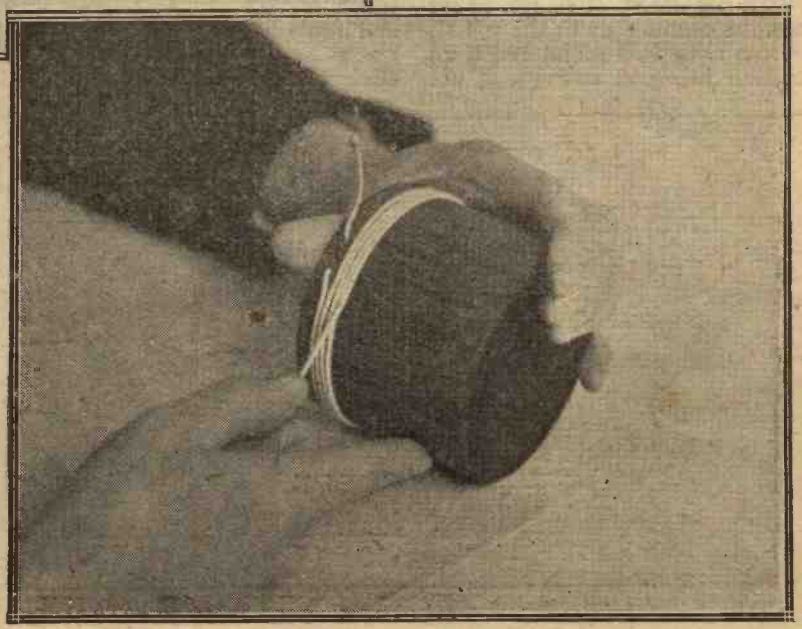
How to Wind a Thick-Wire Coil

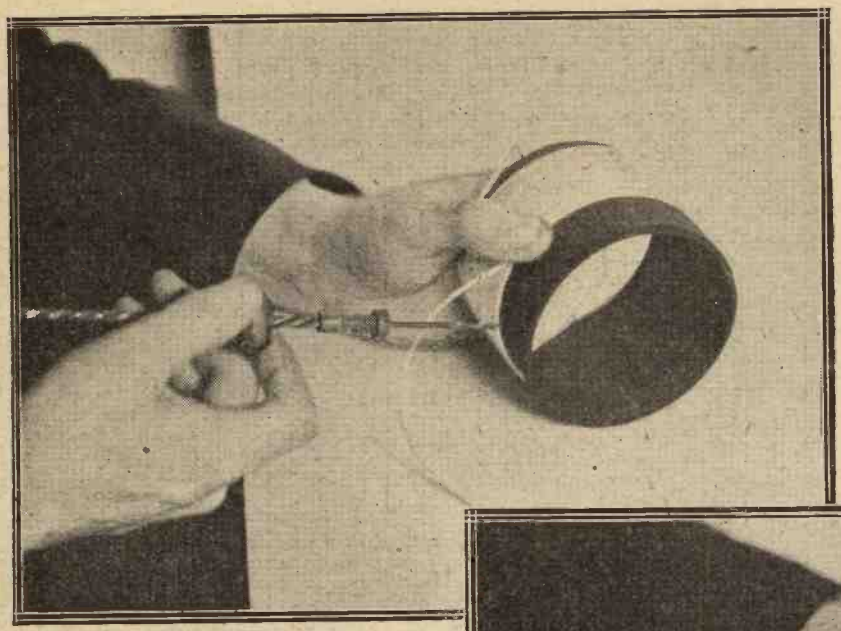
Demonstrated by G. P. KENDALL, B.Sc., Staff Editor



THE winding of a coil of, say, No. 16, wire upon a tube is not quite so easy a matter in the workshop as it no doubt looks upon paper, chiefly because the wire is so stiff that it is difficult to bend it evenly round the surface of the tube, and the starting and finishing of the coil present special difficulties. For example, it is extremely difficult to pass the wire through a small hole in the former, and then thread it through another further round the tube in the ordinary way for securing the ends, unless one knows the right way of setting about it. The accompanying series of photographs show the various steps in the operation of winding a small coil with No. 16 gauge, and we will follow the procedure through from start to finish.

First, two small holes are to be drilled near the edge of the former, and perhaps ½ in. apart. The wire is threaded through these two holes to secure it in the ordinary manner, but the method of doing so will differ from that which would serve in the case of a thinner wire. The end of the wire should be passed through the first hole from the outside of the tube towards the inside, to a length of about 4 in. The end 2 in. of the wire should then be bent back in the shape of a hair-pin, and if the wire is then pulled back towards the outside of the tube the end can be persuaded to come out through the other hole without much difficulty, the result being as shown

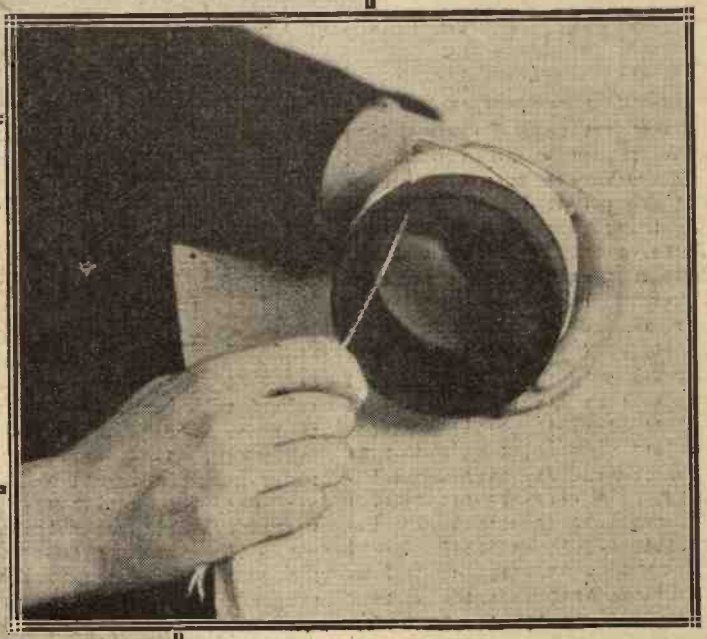


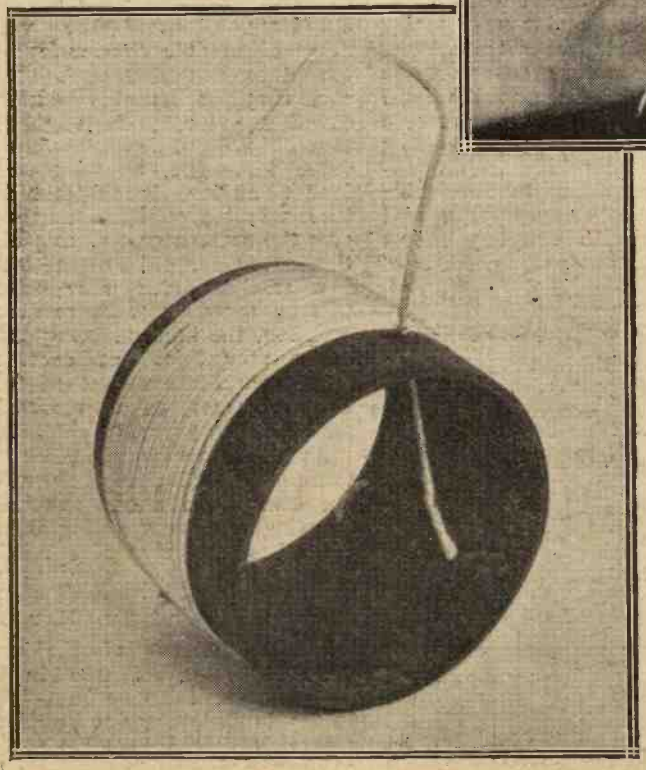


in the second photograph. The wire will then be very firmly held, and one can proceed to wind on the desired number of turns, the most convenient way of doing this being shown in the third photograph, from which it will be noticed that a very firm grip of the tube is necessary, the wire being fed through the right hand in the usual way—a somewhat tiring proceeding to the wrist.

When the desired number of turns has been wound on, the problem of securing the finishing end must be solved, and a convenient method of doing this is illustrated. Having cut off the wire with about 6 in. to spare, the last turn should be held with the thumb in the manner illustrated in the fourth photograph, while with the right hand a hole should be drilled in the tube close to the finishing edge of the winding. For this purpose it will be found that the form of Archimedean drill shown is a convenience.

The free end of the wire should then be placed down upon the surface of the





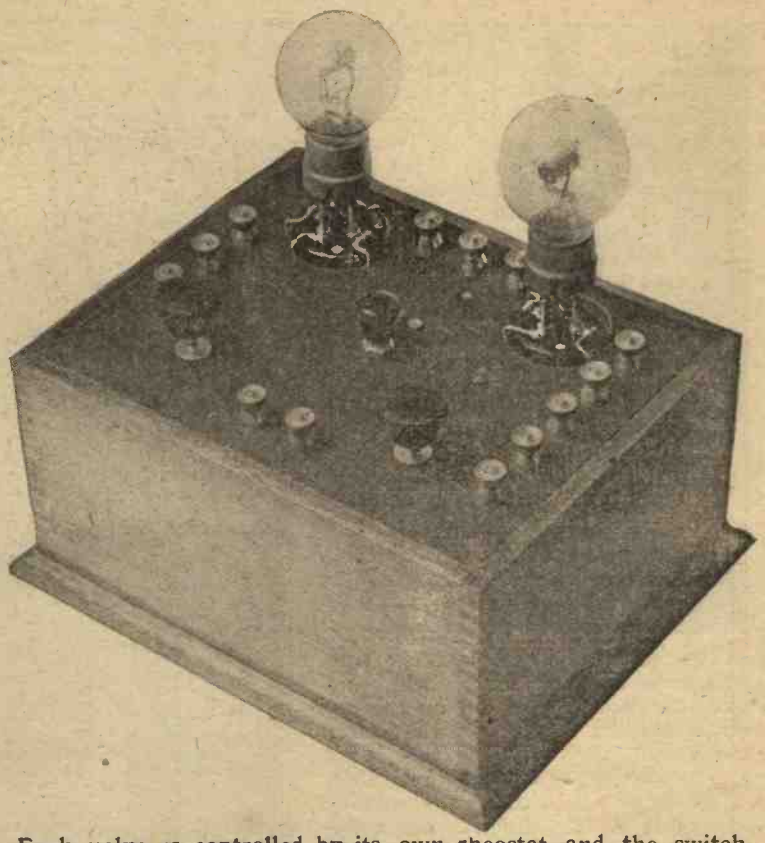
tube, following the preceding turn exactly as though one were continuing to wind the coil, and the point at which the wire crosses the hole which has been drilled should be marked upon the cotton by means of a spot of ink from the end of a pen, and the wire should then be lifted up and a right-angle bend made at this point. It will then be found that the end of the wire can be passed through the hole, and, when pulled tight, the turn will lie flat and tightly upon the surface of the tube.

This in itself does not suffice to secure the last turn firmly, and a further hole is therefore drilled in the tube about a third of the way round the circumference from the first hole. It is not possible to drill the two holes close together as when commencing the winding, since such stiff wire cannot be pulled through another hole which is so near as to involve the making of quite acute bends in the wire. It is, therefore, threaded through as shown in the last view, which will be found to provide quite sufficient security if a slight bend is made in the wire after it emerges.

Increase Your Signal Strength by Building this Two-Valve Resistance-Coupled Amplifier

By JOHN W. BARBER

A neat instrument which will give pure signals



Each valve is controlled by its own rheostat and the switch enables one or both valves to be used.

IN our last issue I showed how a reader could easily put together a two-valve note-magnifying unit in a very short time using transformers for the intervalve coupling. This was not intended in any way to serve as a permanent unit, but merely to fill a sudden demand for louder signals.

In this article I propose to tell you how to make a neat and efficient amplifying unit, the construction of which should not be considered difficult even by a beginner. The coupling employed in this amplifier is known as the "resistance-capacity" method, and has several advantages as well as drawbacks over the transformer method. Let us see what the two methods have to offer us. First of all, let me say that the prevalent idea that satisfactory loud speaking without a lot of distortion cannot be obtained with iron-core transformers is quite wrong, as also is the statement that unreproachable reproduction is bound to follow if we use the resistance-capacity method. True, some of the cheaper types of transformer cannot be made to give distortionless loud speaking, but if good instruments are used in a well-designed amplifier quite satisfactory signals are obtainable, provided that suitable grid bias voltages are applied, and that undesirable coupling effects are avoided.

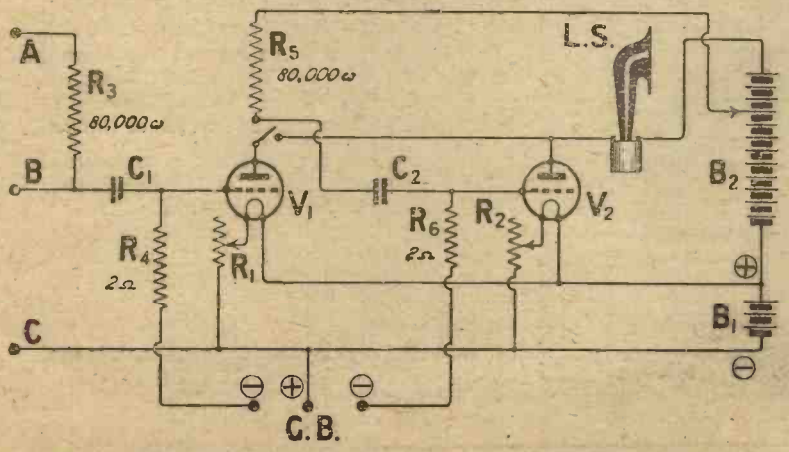


Fig. 1.—This shows the circuital arrangement of the amplifier.

Purity and Volume

Even with the best design, embodying the best components, we cannot theoretically obtain even amplification over the whole range of audible frequencies; on the other hand, we shall obtain such amplification with resistance coupling, given good design, but we shall not get the same volume, valve for valve, as with transformer coupling. Roughly speaking, three valves coupled by resistances give the same degree of amplification as two coupled by good transformers. A higher plate voltage will be necessary with resistance coupling, the increase being somewhere around 50 per cent. for most valves when changed from a transformer to a resistance-amplifier.

As regards expense, the resistance amplifier is cheaper per valve, the cost of an anode resistance, coupling condenser and grid leak being less than that of a reliable low-frequency transformer.

The Finished Amplifier

The appearance of the complete amplifier, as seen in the photographs, is very neat simplicity in design having been considered in the construction. The "in-put" terminals to the first valve

are seen on the left, and are used in a manner to be described later. Terminals for high and low-tension batteries are provided on the right-hand side of the instrument, while the pair in the front are those to which the loud speaker is joined. Grid bias terminals are seen at the back of the amplifier, the centre one being positive, while the two outer ones are negative, each applying to the valve nearest it.

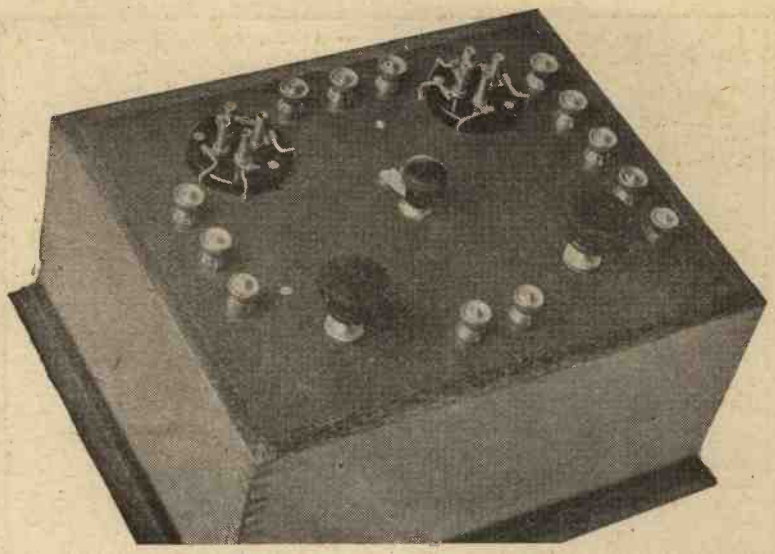
The Circuit Used

Turning now to the theoretical circuit diagram, we see that the three "input" terminals are marked A, B, and C. The anode resistance R_3 is joined across A and B, the latter also being joined to one side of the ·015μF fixed condenser C_1. The terminal C is joined to L.T.−, and to the centre (positive) grid bias terminal.

On the battery side of the diagram, we see a lead coming from the anode resistance R_3 and another from the loud speaker. The first of these is joined to the terminal H.T.+1 (Fig. 2), while the second is connected to H.T.+2. If a power valve, such as the B4, be used in the last stage, a tapping on the high-tension battery above that required for H.T.+1 will be needed on H.T.+2, thus giving a high voltage to the anode of the power valve.

The Coupling Components

The anode resistances R_3 and R_5 may be variable if desired, but in practice no great advantage is found, and a fixed resistance certainly simplifies the controls. A resistance of 80,000 ohms is suitable. The coupling condensers C_1 and C_2 may have any value from about ·007μF. up to ·25μF., and those used in this amplifier are the new type of Dubilier condenser, having a value of ·015μF.



A near view of the panel, showing the layout.

Other Fixed Condensers

It will be noticed that no condenser is shown across the loud speaker, neither is there one across the H.T. battery. I have found that most loud speakers require a certain value of condenser across their terminals for best results, and as this value is therefore a matter for experiment, it is best to try the effect of different capacities across the terminals of the loud speaker itself. When the best value has been found, the condenser may, if desired, be permanently wired into the amplifier by joining it across the "telephone" terminals.

With regard to the reservoir condenser across the high-tension battery, it is becoming a more general practice to connect this across the battery itself, so that if it be used on another set, the condenser is automatically changed also, there being then no need to have an expensive condenser tied up in each set. 2μF. is a usual value here.

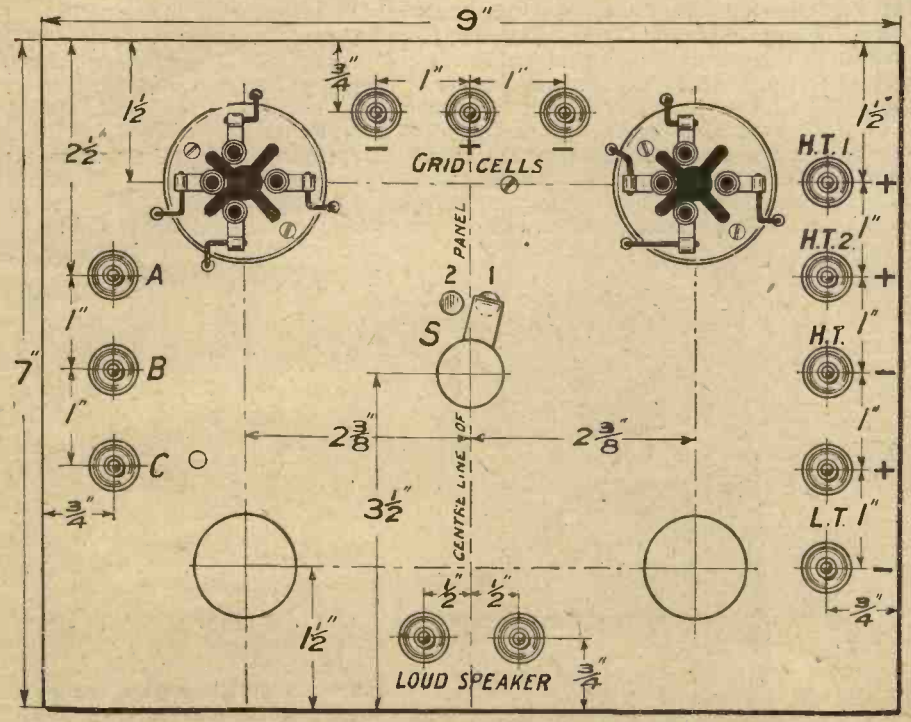


Fig. 2.—This drawing, which is exactly half size, shows the positions of the parts. Full size Blueprint No. C1010A may be obtained.

The Switch

The switch in the anode circuit of the first valve V_1 enables the amplifier to be used as a one- or two-stage instrument; all that is necessary is to turn the filament resistance of the *last* valve to the "off" position when the switch is on the right-hand (single-stage) stud. When desiring to change from one stage to two, turn on the filament of the second valve and move the switch to the left-hand stud.

Parts Used

The following is a list of the component parts

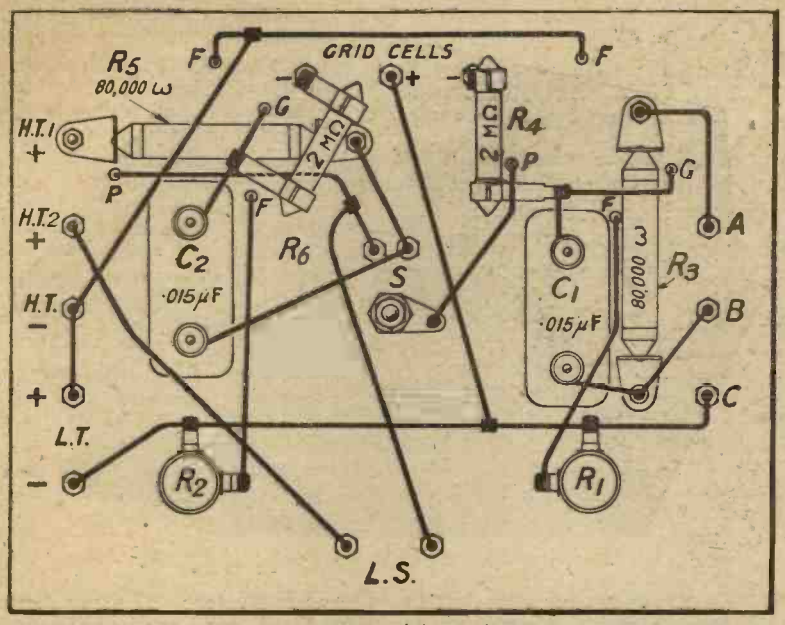


Fig. 3.—Showing the internal wiring of the magnifying unit. Blueprint No. C 1010B (full size).

necessary to build this amplifier, and for readers' information the names of manufacturers are given. It is clearly understood, however, that other makes of components may be used, provided they are of

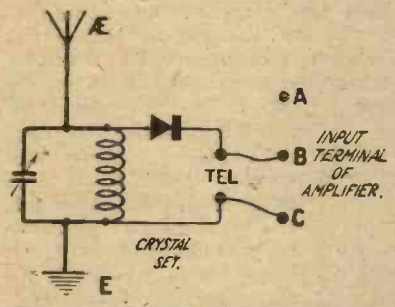


Fig. 4.—The manner in which a crystal set is joined up to the amplifier.

good quality and of the value specified :—

One ebonite panel, 9 in. by 7 in. by $\frac{3}{16}$ in. (Britannia Rubber Co.)

Two valve sockets. (Magnum.)

Two filament resistances. (Enterprise Mfg. Co.)

Two 80,000 ohms resistances. (McMichael.)

Two ·015μF. fixed condensers. (Dubilier.)

Two 2 Ω grid leaks. (Dubilier.)

Four clips for above.

One switch arm and two studs. (Bowyer-Lowe.)

Thirteen terminals. (Magnum, nickel-plated.)

Six 6 BA screws with nuts.

Drilling the Panel

The necessary holes and their location may be seen from the drawing showing the layout of the panel. In the given design only 28 holes are required, and these may easily be drilled in a short time, when the panel has been marked out. Do not use a pencil to mark the panel, as pencil lines form high-resistance leaks; comparable, according to their length, with an anode resistance or a grid leak, and serious falling off in results may quite easily be caused if this warning is disregarded. In this connection it may be of interest to readers to know that, when experimenting with multi-stage resistance amplifiers, I invariably use pieces of card with pencil lines, as both anode resistances and grid leaks. This fact may help to discourage the use of pencils as marking instruments. Use a scriber. A very good one may be purchased for eighteenpence, and will last a lifetime.

Practical Wiring Diagram

The connections necessary are made quite clear in the drawing showing the wiring, and the constructor should not experience any difficulty in following it. The photographs of the back of the panel will show the positions of the wires, and will thus help when wiring up.

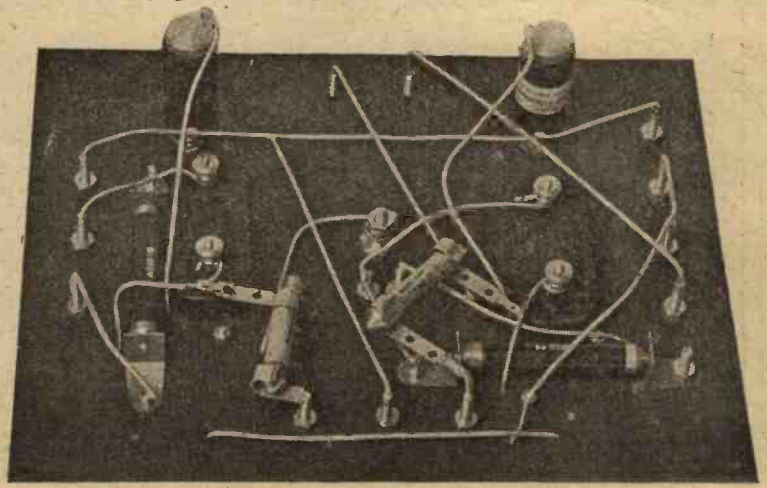
When you have finished the amplifier, you may mount it up in any suitable form of box or cabinet, to suit your own taste. I have used a flat tray type of box, as the photographs show.

Operation

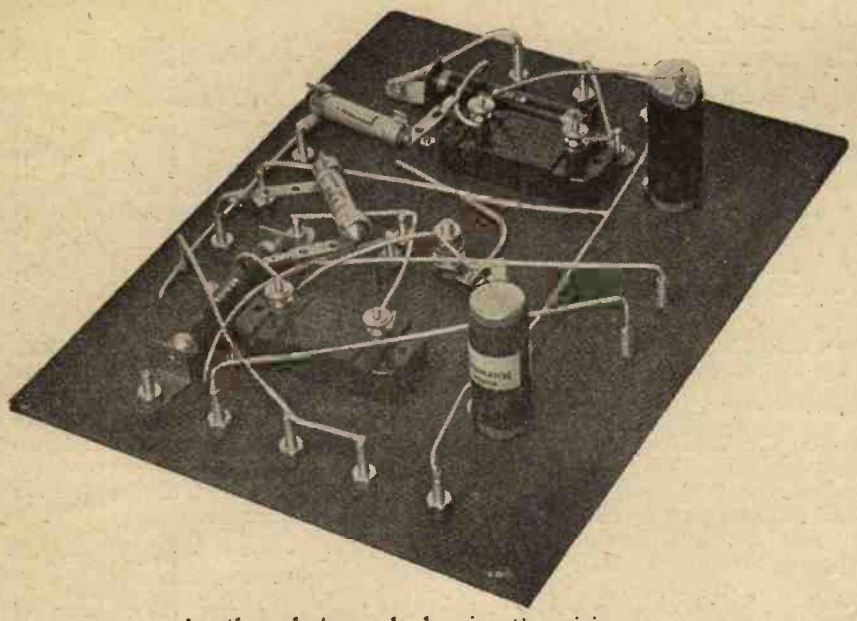
When ready for testing, the amplifier may be tried out on any set which is working at the time, whether crystal or valve, and we will deal with each in turn. Commencing with a simple crystal receiver, we have to connect its telephone terminals to the terminals B and C of the amplifier, as the diagram shows. It is necessary that the telephone terminal of the crystal receiver which goes to "Earth" should be joined to terminal C as shown. These connections put the crystal detector in series between the aerial and the grid of the first valve, which in practice is quite a good method.

Capt. Round's Method

Another method of "feeding-in" is that shown in Fig. 5. This is the method suggested by Capt. Round, in *Modern Wireless* (April, 1924), with the difference that in this case the resistance R_4 is two megohms, while in Capt. Round's circuit the value is 250,000 ohms. Very good signals are obtainable by this method, which leaves nothing to be desired as regards purity. If this



This photograph shows the positions of the various wires.



Another photograph showing the wiring.

method is to be adopted, the substitution of a half-megohm grid leak for the 2Ω one (R_4) may be tried.

Connecting to a Valve Receiver

When connecting up to a single-valve receiver, the terminal B of the amplifier is joined to that telephone terminal of the set which goes to the plate of the valve, whether through a reaction coil or

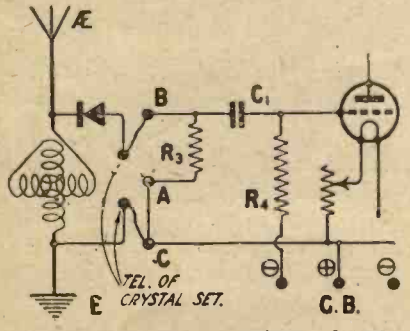


Fig. 5.—Another method of linking up to a crystal set.

not. Terminal A is then connected to the other telephone terminal, which will be joined internally to the H.T.+ terminal of the set. Terminal C is joined to L.T.− on the receiver. The connections to the single-valve set remain as before, its positive H.T. terminal being taken to a tapping on the battery. It is essential that the H.T.− and L.T.+ terminals of the receiver be joined together, and not H.T.− to L.T.−, and this point should be verified by an inspection of the internal wiring before connecting the amplifier, otherwise the accumulator may inadvertently be short-circuited. The accumulator is then joined to the single-valve set as before, and a lead taken from the positive to L.T.+ on the amplifier, the connection to C serving to join up the negative. If the H.T. battery has its negative joined to the single-valve set, no connection need be made to H.T.− on the amplifier, but a separate lead should be taken from each of the H.T.+ terminals to tapping points on the battery. The positive of a 4½ volt battery should be joined to GB+, while the two negative terminals may be joined to the − of the battery. When using low anode voltages the battery may be dispensed with, and all three terminals joined together.

Valves

Almost any good make of receiving valve will be found suitable,

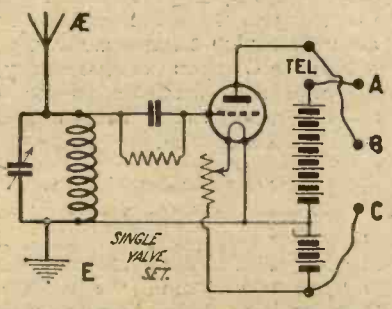


Fig. 6.—Showing how to join up a single valve receiver.

but I recommend the use of a D.E.5B or D.F.A.4 in the first socket, while any small power valve may be used in the last stage. Follow the maker's instructions regarding filament and plate voltages, but do not forget that, in the case of a general-purpose valve, the anode voltage must be increased above the maker's figure, when used with a resistance in the plate circuit. Say, for example, you used a valve in the first socket which required 60 volts H.T. according to instructions. This valve would have a resistance in series with it, and so would require a higher battery voltage to be applied before the plate of the valve was given its recommended voltage. These remarks do not apply to the D.E.5B, which is designed for resistance amplifiers.

A Test

In order to determine which telephone terminal of the existing receiver is joined to the plate socket of the valve holder, we shall need a small dry cell and a pair of telephones. One tag of the phone leads is joined to one terminal of the dry cell, and a piece of wire is run from the other dry cell terminal to the plate socket of the valve holder. The other tag of the phone leads is then touched against one telephone terminal on the set. If a loud click is heard, this terminal is the one which must be joined to Terminal B of the amplifier. If the receiver employs a reaction coil, this should be in position when making the test.

Results

Excellent loud-speaker results of great purity have been obtained with this amplifier connected to a crystal set, a single-valve set, and a two-valve receiver consisting of one stage of H.F. followed by a detector valve. Given good conditions, loud-speaking should be obtained up to 10-12 miles from a broadcasting station, using a crystal set and this amplifier. A general rule is that if signals are of good strength in the 'phones, the addition of the amplifier will give satisfactory loud-speaker signals.

NEXT MONTH:

How to Build a Choke-Coupled Amplifier

The T.A.T. Circuit Simply Explained

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

This simple explanation will make readers realise the importance of a circuit which has been received with immediate enthusiasm by all who desire long-range reception. Extraordinarily successful results by many readers all over Europe have been published in "Modern Wireless," which paper published Mr. Scott-Taggart's new circuit

THE problem of multi-stage high-frequency amplification has interested me for many years, although until recently I have written very little about the subject, chiefly because multi-stage high-frequency amplification has been in such a mobile state. The popular method of stabilising high-frequency amplifiers to stop them oscillating is to use a potentiometer, and this device was used very many years ago.

More recently there has been sufficient development to justify a review of the whole position, and this has been given in a series of articles appearing in *Modern Wireless*.

My general feeling is that there are at present three solutions to the long-distance problem. These are:

1. The supersonic heterodyne receiver.
2. The T.A.T. system of multi-stage high-frequency amplification.
3. The so-called neutrodyne circuits.

The Super Heterodyne

The supersonic heterodyne is in a class by itself, and, for best results, necessitates the use of from five to ten valves. As regards the neutrodyne type of circuit, I have done a lot of development work in this direction and have received British Patent 217,971, which is a master patent in this country for the type of circuit using several stages of high-frequency amplification with condensers for stabilising purposes, these circuits generally going under the name of "neutrodyne" receivers.

The neutrodyne circuit, however, requires careful preliminary balancing, and the inexperienced may have some little hesitation before attempting a neutrodyne set, although the circuit which has been further developed by Mr. A. D. Cowper, M.Sc., of the Radio Press staff, has afforded the simplest neutrodyne arrangement, and the use of an ordinary radio-frequency transformer, suggested by Mr. Harris and incorporated in some of his sets, has further simplified the neutrodyne.

The T.A.T. System

The T.A.T. system, which I have recently developed, is of more recent origin and possesses many advantages in various directions over all the other systems of high-frequency amplification. The greatest advantage is the ease of handling without loss of efficiency. For example, in a receiver involving two stages of high-frequency amplification, the extra stage does not involve any extra variable condenser. An aperiodic coupling is employed which gives good high-frequency amplification without any accurate tuning being necessary.

No special apparatus is necessary, although it is desirable to use a reactance, or choke coil, wound with resistance wire.

Reasons for Oscillation

The great trouble about high-frequency amplification is that, if the full effect is to be obtained, the valves tend very readily to oscillate. The position may become very difficult when two or more stages of high-frequency amplification are employed. The result is that, although everybody is anxious to have more than one stage of high-frequency amplification, very few people actually get beyond the single stage. The T.A.T. circuit makes it just as easy to have two stages of high-frequency amplification as one, and, of course, the range and power of the set are greatly increased.

Single H.F. Valves which Oscillate

One does not often hear of single H.F. amplifiers oscillating, and this is, no doubt, due, in large measure, to the fact that a very high degree of efficiency is rarely obtained. As a matter of fact, a single-valve high-frequency amplifying circuit either oscillates due to bad design or to extremely good efficiency. These apparently contradictory statements are not so when closely examined. Bad design may result in using the wrong type of high-frequency amplifying valve (*e.g.*, one with high capacity between the electrodes), or placing the coils too closely together, or arranging the two variable condensers in the grid and anode circuits near to each other or having the wiring jumbled up together. All these faults in design result in high-frequency coupling between the anode circuit of the valve and the grid circuit.

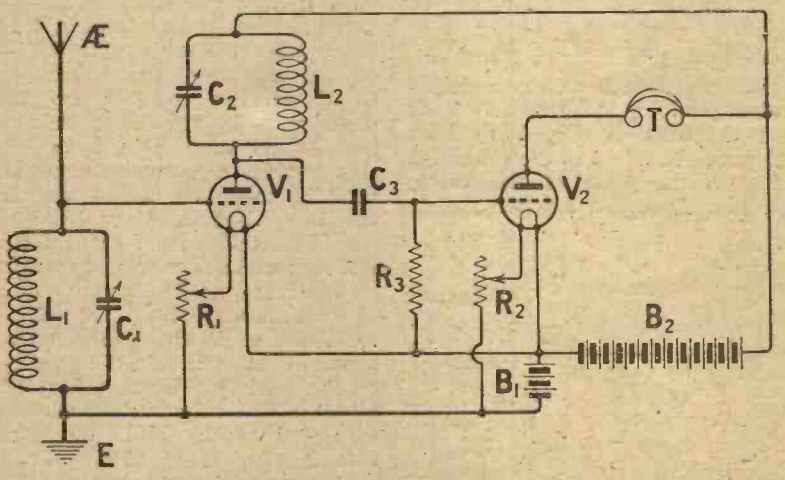


Fig. 1.—A popular method of obtaining high frequency amplification, in which the valve V_1 may oscillate freely.

"Low Loss" Components

If the experimenter goes to the other extreme, and uses low loss condensers and low loss coils, and generally arranges his apparatus to avoid losses in the oscillatory circuits, self-oscillation will readily occur, because the damping of the oscillatory circuits is reduced and the degree of amplification is increased. Consequently, the slightest reaction effect—and it is impossible to avoid a certain amount of unintentional reaction—is sufficient to start the valve oscillating.

Look at Fig. 1, for example. Here we have the first valve V_1 acting as a high-frequency amplifier, a tuned anode circuit L_2 C_2 being connected in the anode circuit. The valve V_2 acts as a detector. In many cases the anode circuit of V_2 will contain a reaction coil coupled to L_2, making the ST34 circuit, which was first published in my book, "Thermionic Tubes in Radio Telegraphy and Telephony," in 1921. Even without this reaction coil, and adhering to the exact circuit of Fig. 1, the first valve V_1 will often oscillate if the design is either very good or bad. If the design is medium, the circuit, in all probability, will not oscillate.

Effect of the Aerial

The size of the aerial also has a lot to do with the tendency of the first valve to oscillate, a small aerial giving more trouble than a large one, and a good aerial giving more trouble than a bad one. This, again, seems strange; but, nevertheless, the greater the efficiency of the circuit the more likely is it to oscillate, and the lower the values of the condensers C_1 and C_2 the greater the tendency to oscillate.

If the valve oscillates, of course all the advantages of good design are lost, and one, therefore, has to look really for some other method of amplifying which overcomes this tendency to oscillate, and the T.A.T. and neutrodyne systems will achieve this.

Stabilising Methods

The usual way of stabilising the Fig. 1 circuit is to connect the earth side of L_1 C_1, not to the negative terminal of the filament accumulator B_1, but to the positive side, or to a point on a potentiometer connected across B_1.

Let me say at once that the reason why such a circuit oscillates is because the grid and anode circuits both contain oscillatory circuits tuned to the same wavelength. If one or other of the grid or anode circuits were not tuned, then the valve would not oscillate, unless the coils in the two circuits were coupled together, as is done in the case of the usual simple single valve reaction receiver. If the coils are kept well apart, as in Fig. 1, a natural reaction effect will still be obtained, due to the capacity coupling between the coils and the condensers, and the capacity coupling inside the valve itself. If this reaction effect becomes large enough, the valve will oscillate. To overcome the reaction effect, it might be thought that a high-frequency transformer could be connected between the anode circuit of the first valve and the grid circuit of the next.

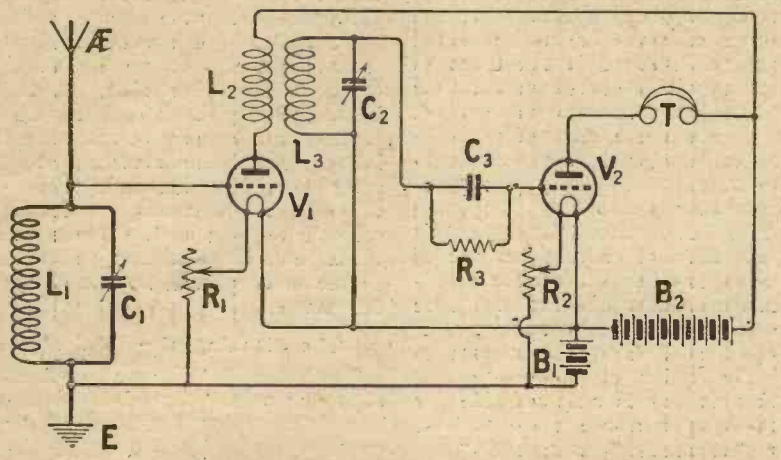


Fig. 2.—A circuit, employing a high frequency transformer, which will often oscillate as freely as that in Fig. 1.

Use of a High Frequency Transformer

This circuit is shown in Fig. 2, L_2 L_3 representing the high-frequency transformer. The secondary L_3 is tuned by means of the variable condenser C_2. A high-frequency transformer may either have the anode circuit (primary) or the grid circuit (secondary) tuned by variable condenser, but I invariably recommend tuning the secondary. If the primary were tuned, we would have a tuned anode circuit, and the valve would oscillate perfectly readily. If we tune the secondary, as shown in Fig. 2, it might be thought that since the anode circuit is not tuned, that the first valve would not tend to oscillate. As a matter of fact, it does, and very often oscillates as readily as in the Fig. 1 arrangement. The reason is that in a high-frequency transformer with a tuned secondary the primary and the tuned secondary act together like one single circuit, as far as the oscillating properties of the valve are concerned. If the secondary L_3 were wound immediately over L_2 in Fig. 2, the circuit would operate electrically exactly the same as Fig. 1. If the secondary L_3 is separated from L_2, the transformer arrangement begins to differ from the tuned anode arrangement. In the case of the ordinary high-

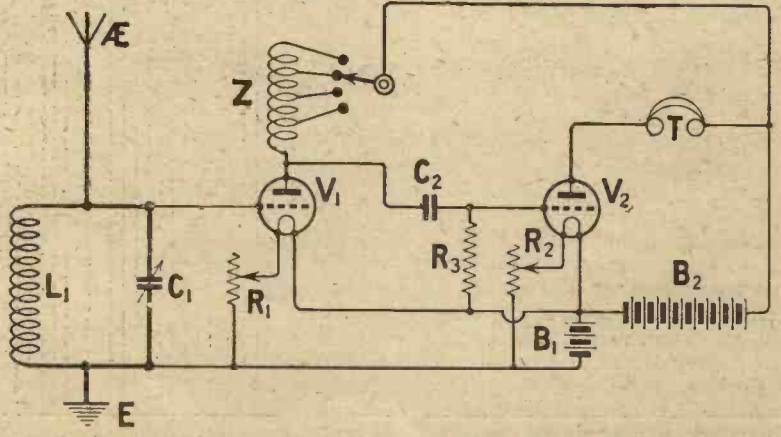


Fig. 3.—The use of a choke coil Z checks the tendency of V_1 to oscillate, but reduces signal strength.

frequency transformer usually marketed, the coupling between primary and secondary is fixed, but we could obtain a variable effect by coupling two honeycomb coils to each other and moving one away from the other. If we used such a high-frequency transformer with the coils well separated it would be found that the tendency of the first valve V_1 to oscillate would decrease, and the further L_3 was away from L_2 the more stable would the first valve be. Unfortunately, at the same time signal strength would be weakened, because of the weaker coupling between L_2 and L_3, and the energy passed on to the grid of the second valve would be decreased.

What I am anxious to emphasise is that any stage of high-frequency amplification involving a variable condenser in both grid and anode circuits will cause a tendency towards self-oscillation.

Using a Choke Coil

Instead of using a tuned circuit between the valves, we can use a choke coil, shown as Z in Fig. 3. This choke coil has tappings taken from it, and the coil itself is preferably wound, and, in fact, should be wound with resistance wire, such as No. 40 gauge silk-covered Eureka wire. The actual value of the choke is not very critical. With such a circuit there is no tendency for the first valve to oscillate, but, on the other hand, reaction is not introduced into the aerial circuit, and loss of signal strength consequently results. Moreover, the degree of amplification obtained with this method is not quite as good as with a stable tuned anode or tuned transformer arrangement. It possesses the advantage, however, of cutting out a variable condenser, and so simplifying the operation of the receiver.

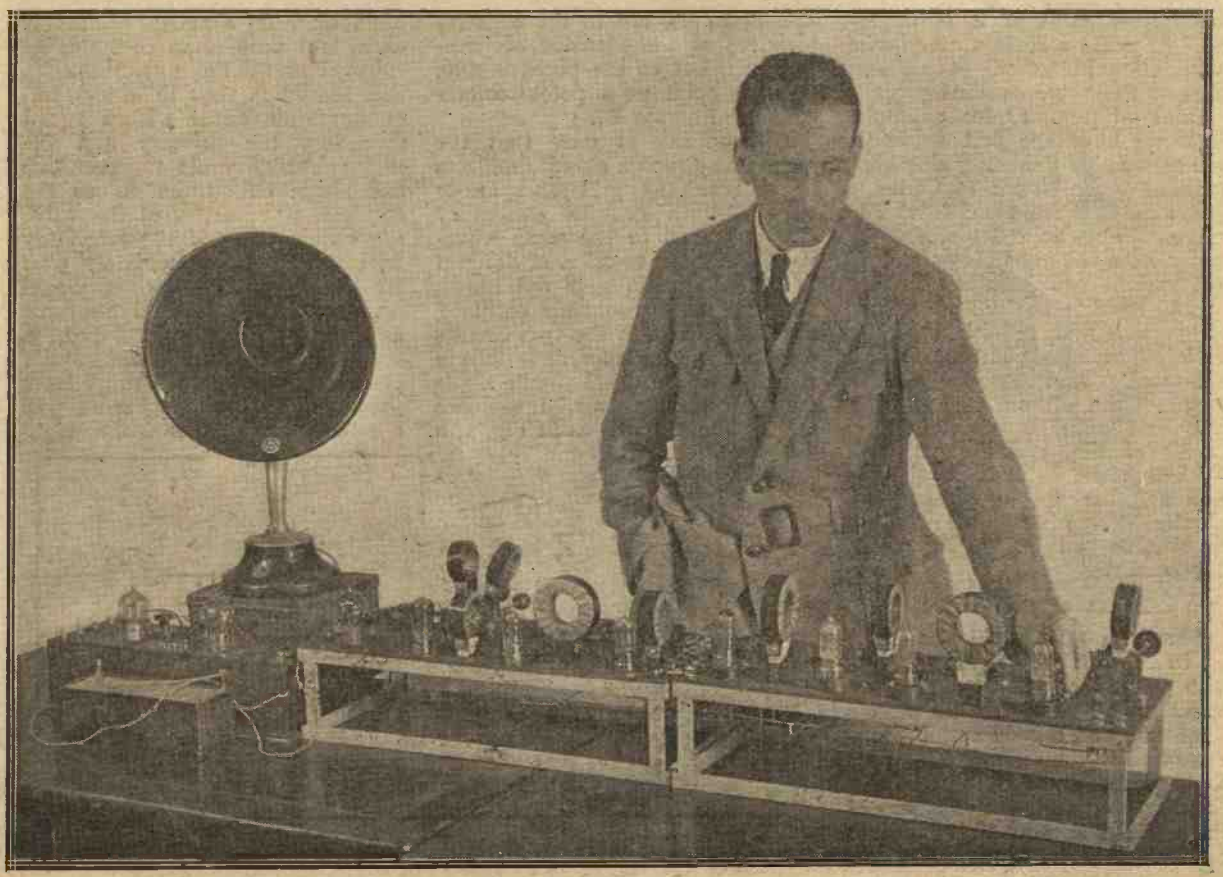
The T.A.T. circuit involves this choke form of coupling as one of the stages of high-frequency amplification, although other aperiodic coupling methods may be employed, such as a high resistance of the order of 100,000 ohms, although this is only suitable for wave-lengths above 1,000 metres. By "aperiodic" is meant "untuned."

A Three Valve T.A.T. Circuit.

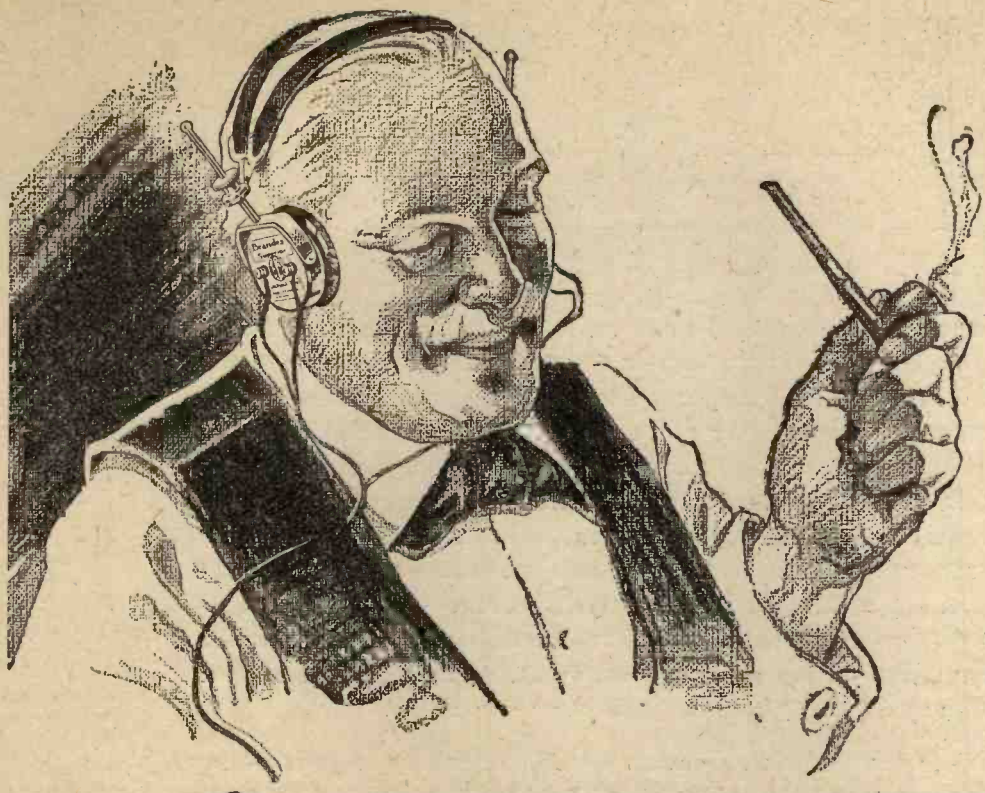
In the T.A.T. type of circuit the aperiodic form of coupling comes between two tuned circuits and an example of a simple three-valve T.A.T. receiver is shown in Fig. 4. In this case it will be seen that the usual aerial circuit is employed, but that in the anode circuit of the first valve is a choke coil Z. The anode circuit of the second valve contains the tuned circuit L_2 C_2, while the last valve acts as a detector. Reaction is introduced by including a coil L_3 in the anode circuit of the third valve, this coil L_3 being coupled to L_1. By this means reaction may be introduced into the aerial circuit and a certain amount is also inevitably introduced into the circuit L_2 C_2. A suitable tapping is taken from the choke coil Z to obtain the best degree of amplification out of the first valve.

The Meaning of "T.A.T."

The letters T.A.T. are the initials of the words "Tuned-Aperiodic-Tuned," implying that the aperiodic coupling separates two tuned circuits.



The author experimenting with a ten valve receiver, employing seven stages of high-frequency amplification by the T.A.T. method.



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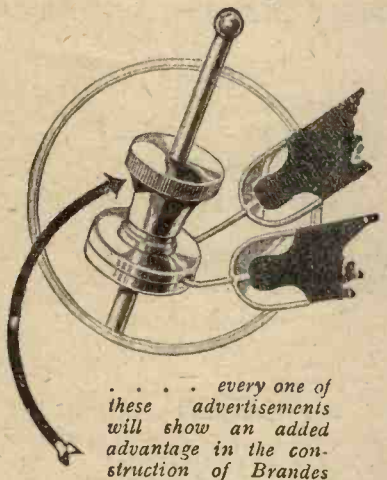

. . . . every one of these advertisements will show an added advantage in the construction of Brandes Headphones.

The lock-nut on the receiver yoke is a clutch that tightens and holds the receivers firmly in place when satisfactory adjustment has been obtained. This point prevents the receivers from slipping, keeps the headphones in correct balance without possibility of working askew and makes the headband follow the natural line of the head. The whole family can wear the headphones with comfort.

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Matched Tone means a technical improvement in telephone construction which should at once grip your attention. If you are intent on better broadcast reception, if you wish to gather the more distant signals with increased strength and clarity, then Brandes Superior *Matched Tone* Headphones are certainly what you want. Matched by ear, the two receivers of ordinary headphones cannot gain an exactly similar degree in tone and volume by a margin of eighty degrees. Brandes, matched by special apparatus, obtain corresponding sensitivity and volume in each receiver to within five degrees and a consequent increase of tone purity, accuracy and strength. For just home stations or trans-atlantic and trans-continental telephony, get Brandes *Matched Tone* Headphones. *Ask your Dealer for Brandes.*

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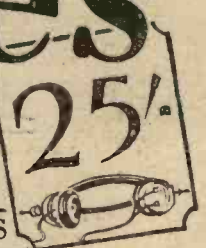


THE . SAME . SOUND . IN . BOTH . EARS

The Advantage of Choke Coupling

The idea and advantage of this choke coupling in the particular position shown is briefly as follows: If we look at the first valve alone we will find that we have a tuned grid circuit and an aperiodic anode circuit: there is no tendency, therefore, for this valve to oscillate. If now we look at the grid and anode circuits of the second high-frequency amplifying valve, we will find that the choke coil Z forms the grid circuit, although one end is connected to the positive terminal of the high-tension battery, while the anode circuit is a tuned one. The choke Z is, therefore, not only the anode circuit of the first valve, but also forms the grid circuit of the second valve. The grid circuit of the second valve is, therefore, aperiodic, and the anode circuit tuned, so that we have the exact reversal of the conditions existing in the first valve circuit. At the same time, however, the second valve cannot oscillate because the dangerous state of affairs, when there is both a tuned grid and a tuned anode circuit, does not exist.

Provision for Reaction

Both valves are consequently stable high-frequency amplifiers, and the arrangement is so stable that a separate reaction coil L_3 is necessary to obtain that degree of reaction which is necessary for obtaining the loudest signals or the furthest range.

It will be noted that no extra stabilising arrangement of any kind is employed. It must not be imagined by beginners that because there is a grid condenser C_3 in the grid circuit of the second valve that this valve acts as a detector; the gridleak R_4 has one end connected to the negative terminal of the accumulator B_1 so that there is no appreciable tendency for the second valve to act as a detector. The last valve, however, does act as a detector and the bottom of R_5 is connected to the positive terminal of the filament accumulator B_1.

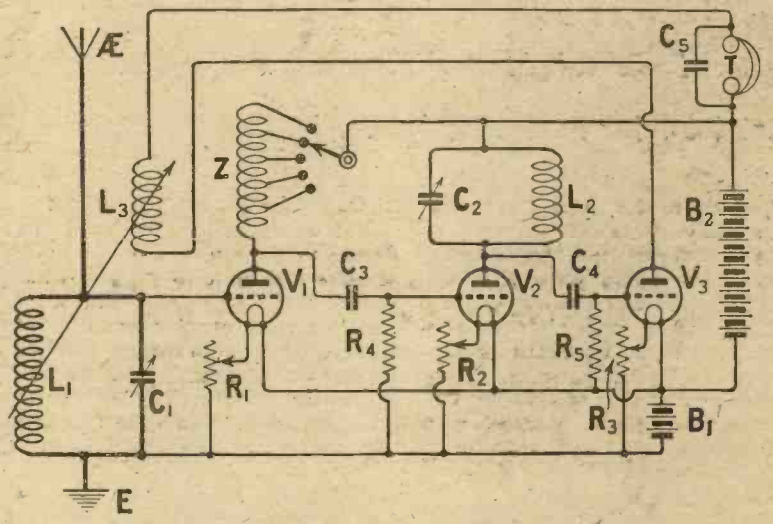
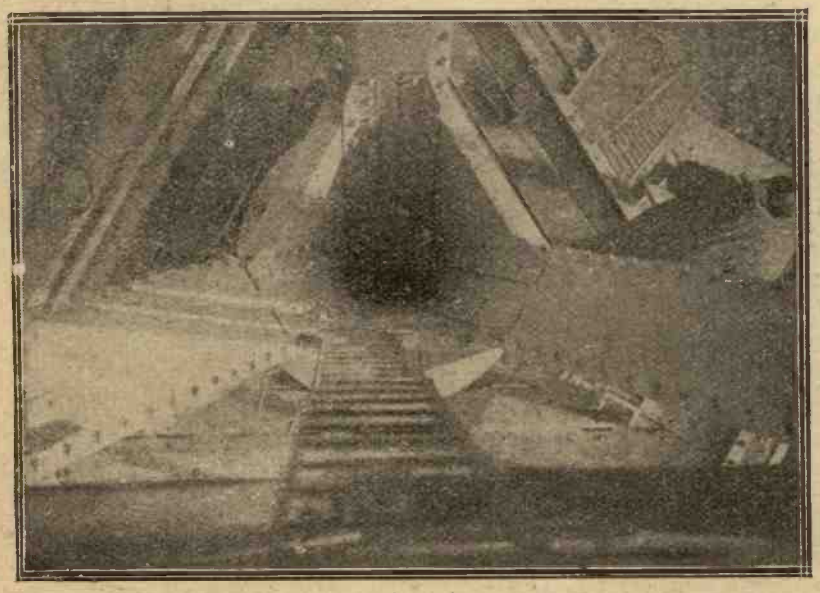


Fig. 4.—A simple three-valve T.A.T. receiver.

A Seven-Valve T.A.T. Receiver

Readers who desire a much fuller description, further circuits and details of components will have to refer to the articles appearing in *Modern Wireless*, especially in the November, 1924, and December, 1924, issues. In the January issue of *Modern Wireless* full instructions are given for building a 7-valve T.A.T. receiver in which four stages of high-frequency amplification are used, and I have reproduced in this article a photograph of a 10-valve set in which seven stages of high-frequency amplification are employed, the T.A.T. system being employed.

Suitable tapped "reactance" coils or chokes are being marketed, and there is every indication of a great popularity of this simple, yet highly efficient, type of circuit.



A view looking down one of the 820 ft. masts at the Hillmorton wireless station, near Rugby. There are eight masts, and each weighs 200 tons.

6BM Heard at Bombay on S.T. 100

SIR,—I notice in to-day's *Daily Mirror* the following sentence: "Chelmsford's broadcasting programme is being heard each night in India on a home-made three-valve set." I saw a similar announcement in the *Yorkshire Post* a few weeks ago.

May I point out to you that the wireless operator on board the motor vessel "Somersetshire" made an S.T.100 for my son (who is a cadet on board), and both of them heard the Savoy Hotel bands and the Bournemouth concerts in the early part of this year, while at Bombay.

I thought this might interest you, hence my troubling you.

Faithfully yours,
(DR.) BASIL G. EWING.

Woodhouse Hall,
East Ardsley, nr. Wakefield.

How to Erect Your Aerial

BY "HOT-WIRE"

Some enlightening notes upon a subject of interest to all readers

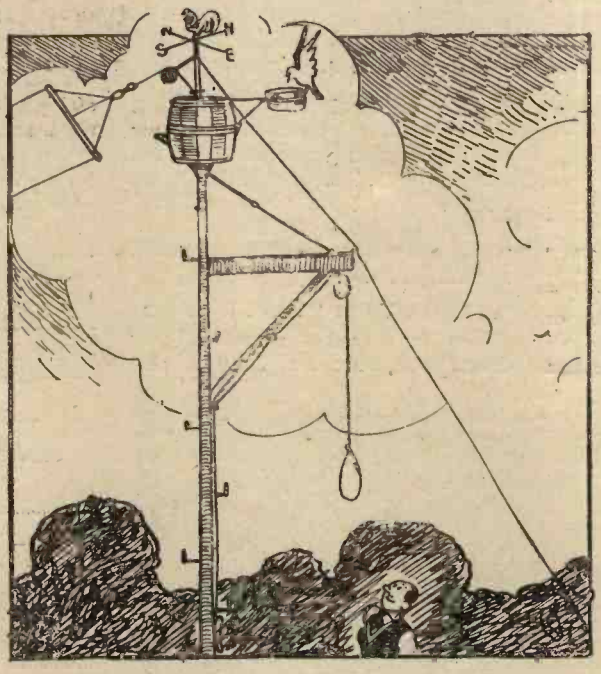
IF, dear reader, you have not already installed an aerial, the time is not far distant when you will find yourself called upon to undertake the stupendous task of raising one aloft in the grounds, garden, backyard or cat battlefield of your demesne. Supposing, again, that, following the directions of inferior writers, you have already slung up something which faintly resembles an aerial, you will, if you have any real sense of wireless decency, feel impelled to take it down and to replace it with something that is worthy of the name of aerial. I am speaking now of the outdoor aerial, whose presence is an outward and visible sign that you have bought your licence. The frame or indoor aerial is used only by poachers, pirates and other villains who, not having parted with the necessary small sum in exchange for a scrap of paper, desire, so to speak, to hide their light under a bushel.

Judge your Neighbour by his Aerial

There are many types of outdoor aerial, amongst which we may name the sausage, the bird's-nest, the umbrella, the T, the L, and the catscradle. From these you must make your own choice, remembering that a man's wireless character may be read fairly clearly from the appearance of his aerial. The fellow above whose garden a sausage floats proudly is most probably a skilled radiolar, who will tell you that he revels nightly in loud-speaker reproduction of Japanese broadcasting; all teetotalers show a preference for the T-aerial, preferably of the one-sided type; whilst if a man has an L-aerial, you may safely put him down as the L of a wireless enthusiast.

Carefully Choose your Mast

But whatever type of aerial you decide to put up, you will require at least one mast to support what is termed its free end. The word free is merely another example of the happy way in which wireless terms are chosen. Just as the condenser is so called because it does not condense, so the free end gets its name from the fact that it is anchored to a mast. Now, the question of aerial masts, rods, poles or perches is an exceedingly important one to which we must give a few moments' earnest consideration before proceeding further. Some people choose their masts without giving a thought to their effect upon wireless waves. Now, imagine for a moment that you are a wireless wave bobbing up and down about a million times a second and flying all over the place at the terrific speed that everyone knows, though for the moment I have forgotten the exact figures. Would you feel attracted by aerials suspended from masts made from fishing-rods, broom handles and things of that kind? Most emphatically not. The very sight of these things would sicken you, and you would turn aside in disgust, giving them as wide a berth as possible. On the other hand, the sight of an elegant, towering mast would so warm the cockles of your heart that you simply could not help caressing the wires so gracefully supported by it. It is for this reason that many of those who stick up ramshackle masts run about the place complaining bitterly of the weakness of their signals.



A thing of beauty is a joy for ever.

A Quick Method

There are several ways of obtaining a really satisfactory mast. One of the simplest is to plant an acorn in the middle of the tennis lawn, watering and tending it daily until a noble oak thirty or forty feet in height has grown up. This method has many advantages. In the first place, it costs nothing, secondly, it demands no digging, and, thirdly, it results in the erection of a mast stout enough to withstand even the snow-storms of an English summer. It has, however, the drawback that both time and patience are required. Most wireless people are in a hurry, wishing to hear something immediately, or even rather sooner; but the man who plants his acorn in the way described is a philosopher well content to bide his time, for he knows that broadcasting forty or fifty years from now will be a far, far better thing than it is to-day.

My Little Hatchet

Among the speedier methods of obtaining an aerial mast is that

known as the George Washington. You take your little hatchet into a neighbour's plantation and hew down his tallest pine tree. If you are fortunate, you will get away with it before he discovers his loss; but, should he arrive upon the scene in the midst of your operations, a little mopping, mowing and gibbering, accompanied by suitable demonstrations with the hatchet, will usually enable you to make good your escape whilst he rushes off in search of assistance. Quite good masts may also be acquired at dead of night from places in which building operations are in progress. Or, again, you may purchase a second-hand telegraph pole from the Postmaster-General. Telegraph poles possess great strength and, if they are fitted with those jolly little step things, you can climb to the masthead whenever you want to for the purpose of greasing the pulley. Barbers' poles look most attractive, but they are hardly long enough for real efficiency. On no account follow the example of a man I know, who in a rash moment inserted in a local paper, "Wanted immediately a Long Pole." During the next week he received no less than 317 personal applications for the job from gentlemen of Central European nationality with names like Czrxbwski or Pszrstkoff. Perhaps, after all, in your search for a wireless mast, you will be well advised to visit a neighbouring timber merchant and to acquire from him something really suitable.

The Ideal

In one of the masterly drawings which accompany this article you will see a representation of the ideal aerial mast. This should not be less than 150 ft. in height, for aerials, like grouse, venison and salaries, must be high if they are to be really useful. At the top of the mast is a little round thing-amejig, which for reasons that I do not know is called the truck. Nor do I know what its use is, but it is ornamental and it does no harm. Above this comes the weather-cock, which is most useful in enabling you to distinguish a nor'easter from a sou'wester. In conjunction with the rain gauge which may be placed at the foot of the mast, it also helps you to appreciate the reliability of the broadcast weather reports, which nearly always prophesy a monsoon, a typhoon or something of that kind when a spell of fine weather is at hand. Next we have the pulley supporting the aerial wires. Just below this is a bird-bath supported upon a neat little bracket, made at trifling cost by the inhabitant of the smithy beneath your local spreading chestnut tree. Why a bird-bath, you may ask? My answer is that it encourages habits of personal cleanliness amongst the pretty little feathered creatures, whilst providing you each morning during the operation of shaving the delightful spectacle of their matutinal ablutions. Next comes the crow's nest.

Kindness to the Birds

You may think that my mind is running rather upon birds, since

A pleasant Saturday afternoon.

I have provided you with a weather-cock, a bird-bath and a crow's nest; but you need be in no apprehension, for, though birds will bathe in the bath provided for them, it is unlikely that any barndoor fowl will take up its quarters on your weathervane, or that a crow will endeavour to rear a family in your crow's nest. The crow's nest actually is intended to be occupied by yourself during your moments of leisure. It provides an excellent means of observing from afar the approach of icebergs, submarines, rate collectors and bores. It is reached by the little iron steps made by the harmonious banger of the anvil on the lines of those, to which reference has already been made, used for the decoration of telegraph posts. Next we come to the yard arm, intended for the execution of local howling fiends. Just as the gamekeeper has his rather gruesome larder of vermin, so you should always keep the body of one oscillator dangling from the noose as a warning to others. Speaking from experience, I can testify to the fact that there is no method so good as this of ridding a district from interference. The mast is stayed by means of the main brace, which should be spliced at frequent intervals.

How to Put the Mast Up

Now I suppose that you all want to know how to erect your mast once you have purchased it and equipped it in the way described. You must first of all select the site upon which it is to stand, after which pick, shovel and crowbar should be plied strenuously for a week or two until the hole is deep enough. Do not be discouraged by the amount of digging required. Remember that should you strike oil on your way down to the bowels of the earth your fortune is made. Having finished the hole, you should engage a dozen of the strongest men in the locality to place the foot of the mast in it and do the heaving necessary to bring it to a vertical position. A body suspended from the yard arm will act as a plumb bob and help you to see that the thing is really straight. The suspension of the wires has already been dealt with fairly capably by other writers, so I will say no more on that score.

A Really Good Earth

The earth, however, is a matter of real importance, and no one so far as I know has described the proper way of installing it. Nothing is so suitable as a baby's bath, which should be buried at least three feet below the surface of the earth. Care should be taken to remove the baby before doing this, or bad howling may be experienced.

The Procedure to be Followed

Having buried your bath, the next process is to solder on the numerous wires which compose the earth lead. Another of our able illustrations shows precisely how this is done. About six feet from the point at which the bath is buried a shaft of the requisite depth is sunk in Mother Earth. Then.

with the aid of a T-square and a prismatic compass, you make a tunnel in the direction of the bath. If a supply of old bones is buried in the bath, little Fido will assist you considerably in this task. All being now ready for the final act, the earnest worker descends into the tunnel armed with a candle and a soldering iron. A rescue party fully equipped should be left upon the surface ready to come to his assistance at a moment's notice. With the aid of the candle the soldering iron is brought to the proper heat. This of course takes time, but in wireless it's dogged as does it. Each wire is now soldered on separately, and the earnest worker proceeds to make his exit. This, owing to the size of the tunnel, he must do feet foremost, the rescue party supplying the necessary raising power once his boots come into view. The entrance to the workings should be covered with a wooden lid when the soldering job has been completed. At night time the lid may be removed, in which case the shaft serves as a protection against "cat" burglars, who fall into it during their prowlings, and can be removed in the morning.

Carry on

I think that I have now said enough to show the beginner exactly how to proceed so as to obtain the finest of aerials. It is up to him to carry out my instructions conscientiously, in which case his aerial will be the talk of the neighbourhood. Should he be so misguided as to follow the directions given by those inferior writers to whom I have made previous reference, he has only himself to blame if he finds it necessary to draw a long bow in order to obtain really satisfactory reception from Brussels or Lisbon.

How to Make a Useful Extension Handle

THE effects of hand capacity sometimes make a set extremely difficult to tune, particularly when reception is being done upon very short wavelengths. With your hands on the controls you succeed after long

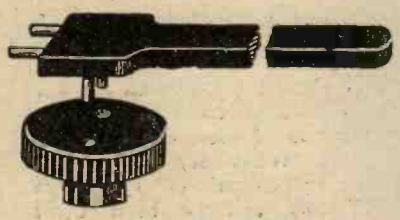


Fig. 1.—Using the handle in a horizontal position.

labour in bringing in the desired signal; satisfied, you remove your hand, and as you raise it the signal fades out. If the effects of hand capacity manifest themselves when you try to make fine adjustments, rendering sharp tuning difficult, if not impossible, the best way out of the difficulty is to provide some means of operating the controls from a distance. The most obvious means of doing this is to fit some form of extension handle. Now, there is one great drawback to the long, fixed handle. Its sweep is so big that there simply is no room for it on many sets. If it were fitted it would foul valves and other components on the top of the panel, and were there several such controls matters would become very much worse.

Necessary Materials

Here is a very simple contrivance, easy and inexpensive to make, which solves the problem in a most satisfactory way. As is seen by an examination of the drawings, it consists of a spade-shaped piece of ebonite, some 6 in. or 8 in. in length (or longer if required), provided with two sets of prongs, one set being on one of the faces of the spade portion whilst the other is situated at the end. In the control knobs of the set holes are drilled into which the prongs are a good fit. Where there is plenty of room the handle may be used horizontally, as shown in Fig. 1, but if space is cramped any knob may be turned with the handle in a vertical position, as shown in Fig. 2.

Making the Handle

Fig. 3 shows the way in which the handle is made. A piece of ½ in. ebonite is cut out to the shape

Fig 2.—How the handle is used when space is limited.

indicated, the edges of the ½ in.-wide portion which forms the handle being rounded off. In the end drill and tap two 6 B.A. holes ½ in. apart. The proper drill to use for this operation is a No. 41 Morse size. Make these holes about ⅜ in. deep. It does not matter if they are a little more or a little less so long as screws can be fixed firmly into them. Insert a ⅜ in. or ¾ in. 6 B.A. screw into each and cut off the heads. Next, drill and tap two similar holes the same distance apart in the face, inserting another pair of screws and cutting off their heads as before. The handle is now ready for use. Remove your control knobs from the set and in each of them drill two 6 B.A.

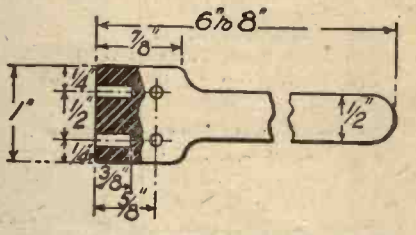
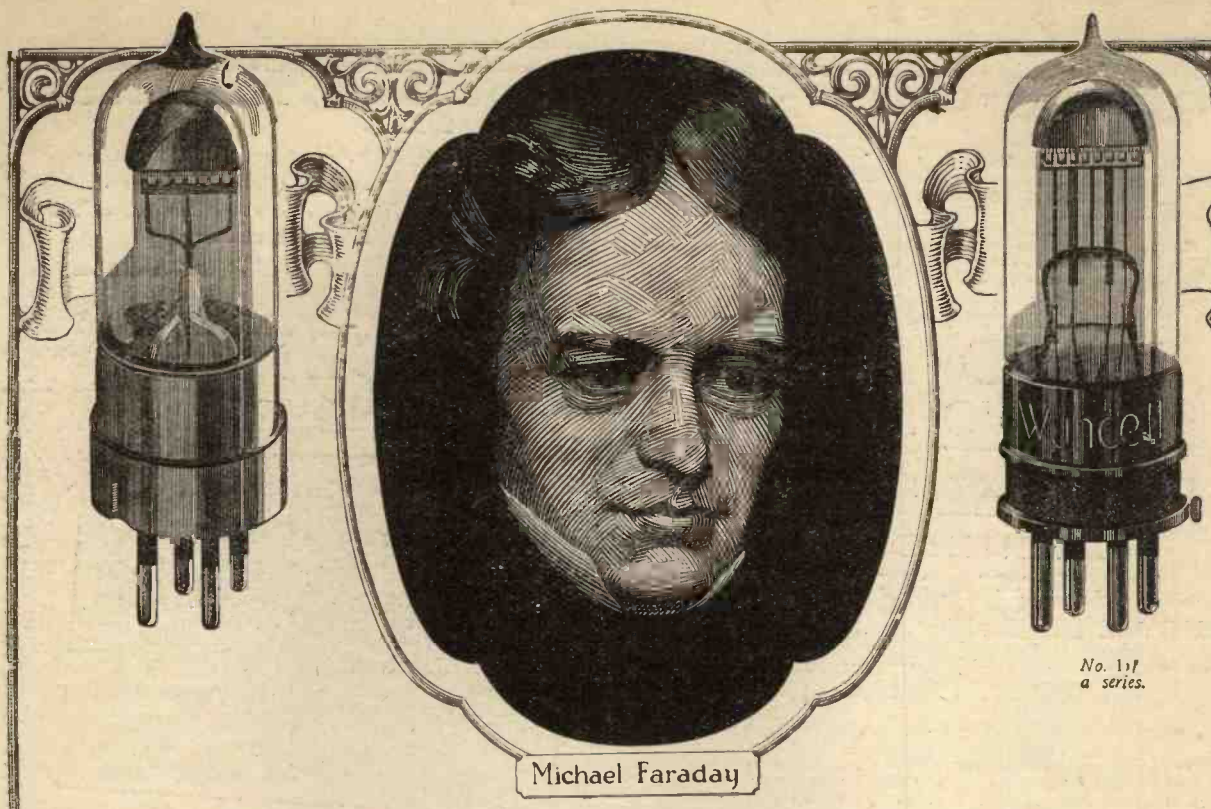


Fig. 3.—The dimensions of the extension control.

clearance holes spaced ½ in. from centre to centre. The drilling size is No. 34 Morse. Replace the knobs, and you will find when next you use the set that the handle will help to reduce undesired capacity effects. The great advantage of this type is that it is necessary in most cases to make only one handle which serves for all controls. Of course, if you require to adjust two condensers simultaneously, a pair of handles should be made.



Michael Faraday

No. 1 of a series.

The birth of a great idea

TO Michael Faraday we owe the discovery of induced currents. From his first simple experiment of winding two lengths of silk-covered wires around a wooden cylinder, and placing in circuit with the one a simple battery and between the ends of the other a galvanometer, has sprung most of the great electrical achievements of to-day. Without Faraday's masterpiece there could have been no electric motors, generators or transformers—in fact, the complete structure of electricity is closely interlocked with the corner-stone of electro-magnetic induction.

Truly the birth of a great idea from one simple little discovery.

And in its way the invention of the Cossor Valve provides a striking analogy. Here you see the inventor carefully considering the action of the thermionic valve. How its whole success is bound up in the efficient use of the electron stream given off by the filament. He, too, gets a great idea. If electrical measurements so conclusively prove that losses in electron emission mean losses in signal strength and sensitiveness, then why not re-design the Valve to keep these losses down to a minimum?

And so you see the inventor's dream crystallised into practical reality with the familiar arched filament almost totally surrounded by the hood-shaped anode of the Cossor Valve.

Reduction in Price of all Cossor Valves

Bright Emitters:

P1 11/- P2 11/-

Wuncell Dull Emitters:

W1 18/- W2 18/-

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Cossor Valves

Advertisement of A. C. Cossor, Ltd., Highbury Grove, N.5 *Gilbert Ad. 2064.*

Freak Crystal Receptions

SOME NOTES ON INTERESTING PHENOMENA

By THE EDITOR

THIS is an article I have been burning to write for a long time. It may possibly damp the ardour of some enthusiasts, but, on the other hand, I think it will save a great deal of disappointment to those who imagine that it is possible for them to obtain results equal to those obtained by a few people in quite different circumstances.

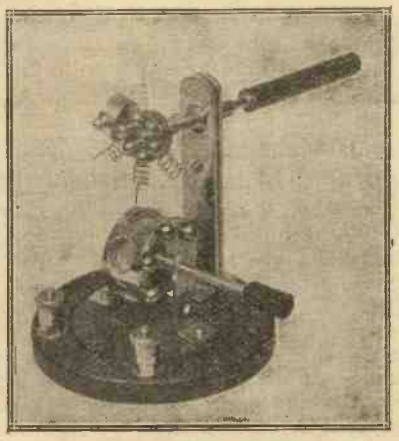
A Classification

Although there are thousands of circuits, and all kinds of conditions and combinations of apparatus possible in the making of a wireless receiver, we can still divide receivers into two main divisions—amplifying and non-amplifying. As most readers know, we can magnify high frequency current set up in an aerial by the incoming waves before they are rectified (or "detected," as we say), or we can magnify the signals after they are detected. The first method is called "high frequency amplification" and the second "low frequency amplification." A detector valve, too, itself magnifies, and the signals we obtain when using a valve detector depend for at least some of their energy upon the high-tension battery which supplies the anode, or plate, current.

Crystals Do Not Amplify

In the case of the crystal detector, however, we can deal only with the currents set up in the aerial by the waves from the station which we are receiving. We add nothing whatever to them by the crystal action. There is no auxiliary current supply, such as we have from the high-tension battery in the valve detector, and before the crystal will operate or give signals good enough to identify, the current set up by the waves in the aerial must reach a certain strength. If however, we have amplifying valves before the detector, almost incredibly weak currents can be magnified up to such a strength that they give far louder signals than we can obtain with a straight crystal detector much nearer the station.

That is a kind of preamble to my article. The next matter I want to bring to your attention is the question of range of a broadcasting station. The waves, as you know, radiate in all directions from a broadcasting station, and we might suppose that all equal-sized aerials situated on the circumference of a circle of which the broadcasting station is the centre, would receive a current of equal strength. Those of us who design crystal receivers are in the habit of indicating that we do not recommend them for use at distances of over 10 or 15 miles from a broadcasting station. We say this because in our experience 10 or 15 miles is



A good crystal stand for the experimenter. Crystals and catwhiskers can be changed in a moment.

the maximum distance in *average* conditions at which satisfactory strength can be obtained. If we draw around the broadcasting station a line which traverses a large number of stations all of which are receiving equal signal strength from a particular broadcasting station, this ring will be by no means a perfect circle. As a matter of fact, it will take a very weird shape, sending out tentacles in some directions, having severe contractions in others and even including in its embrace small areas in which nothing whatever can be received. I am assuming, of course, for the purpose of argument, that all the stations through which we are passing a line, have aerials of equal size and shape, and possess equally efficient receiving apparatus of a non-amplifying character.

A Curiosity

I have just mentioned that the irregular area may contain spots where nothing whatever can be heard. These are called "dead-spots."

Why the spots should be dead is difficult to determine. Sometimes, however, the reason is clear—there is local screening by a mountain, cliff or hill. In other cases the area seems quite open and free from obvious screening, and no satisfactory solution to the problem has yet been found.

It is now beginning to be recognised that besides "dead" spots there exist "live" spots—that is to say, areas in which the reception from a particular station is exceptionally good. These live spots may be some distance outside of the normal ring to which I have referred.

Freak Nights

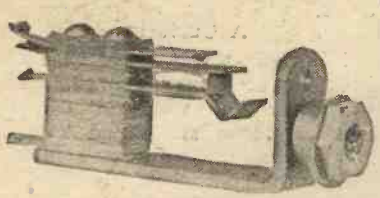
All of this long-distance reception on crystals is done at night. On some nights conditions are extremely favourable for long-distance reception on both amplifying and non-amplifying detectors. On other nights nothing whatever from a distance seems to come through. America can sometimes be heard with a single valve. On other nights the most elaborate multi-valve super heterodyne receiver will not bring in a single dot. Thus do conditions vary.

Erratic Results

I could write a great deal on freak reception, but I hope I have said enough to indicate that long-distance reception with crystal receivers (unaccompanied by magnifying valves) is an extremely erratic affair, depending upon abnormal conditions, suitable location, and a whole lot of things quite apart from the crystal itself. No crystal amplifies. It can deal only with the currents already present, and there is not a single crystal on the market which gives anything approaching the signal strength obtainable with a single valve detector using reaction.

In conclusion, do not think that I am saying that all crystals are the same. Some are decidedly better than others. The whole object of this article is to put exaggerated claims in the right perspective and to safeguard you against disappointment.

Switching with Jacks and Plugs



A "single-filament" Jack

The plug within its shield

By R. G. STANLEY.

PROBABLY one of the most convenient forms of switching in or out those valves in a receiver which are not required for immediate use is the employment of jacks and plugs. Though used very extensively in American receivers, they have not as yet attained very great popularity in this country, due very probably to the fact that few constructional writers have incorporated them in their sets, and also because they are not suitable for use in high-frequency circuits. For L.F. switching however, they are admirable. The most commonly used jacks are four in number, bearing the following definitions: (1) The "single closed" jack, (2) the "single filament" jack, (3) the "single open" jack, and (4) the "double filament" jack.

The "Single-Closed" Jack

Taking as our first example the "single closed" jack, this permits either the telephones to be plugged into the plate circuit of the last valve of the number required, or else will, with the plug removed, complete the circuit to the next stage, and is connected as shown in Fig. 1. The method of switching the L.F. stages in Mr. Harris's "Anglo-American Six" is similar to this.

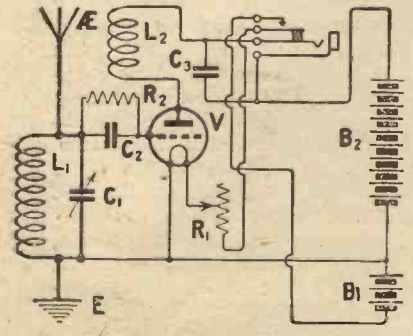


Fig. 2.—In this circuit a "single-filament" jack is used for lighting the valve when the telephones are plugged in the circuit.

The "Single-Filament" Jack

The second, or "single filament" jack, is rather more complicated in its connections and permits the telephones to be plugged into circuit, at the same time switching on the L.T. circuit for lighting the valve. As an example of its use, Fig. 2 shows a simple single-valve circuit using reaction, and it will be seen that by pushing in the plug the filament circuit is completed by the lifting of the two upper contacts, whilst the telephones are placed in circuit by the plug making contact with the spring leaf and with the sleeve.

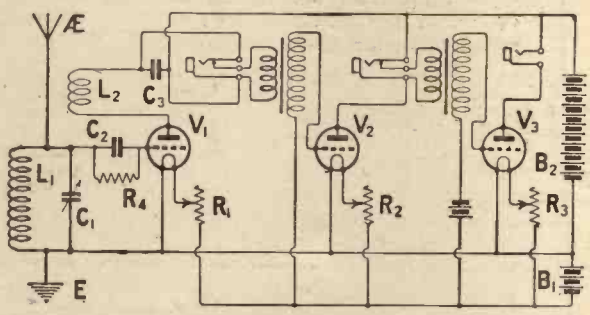
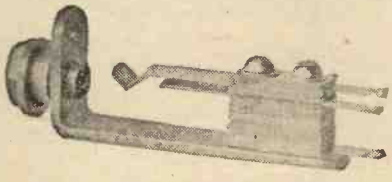


Fig. 1.—The first two jacks are "single-closed," whilst the third is a "single-open" jack.



A "single-closed" jack.

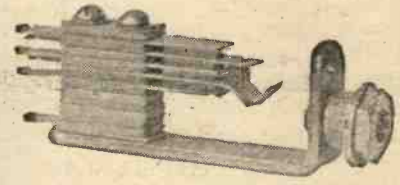
The "Single-Open" Jack

The "single open" jack is the simplest of any and acts as a "one way" switch such as would be used in a crystal set for switching in or out the telephone receivers; by pushing the plug home the telephones are in circuit, whilst with plug out the telephones are disconnected. Fig 3 shows its connections.

The "Double-Filament" Jack

The "double filament" jack is the most complicated of the four being described, and its purpose is to connect up intermediate stages of valves when it is desired to control the L.T. circuit in addition to connecting the telephones in the desired position. In all there are six contacts on this jack, and the method for using them is shown in Fig. 4.

In this circuit it will be seen that we have three separate jacks, the first being a "single closed" jack, the second a



A "double-filament" jack.

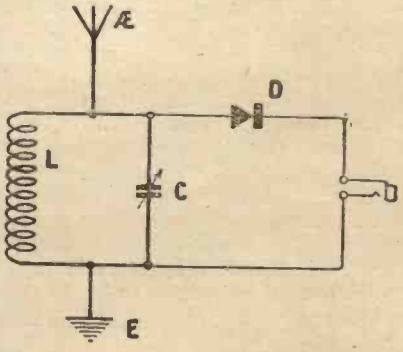


Fig. 3.—Using a "single-open" jack in a crystal circuit to plug-in the 'phones.

"double filament" jack, and the third a "single filament" jack. The circuit itself is that of a simple two valve low-frequency amplifier using transformer coupling, and it will be observed that when the plug is in the "single closed" jack all valves to the right of that jack have their filament circuits broken and are also out of the main circuit. With the plug in the "double filament" jack the filament of V_1 is lighted and the plate of the same valve is connected to H.T. positive through the telephones.

By putting the plug into the "single filament" jack, contact is made to bring into circuit the filaments of both valves, whilst the plates of both valves are connected to H.T. positive by way of the "double filament" jack and primary of the second transformer, in the case of the first valve, and by way of the "single filament" jack and telephones for the second valve.

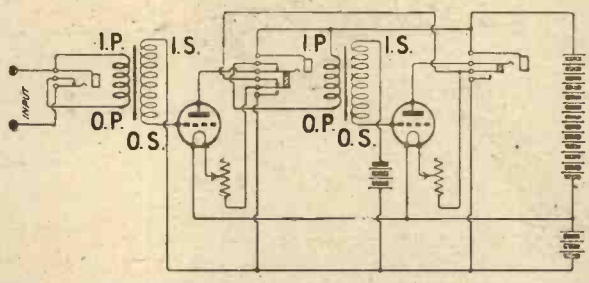
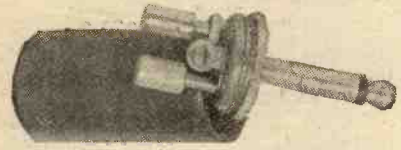


Fig. 4.—A two-valve L.F. Circuit, the first jack being a "single-closed" jack, the second and third being "double-filament" and "single-filament" jacks respectively.



The plug removed from its shield showing how connection is made.

There are, of course, many other uses to which plugs and jacks may be put, but for the purposes given above they perhaps serve their greatest utility.

The Plug

Irrespective of whichever jack is used, the plug which completes the various connections remains the same. This consists of two nickel-plated brass rods one within the other, one being a little shorter and insulated from the other. The photographs of the plug show at the point a little black ring which is actually a short section of the ebonite insulation exposed to prevent short-circuiting between the two rods as the plug is pushed into the sleeve. Contacts from the two rods are taken to two terminals which, when the connections are made, are protected by the ebonite shield, the two connections being brought out through a hole in the shield.

Simplicity

The judicious use of plugs and jacks does much to simplify the operating of a receiver in which it is desired to be able to switch certain of the valves. The space occupied by the jacks on the face of the panel is decidedly less than that taken by the majority of suitable switches, while the space required at the back of the panel is practically the same.

Further, the one movement of plugging-in the number of valves it is desired to use is far more simple in operation than that of "throwing" the switches to give the desired combination.

Watch Your Accumulators!

NO accumulator is fool-proof. Neglect of these accessories may cost you pounds. Here are some points to note.

* * *

1. Guard against evaporation. If the electrolyte (that is, the acid) falls below the level of the top of the plates, these latter may be injured.

* * *

2. Keep a bottle of distilled water handy to "top up" the cells when the level falls. Keep the plates just covered. Never use tap water. The salts in it will ruin the plates. Only use acid to replace acid spilt, and then only with expert advice.

* * *

3. When the valves begin to dim, get your accumulator re-charged. Do not try and get the "last ounce" out of the battery. This applies particularly to dull emitter valves, which can still be made to work after the battery has been discharged too far.

* * *

4. Never leave the battery in a discharged condition. This will inevitably ruin the battery. If you are going to leave your set unused for a few weeks, get the accumulator recharged at once, even if "there is still something in it."

* * *

5. Keep the accumulator in a cool, but not too cold, place.

* * *

6. Never flick a wire across it to see if there is a spark. It is no indication of the condition of the battery, and will always do harm.

The controls only are mounted on the outside of the panel, the valve being inside.

Build this Sharp Tuning Single Valve Receiver

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

THE photographs of the receiver to be described show that three plug-in coils are used, the purpose of which is to make tuning extra selective in those districts where interference is experienced from either the local broadcasting station or other sources. Further the number of broadcasting stations is becoming so large that the elimination of undesired transmissions is already difficult unless some selective device is used in the tuning circuit, and in order to satisfy this condition in the receiver illustrated the aerial circuit is inductively coupled to a secondary or closed circuit.

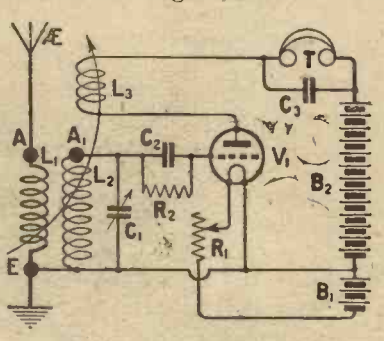
Inductive Coupling

The various forms by which such indirect coupling may be obtained are, first, that in which the aerial circuit consists of a few turns of wire wound over the secondary circuit and untuned; secondly, that in which the coupling between the aerial and secondary circuits may be varied, either the aerial or secondary circuits or both being tuned, this latter arrangement being what is commonly known as loose coupling.

Selective tuning in the receiver under description is obtained by means of using loose-coupled semi-aperiodic aerial tuning, which simply means that the aerial circuit, consisting of a plug-in coil, is untuned, and is variably coupled to a secondary or closed circuit, consisting of another plug-in coil, which *is* tuned. A glance at the circuit will make quite clear exactly what is meant, when L_1 represents the semi-aperiodic aerial circuit and L_2 the tuned secondary or closed circuit.

The Circuit

In those cases where loose-coupling is used in valve receivers for aerial tuning purposes there arises the interesting question of how to apply reaction. First, the reaction coil may be coupled to the aerial coil (in this case L_1), secondly, it may be applied to the secondary coil (L_2), or one may use the method known as the "split secondary"; this latter arrangement means that



The circuit diagram of the receiver.

the secondary coil (L_2) may be divided into two halves, one-half being coupled to the aerial coil and the other half being coupled to the reaction coil. This method, though without doubt a very excellent one, has the disadvantage, when using plug-in coils, that it necessitates the use of two two-coil holders, one being for the aerial coil and one half of the secondary, and the other for the reaction coil and other half of the secondary; it is also necessary to have a larger supply of coils than the average reader is likely to possess.

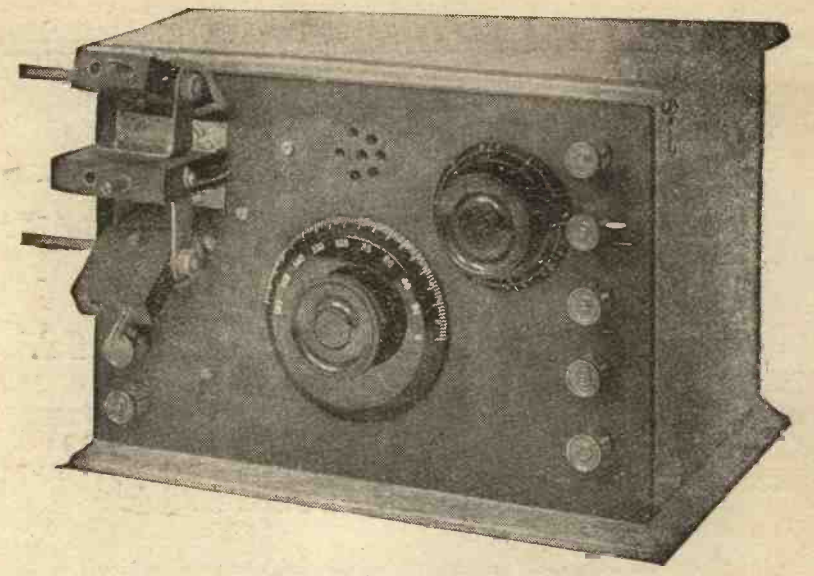
The manner in which reaction is obtained in the receiver illustrated is by coupling the reaction coil (L_3) to the secondary coil (L_2), and the reason why this arrangement was chosen was in order to allow the receiver to be used with single-circuit tuning, still employing reaction without the need for a change-over switch. Had the reaction coil been coupled to the aerial coil (L_1) then, when using single-circuit tuning, the change-over switch would have been necessary to connect the top end of L_1 to the grid of the valve and to disconnect the coil L_2 from the circuit.

Terminal Arrangements

The general appearance of the receiver may be gathered from the photograph. The three terminals on the left-hand side of the panel permit the use of either loose-coupling or single-circuit tuning, whilst the five terminals on the right-hand side of the panel are for the telephones and batteries. The positions of the components and general make-up of the receiver may be seen from the photographs showing both top and underside of panel views.

Referring to the circuit diagram, the points marked A, A_1 and E are intended to represent the three terminals on the left-hand side of the panel, and it will be seen that if we connect the aerial to A and the earth to E, leaving A_1 free, then the circuit is a loose-coupled arrangement; if, on the other hand,

How often are you troubled by interference? Have you ever wished that your single valve set were more selective? Try the arrangement described in this article and reduce your troubles.



A nearer view of the panel.
Note the "window" by means of which the brightness of the filament may be viewed.

we connect the aerial to A_1, still making our earth connection at E, but leaving A free, we have a single circuit arrangement.

Components

In order to build a receiver to the specification here given the following components are necessary, and, as is usual in Radio Press constructional articles, the names of the manufacturers of the actual components embodied in the receiver photographed, are also given. This latter information is intended for those readers who wish to adhere in every detail to the specification given, and does not necessarily mean that the makes mentioned must be used before results can be obtained, neither does it mean to infer that the choice of other makes constitutes any departure from the original design. On the contrary, so long as the values of the components are respected, any good make of component may be used.

One ebonite panel, measuring 9 in. by 5¾ in. by ¼ in. (Paragon).

One three-coil holder (Magnum).

One variable condenser, ·0005 μF, square-law (Jackson Bros.).

One valve holder (Magnum).

One dual rheostat (McMichael).

One fixed condenser, ·0003 μF. (Dubilier).

One fixed condenser, ·002 μF. (Dubilier).

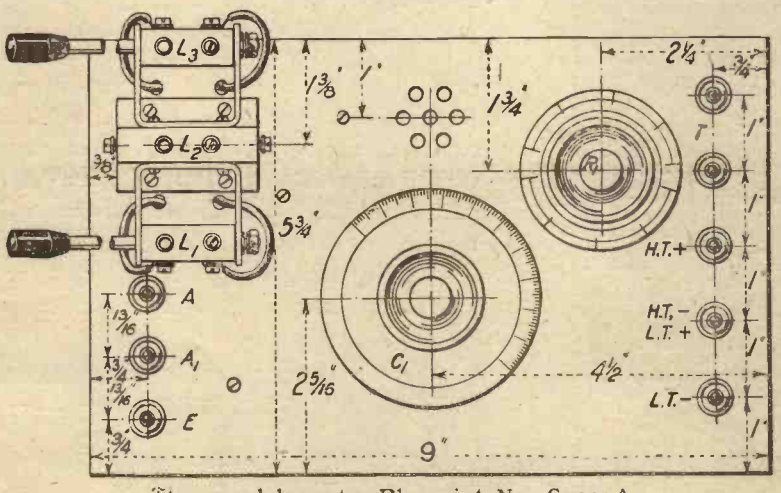
One grid-leak of 3 megohms (Dubilier).

Eight terminals.

One containing box (Bowyer-Lowe).

The Panel

The illustration showing the panel layout also gives all the necessary dimensions for marking and drilling. When purchasing ebonite for the panel it is advisable to obtain the material squared-up to the required size, as otherwise it is quite conceivable that a certain amount of waste may result; another point which the constructor should bear well in mind is that he should ascertain whether or not the material supplied is free from surface leakage, and bears a guarantee to this effect. This precaution becomes necessary when it is remembered that there are on the market ebonites which are, as purchased, *insulators* to high frequency currents, and also ebonites which are almost *conductors*. In those cases where the latter is obtained, in order that no ill effects may result it is necessary, after all drill holes have been made, to treat both sides of the panel with a vigorous rubbing with fine emery paper in order to remove the surface skin, the final rubbing being made with a soft rag and a drop of oil in order to restore the deep black of finished ebonite.



The panel layout. Blueprint No. C1009A.

The Wiring

The photographs showing the underside of the panel will indicate to readers the simple layout and easy method of wiring; further, the practical back of panel wiring diagram will make clear any point which the photographs are unable to convey. The wiring, it will be seen, is carried out by means of square tinned wire, and in view of the easy accessibility of components there should be no difficulty in handling material of this

stiffness; all leads should be kept short, should be well spaced and should preferably be soldered.

Valves

Since the receiver is fitted with a dual rheostat for filament control, either a bright or dull emitter valve may be used. In connection with the subject of valves particular attention should be paid to the value of H.T. voltage applied to the plate as any excess of voltage will cause the receiver to oscillate too freely when using the loose-coupled arrangement and so render the set very unstable. Information concerning the best values for H.T. and L.T. for the particular valve chosen, is usually either stamped on the valve itself or else is given within the carton which contains the valve when purchased.

Coils

The simplest manner in which the receiver can be used is to employ single circuit tuning, and after the batteries and telephones have been connected to the terminals indicated in the illustration showing the layout of the panel, the valve should be inserted within its holder. Using this form of tuning the fixed coil socket (L_2) constitutes the aerial coil whilst L_3 is the reaction coil; we must, therefore, connect the aerial to A_1 and the earth to E_1, leaving A free.

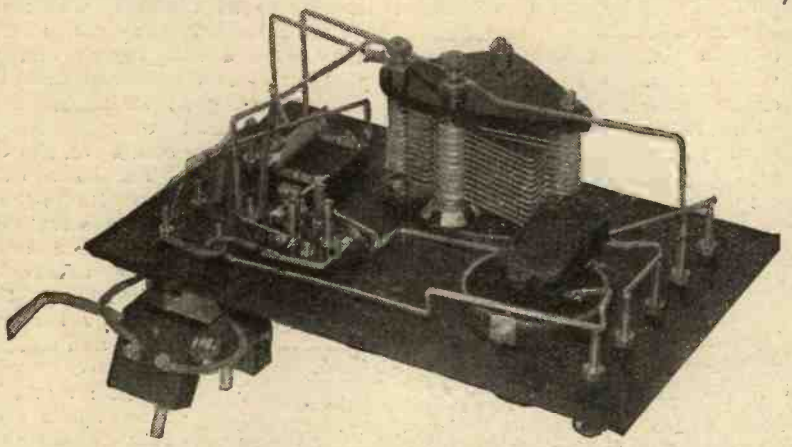
In order to tune the B.B.C. stations using wavelengths up to 400 metres a No. 25 or 30 coil should be used for L_2 (according to the aerial) and a No. 50 for reaction; for wavelengths above 400 metres and below 500 metres, a No. 50 coil should be used for L_2 with a No. 75 for reaction. For the reception of 5XX coil No. 150 should be chosen as the aerial coil with a No. 200 for reaction; these same coils also apply for the reception of Radio-Paris (Radiola).

Operating the Single Circuit Arrangement

Having chosen and inserted in their respective sockets, suitable coils for the wavelength it is desired to tune, the aerial coil (L_2) and reaction coil (L_3) should be spaced as far apart as possible before lighting the valve by means of the filament rheostat. When the valve is burning at the required temperature the variable condenser (C_1) should be set at zero and slowly tuned towards its 180° mark until the desired signals are heard. When these signals have been picked up the condensers should be allowed to remain at that setting which gives the best possible results and the reaction coil should be slowly moved nearer to the aerial coil until signals become a little louder. Now, leave the reaction coil and again adjust the condenser one or two degrees either side of the previous setting for louder signals. Again move the reaction coil a little nearer to the aerial coil, making further adjustment upon C_1 as the final operation.

Irrespective of wavelength these operations are always the same excepting in those cases when signals are too weak to be heard when the two coils are set at right angles to each other, whereupon the reaction coil may be moved a little closer and searching with the condenser C_1 again made as before.

(Some notes on how to tune a circuit of this type in order to get the best results, at the same time avoiding the objectionable habit of oscillating, were given by the present writer in the February number.)

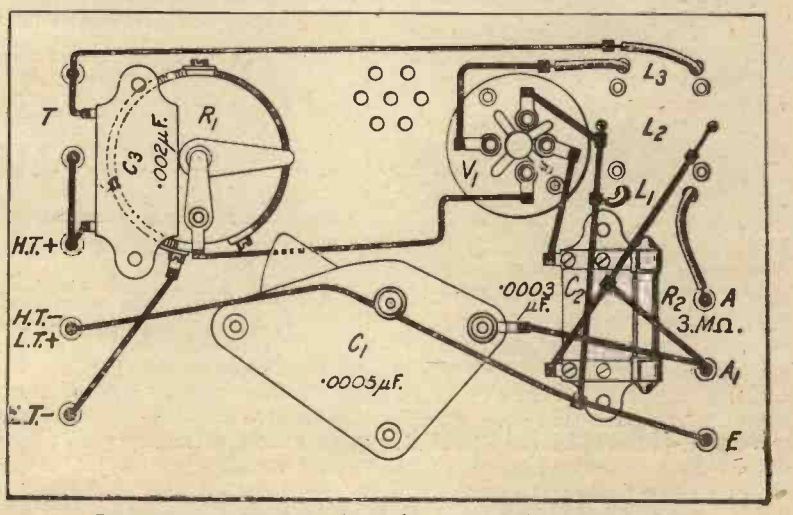


A view of the panel removed from the cabinet, showing the wiring.

Loose Coupling

Having mastered the operation of the receiver as a single circuit arrangement the aerial should now be connected to A with the earth still remaining at E, the A_1 terminal being free. With this arrangement we have the aerial coil (L_1) loosely coupled to the secondary (L_2) with the reaction coil (L_3) coupled to the secondary. Coil sizes for this arrangement are in the case of L_1 best found by experiment using for the shorter waves of the B.B.C. band Nos. 25, 35 and 50; for Chelmsford and Radio-Paris a No. 150 coil should be used.

For B.B.C. wavelengths up to 400 metres the secondary coil will be a No. 50 or 75, whilst the same size coil (or a No. 50 if another No. 75 is not available) should be used for reaction. For wavelengths up to 500 metres the secondary coil will be a No. 75 with reaction as before. In the case of 5XX and Radio-Paris the secondary coil will be a No. 200 or 250 with a No. 200 for reaction.



This drawing makes clear the connections necessary.
Full size Blueprint No. C1009B is available, price 1/6 post free.

Operating the Loose Coupled Circuit

Using a suitable combination of coils, say, a No. 35 as L_1, a No. 75 as L_2 and a No. 50 as L_3, set the two moving coils (L_1 and L_3) at right angles to the fixed coil. The operation of tuning is to place the aerial coil (L_1) fairly close to the secondary coil (L_2) and to tune with the condenser C_1; if no signals are heard move the aerial coil a little nearer to the secondary and again tune with the condenser. When signals have been tuned to their loudest, again bring the aerial coil nearer or move it farther away according to results, at the same time making slight adjustment upon the condenser.

Reaction

With the best results obtained in this way slowly move the reaction coil (L_3) nearer to the secondary (L_2), at the same time making further slight alteration upon the tuning condenser, taking extreme care that the set is not made to oscillate.

Selectivity

The careful handling of a receiver employing this means of coupling will, in most cases, either permit the elimination of interference altogether or else reduce it to such a degree that the desired signals will be heard above it, usually, however, with a certain loss in the signal strength of the desired station, which with the interference eliminated can invariably be afforded.

In the majority of cases this condition of selectivity is controlled by the separating of the aerial and secondary coils by as great a space as the reception of the wanted signals will permit.

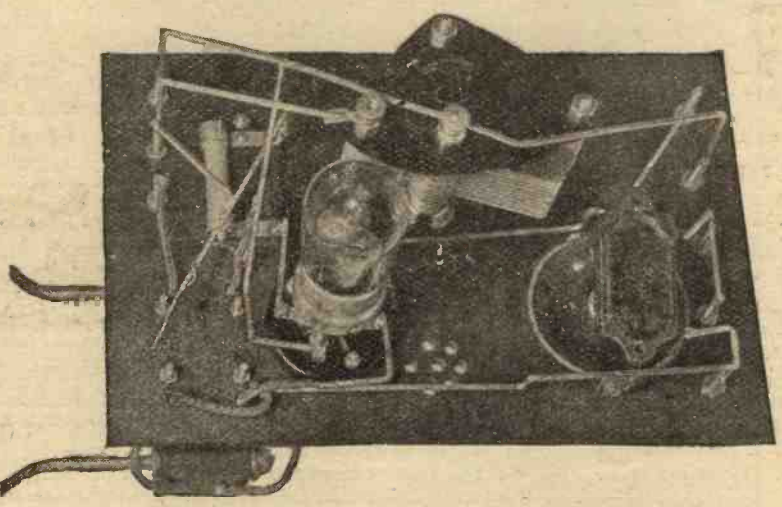
When making sets of the type described above it may be observed that the receiver will not oscillate, which indicates that either one or all the connections to the three coil holders are at fault and should be carefully checked with the wiring diagram. The condition of oscillation will make itself known by an easily audible "cluck" in the telephones, when either the aerial coupling is loosened too much or the reaction coil is moved too near to secondary coil.

Results Obtained

Using single-circuit tuning with the receiver connected to an indifferent aerial in S.E. London, good results were obtained from 2LO, 5WA, Brussels, and two German stations whose identity is unknown, using a No. 35 coil in the aerial, with a No. 50 as reaction. By changing the No. 35 coil to one of 50 turns, good signals were obtained from 5IT, Rome, and 5SC, the tuning being fairly critical, with easy control of reaction. The reception of 5XX was also tried, using a No. 150 coil in the aerial circuit with a No. 200 for reaction, when perfect reception was obtained from both Chelmsford and Radio-Paris, using the same coils.

With the receiver used as a loose-coupled arrangement there was an increased tendency for the set to oscillate, but, by keeping the reaction coil as small as possible, easy control was obtained. With the loose-coupled circuit the same stations mentioned above were successfully received, using in the case of those wavelengths below 400 metres a No. 35 coil in the aerial, a No. 50 as secondary, and a No. 50 as reaction, whilst for wavelengths up to 500 metres they were a No. 35, 75 and 50 respectively. Chelmsford was also received at good strength, using aperiodic aerial tuning with a No. 150 as aerial coil, a No. 250 for the secondary, with a No. 200 for reaction. Signals from Radio-Paris with these same coils were also obtained at good volume after eliminating 5XX by means of loosening the coupling between aerial and secondary coils.

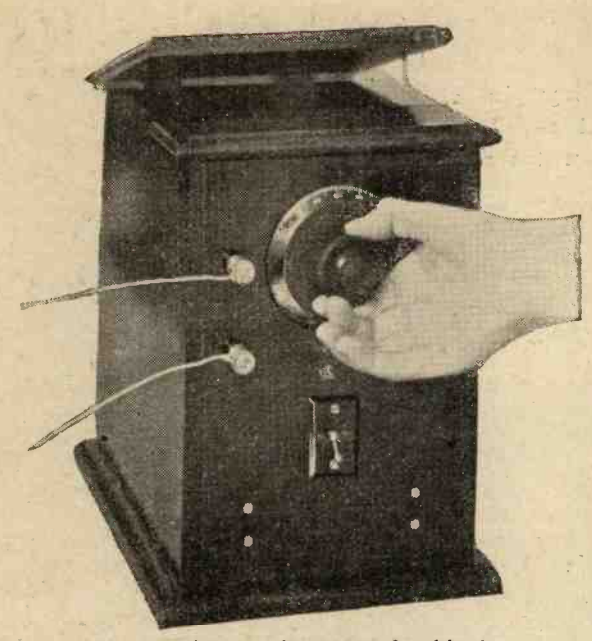
The receiver in the hands of another member of the editorial staff, living in S.W. London, gave similar results, and for the information of readers are here given: Single-circuit tuning, 2LO, good; Brussels, moderate 'phone strength; Rome, moderate 'phone strength; Birmingham, clear, with volume improving later; three German stations at moderate strength and another B.B.C. station fairly good. Loose-coupled circuit, using as coils L_1=40 Lissen, L_2=50 Igranic, L_3=Tangent 75, two German stations, moderate 'phone strength, Brussels good 'phone strength, 2LO very loud, and Madrid fair.



Another view of the back of the panel, with the valve in position.

How to Simplify your Constructional Work

IN wireless construction there is a great deal of repetition work, especially in drilling. For example, every set of holes that you make for valve legs will be spaced in exactly the same way; plugs and sockets are always $\frac{3}{16}$ in. apart from centre to centre, and, if you use always fixed condensers of one make, the distance between the holes for the screws used to mount them upon the panel does not vary. Now, it is obviously a great waste of time to measure out, for instance, the positions of each set of valve-leg holes separately, and it introduces possibilities of error. If you make a practice of doing this, you will find that valves fit too easily into some of your holders whilst they are overtight in others. The best tip is to make a set of jigs to cover all drilling jobs that have frequently to be done. A jig is a piece of metal in which are holes of the same size as those that one requires to make in the work, spaced the correct distance apart. In use the jig is clamped over the work and the drill is simply run straight through the holes in it. Jigs for all kinds of repetition jobs can be made very easily. They are easy to turn out and they save an enormous amount of trouble, besides making one's work perfectly accurate.



The condenser should preferably have vernier control.

A Wavetrap for the "Anglo-American Six"

By PERCY W. HARRIS

ELIMINATING INTERFERENCE FROM THE NEAR-BY STATIONS

The Wavetrap described in this article, although designed as a companion cabinet to the "Anglo-American Six," described in previous issues, can be used with any type of receiver, and will be found to cut down interference from a near-by station to a very large extent

ALTHOUGH the Anglo-American Six is a highly selective receiver, there are conditions where the near-by broadcasting station is a source of interference even with highly selective receivers. For example, three or four miles from a broadcasting station signals are so strong that they will force the receiver into resonance with their own wavelength unless some special device is used. About the only receiver sufficiently selective to eliminate the local broadcasting station, even when it is practically in sight, is the super-heterodyne receiver, but this, as readers know, is a multi-valve affair, quite expensive to build and run.

What is a "Trap"?

A Wavetrap is a device inserted in a receiver or in the aerial connected to the receiver, for the purpose of eliminating interference in one of two ways. We may, for example, arrange a wavetrap to permit the passage of all frequencies except one (that of the station which it is desired to reject), or we may arrange it to by-pass all frequencies except that we desire to receive (that of the station we desire to hear). Several types of wavetraps are described in my book "Twelve Tested Wireless Sets," and constructional details of a very efficient wavetrap which can be used in several different ways are given in the Radio Press Envelope No. 6, entitled the "A.B.C. Wavetrap," by G. P. Kendall, B.Sc.

The wavetrap in the present article is designed in a cabinet made to match that used for the Anglo-American Six Receiver, and is designed primarily to act in the second manner mentioned above—*i.e.*, to allow only one frequency to pass through and to by-pass all the others.

Components

The following are the components required to build this wavetrap:—

Suitable cabinet to take a panel 9×6×¼.

One ebonite panel of the dimensions given.

Baseboard to slide into cabinet.

Two brackets to hold panel vertical.

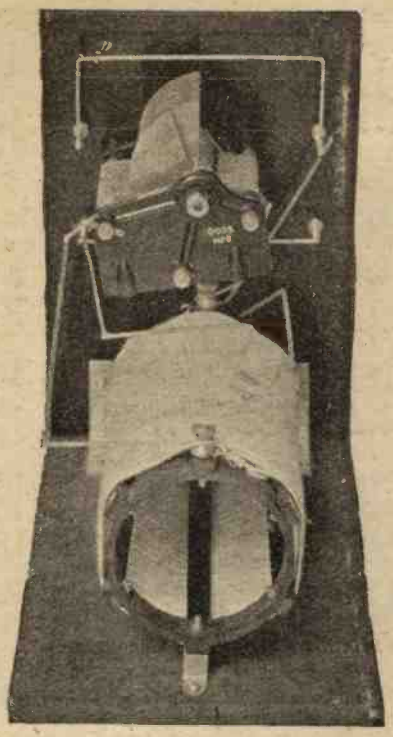
One variable condenser, ·0003 or ·0005 mfd., with vernier. (I have used a Sterling but any of the good makes will do.)

One skeleton coil former measuring 6" × 3½". This can be made up from three ebonite rings cut from tube 3" diameter, with thin ebonite strips secured to the rings longitudinally, or it may be purchased ready made from the Bowyer-Lowe Company and others.

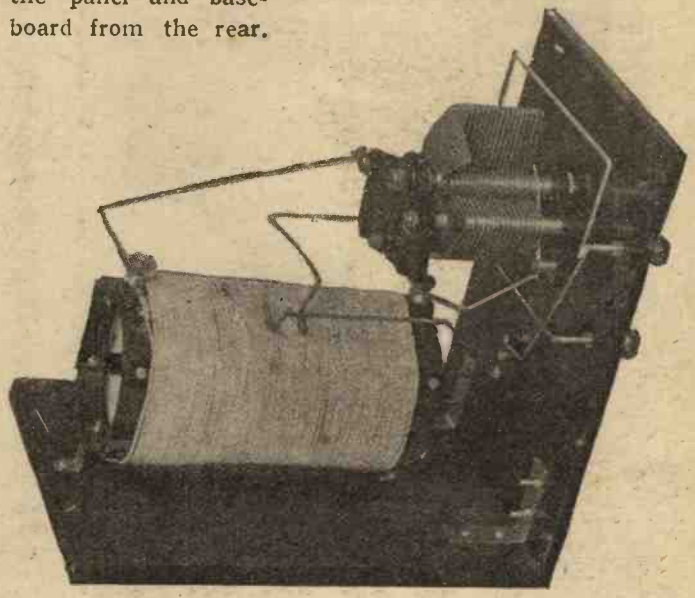
Four terminals.

½ lb. No. 18 D.C.C. Wire.

The cabinet matches in height and depth that used in the "Anglo-American Six."



Two photographs of the panel and base-board from the rear.



One on-and-off switch. (That shown is a Connecticut.)

No. 16 tinned wire for wiring up.

Construction

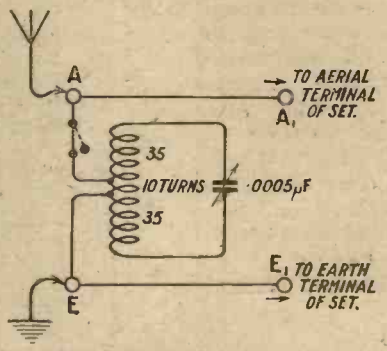
The construction is of the simplest. It is merely necessary to wind on the former 80 turns of the wire as a single layer coil, and to solder two connections to the 35th and 45th turns. To these turns connections are made as shown in the wiring diagram. If you trace the wiring you will see that there is a path from the upper right-hand terminal (looking from the back) through the on-and-off switch, through the ten central turns to the earth terminal, which, as you will observe, is on the right-hand side immediately below the aerial terminal. Notice that the ends of this single layer coil are connected to the variable condenser. In this way a circuit is formed of the whole of the coil and the variable condenser.

The Terminals

There are two terminals on the opposite side of the panel, and when viewed from the front it will be seen that the left-hand terminals are for aerial and earth and the right-hand terminals go to the aerial and earth terminals on the "Anglo-American Six." Equally, of course, they could go to the aerial and earth terminals of any other receiver. The aerial terminal on the left is connected directly through to the aerial terminal on the right of the trap, which, as explained above, goes to the set. The lower or earth terminal is connected right through in the same way.

Operation of the Set

The wavetrap is simply stood alongside the "Anglo-American Six," and the aerial and earth wires are connected to the trap terminals instead of to the set. Linking wires are passed across to the "Anglo-American Six." When the on-and-off switch is at the "off" position, there is a



The circuit of the trap.

direct connection from the trap panel through to the "Anglo-American Six," and no trap is in circuit. We can then tune our receiver to the station we want, irrespective of interference from the local station. When it is properly tuned in, turn the trap switch to the "on" position, and immediately you will have dead silence in your loud-speaker or in your earphones. You may imagine something is wrong, but you will find that by slowly turning the dial of the variable condenser on the trap there will be a point where the signals from the station you want come in loudly, with far less interference than normally from the local station. Do not mistake this point. You will find the tuning is exceedingly sharp, and if you turn the dial rapidly you may easily miss it. Notice, too, that the tuning of the main set is not upset by the trap—a considerable convenience.

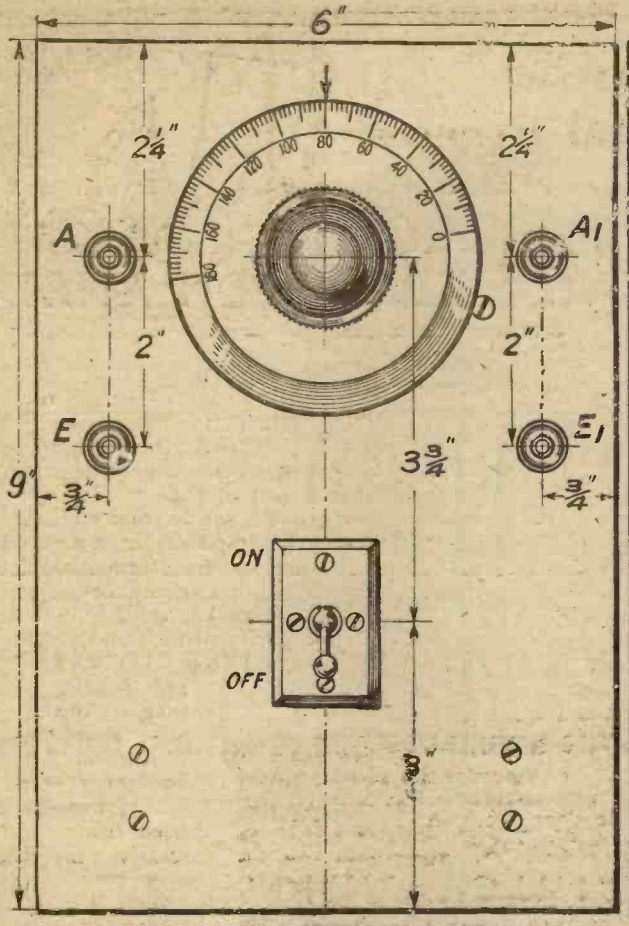
Trap Tuning

By withdrawing the aerial coil from the receiver it is possible to tune entirely on the trap, as explained by Mr. John Scott-Taggart, F.Inst.P., in his article on trap tuning in the February issue of *Modern Wireless*. This article should be read by all who are interested in the elimination of interference.

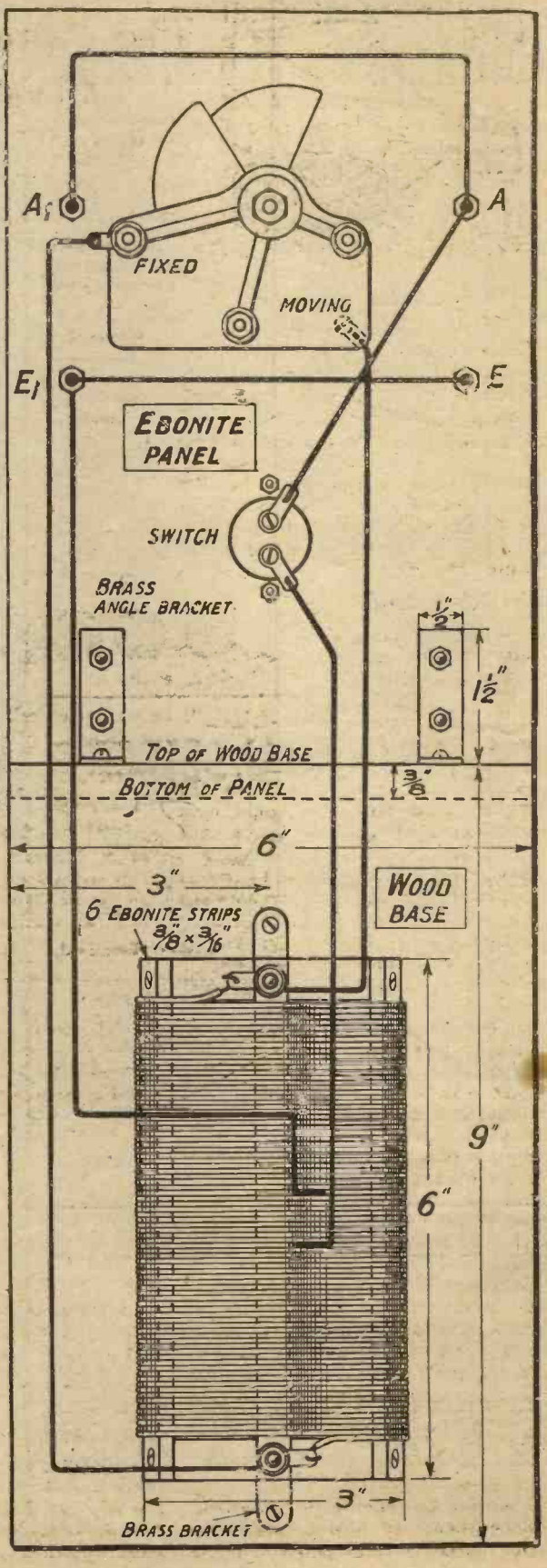
It is possible, of course, to use this trap as a series trap by connecting the aerial wire to the aerial socket on the trap (omitting the usual linking wire between the trap and the receiver), the earth terminal on the trap going to the aerial terminal on the receiver and the earth terminal on the receiver going to earth as generally arranged.

Another Method

The use of the trap in this way will be quite efficient, but instead of



Above: Dimensions and terminal markings of the front of panel.



On the right: Extended drawing to show practical wiring of the trap.

rejecting all frequencies but the one we want, it will accept the frequency we do not want and to a large extent nullify it. It will, however, interfere with the tuning of the receiver, and it is therefore not quite so convenient to use. Both wavetraps will bring about a certain loss in signal strength, but in many cases this is not an inconvenience, as the station we want to receive will be amply strong enough to stand a little reduction without discomfort.

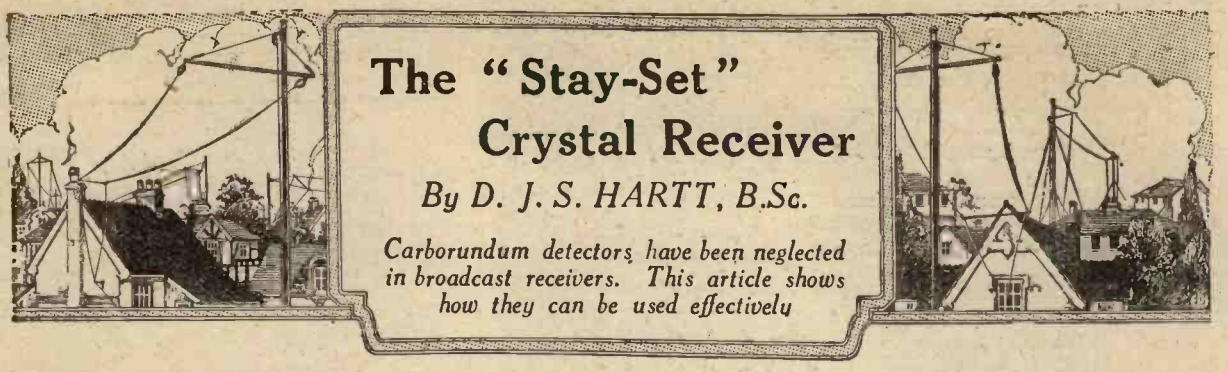
SYMPATHY REQUIRED

To the Editor.

Sir,—Why do you put in articles "For your spare moments" (see p. 368)? What wire'ess man has any? I suppose next you'll be giving "What to buy with your spare cash?"

Yours indignantly,
"WIRELESS WIDOW."

P.S.—Don't for heaven's sake start editing any more new Wireless Mags. He'll never come to bed at all if you do!



The "Stay-Set" Crystal Receiver

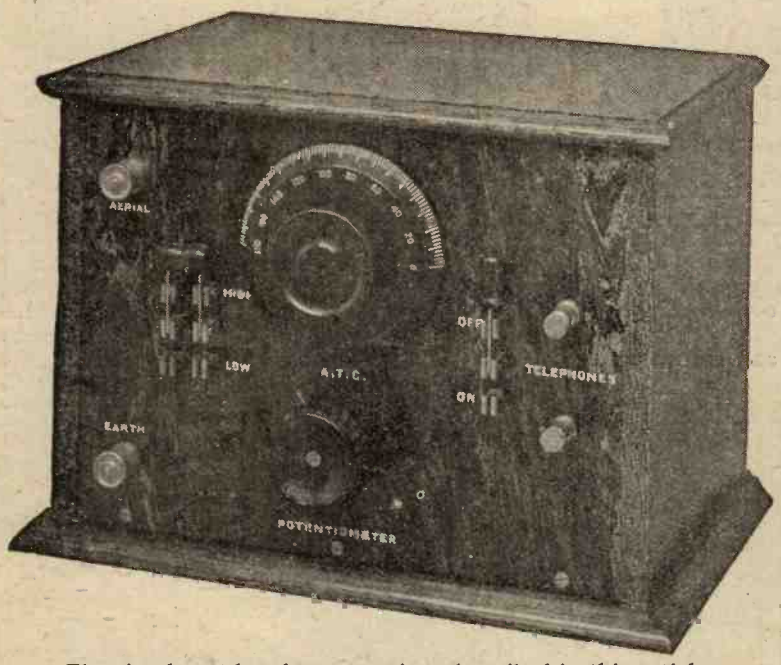
By D. J. S. HARTT, B.Sc.

Carborundum detectors have been neglected in broadcast receivers. This article shows how they can be used effectively

HOWEVER carefully and efficiently a crystal set may have been designed and constructed, a certain amount of the pleasure derived from its use in listening to broadcasting is lost unless a detector which can be relied on to maintain its most efficient setting for a long period is incorporated. That is to say, we require a stable, and yet sensitive, form of detector.

Carborundum

The author, after careful consideration, decided to use the carborundum-steel combination in the set to be described in this article. This form of detector does not appear to have attained the popularity it deserves, probably because there is a general feeling that it does not give such satisfactory results as good galena or its many commercial forms usually designated as various "... ites," and also because a potentiometer and dry battery are required.



The simple yet handsome receiver described in this article.

With regard to the first point, equally good results can be obtained with a well-adjusted carborundum detector as with the usual galena-catwhisker combination, and while the use of a potentiometer and a dry battery introduces a little extra complication, this is offset by the greatly increased stability obtained.

Potentiometers

As far as expense is concerned, since there are now available on the market several potentiometers at a popular price which will serve quite well for use with carborundum, this need be no greater than would be the case if a good type of galena-catwhisker detector were used.

No special constructional ability is required in making this set, in which provision is made for receiving the high-powered station, 5 XX, on 1,600 metres, as well as the lower wavelength broadcasting stations, a switch to change rapidly from the lower to the high wavelength being incorporated for convenience, and the results on the actual set have been very satisfactory.

Results Obtained

At 9 miles S.W. of 2LO, on a single-wire aerial 50 ft. long and of an average height of 38 ft., this station comes in at very good strength on the 'phones, and, with reasonable quietness prevailing, is clearly audible on a medium-sized loud-speaker in a small room. 5XX, about 35 miles away, is heard quite well, the strength on the 'phones being slightly less than when tuned to 2LO.

When the set is connected to a two-valve amplifier, in which the first valve is transformer-coupled and the second resistance-coupled, good loud-speaker results, both as regards purity of tone and volume, are obtained from 2LO, 5XX giving smaller volume. Incidentally, Radio-Paris ("Radiola") and two other broadcast stations have been heard quite clearly in the 'phones when using the same two-valve amplifier.

The Circuit

The circuit adopted is shown in Fig. 1. The switch S_1 enables one to use either the coil L_1 for the ordinary broadcast band, or L_2 for receiving 5XX. The switch S_2 breaks the battery circuit through the potentiometer, while when the set is not in use, if one end of the telephone leads is disconnected, or the switch S_1 raised, the battery circuit will be entirely broken and no current will flow. A fixed condenser of, say, ·001 μF may be tried in the position shown by the dotted lines; in the actual set this made no appreciable difference in reception, and so was not incorporated.

List of Parts

In order that intending constructors may, if desired, make

their sats on the same lines as the original, a complete list of components is given :—

One ebonite panel, 8 in. by 6 in. by ¼ in. (Peter Curtis, mahogany finish).

Two W.O. type terminals (nickel plated).

Two telephone terminals (nickel plated).

One double-pole, double throw switch.

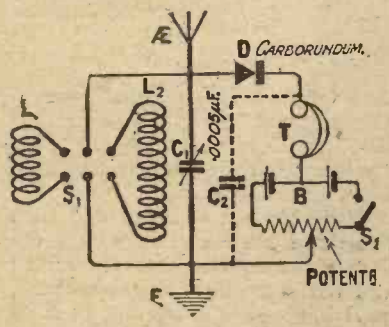


Fig. 1.—The circuit of the crystal set.

One single-pole double throw switch (both switches for panel mounting and nickel plated).

One ·0005 μF square-law condenser, ebonite end plates (Jackson Bros.).

One 600 ohm potentiometer (Shipton).

Two 1½ volt dry cells (Ever-Ready, Type U.W.1).

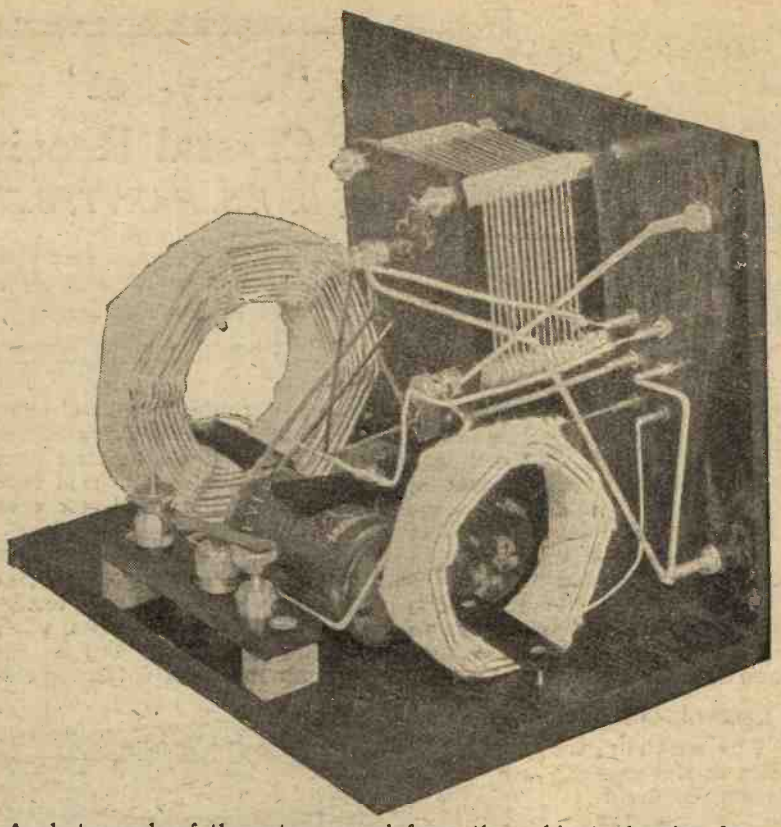
One carborundum crystal.

No. 18 double cotton-covered wire (4 to 6 ounces).

No. 20 double cotton-covered wire (12 ounces).

Three brass terminals, a small strip of ebonite, 3½ in. by ¾ in. by ¼ in., one crystal cup, and a short length of steel clock spring, are also required for the detector.

A suitable cabinet or containing box will be necessary. That shown in the photograph is a "Camco" cabinet, with a loose or pull-out baseboard, made to accommodate this design. A combination of mahogany-finished ebonite and a dark mahogany cabinet gives a very pleasing appearance to the finished set.



A photograph of the set removed from the cabinet, showing how the coils are mounted.

The Ebonite Panel

It will be most convenient to buy the panel cut to the correct size, and ready for use, in which case it may be carefully marked out on the back and drilled in accordance with the diagram in Fig. 2. No difficulty should be experienced here if due care is taken. The next step is to mount the components which go on to the panel. The switches should be mounted first, and before the small nuts are screwed up tightly make sure that the switch engages properly. Next fix the four terminals, screw them up tightly and then mount the potentiometer as shown in the back of the panel photographs. The potentiometer used is provided with a rather long screwed shank to pass through the panel (useful in many cases), and in the actual set a ⅛ in. thick piece of ebonite, drilled with a hole to take this shank, was placed between the poten-

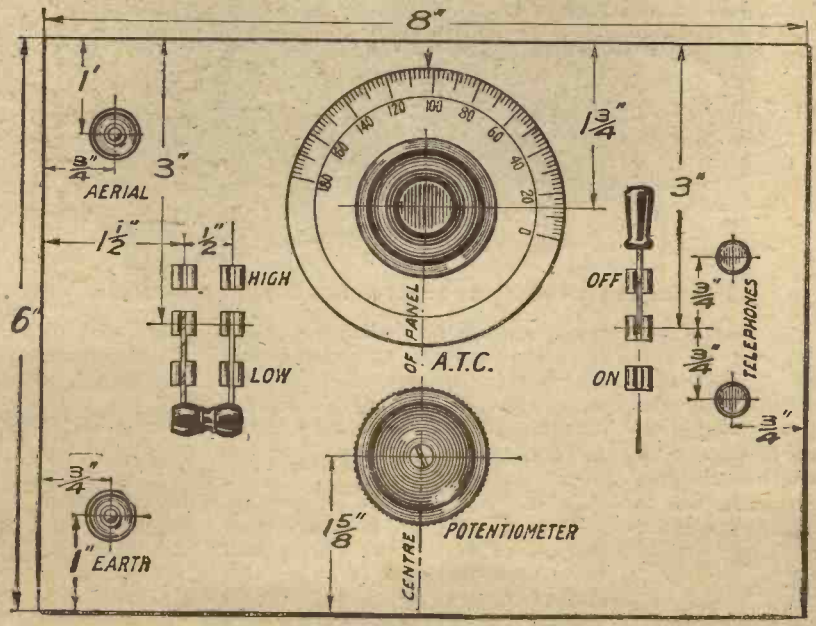


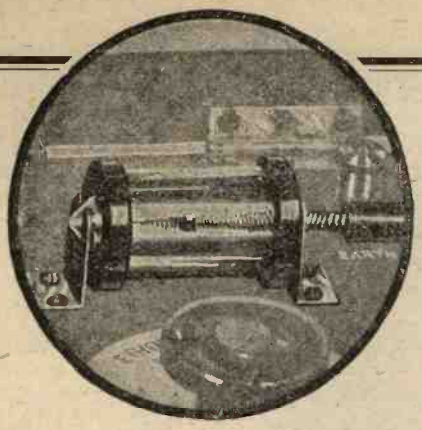
Fig. 2.—This diagram of the panel layout is exactly half size, and sufficient dimensions for drilling are given.

A contrast—and a comparison.

Here a "Type 600" is being shown in contrast with one of ten high-power condensers recently built at our works. These are the biggest mica condensers in the world. The contrast is one of size and load-capacity only. In quality of materials employed; skill in design and workmanship; rigorous testing before dispatch; and guarantee as to performance, the "Type 600" will stand the closest comparison, point for point, not only with the big condenser shown but with any other Dubilier Product large or small.

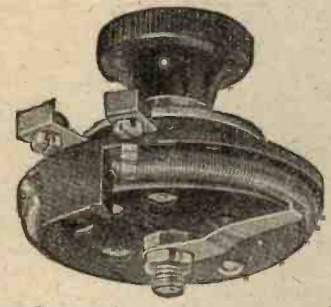
BE ADVISED—SPECIFY DUBILIER.

Advt. of the Dubilier Condenser Co. Ltd., Ducon Works, Victoria Road, North Acton, London, W.3. E.P.S.126.
Telephone: Chiswick 2241-2-3.



The Burndept Crystal Detector, mounted on the panel of the Ethophone Junior Crystal Receiver.

The Balkite Battery Charger, showing the adapter which plugs into any lamp socket, and the spring clips which are attached to the accumulator.



The Dual Rheostat, which enables you to use bright or dull-emitter valves without alteration to your set.

Burndept Crystal Detector
Now Reduced in Price

THE popular Burndept Crystal Detector has been reduced in price by one shilling. A great and increasing demand has enabled us to save on production costs, the benefit being passed on to the public.

The Burndept Crystal Detector gives you crystal rectification in its most reliable and efficient form. The cat-whisker is controlled by a micrometer screw working through a ball-joint, and does not require frequent attention, remaining firmly in position when set. All moving parts and the sensitive synthetic crystal are enclosed in a glass tube.

In the experimental model, the Detector is mounted on an engraved ebonite panel fitted with gold-lacquered terminals, the whole being mounted on a polished walnut base.

No. 215. Crystal Detector, for panel mounting, in carton, with screws and drilling template **4/-**

No. 216.—Crystal Detector, for experimental use, mounted on ebonite **11/6**

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IF you have alternating current electric supply (200-240 volts, 50-60 cycles), you can charge your accumulator at home in the cheapest and most convenient manner possible by means of the Balkite Battery Charger. *This appliance has no valves or moving parts, and is absolutely noiseless in operation. Both* half cycles of the alternating current are converted into direct current for charging the accumulator. The charging rate being 2½ to 3 amperes per hour, a 6-volt 50-ampere accumulator will be completely charged in about 20 hours at a cost of less than ½d. per hour, based on a cost of 6d. per unit. The Balkite Charger is robustly constructed and absolutely "fool-proof." A rare metal called Balkite is specially produced for use in this appliance. Full particulars sent on request.

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The handy Dual Rheostat

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No. 222.—Dual Rheostat, 5-30 ohms, for mounting on any panel from ⅛ to ¾ inch in thickness **7/6**

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tiometer and the panel. This brings the control knob nearer the panel, and increases the tension on the moving contact.

The Variable Condenser

The condenser is next mounted on the panel with the one-hole fixing provided. Here, it may be as well to mention that if components other than those specified are used care must be taken to see that there is sufficient clearance room for them.

The Crystal Detector

Having mounted all the components on the panel, set it aside, and proceed to make the detector, which is very simple. Cut the ebonite to the correct size, rub down with fine emery paper, clean and then mark out and drill as shown in Fig. 3. The crystal is then mounted in its cup, which may conveniently be of the type in which the crystal is put into the upper half packed round with tinfoil, this half then being screwed tight on to the lower half. This is then mounted on the ebonite strip, a soldering lug or piece of copper strip being placed under the fixing nut, so as to project out at the side.

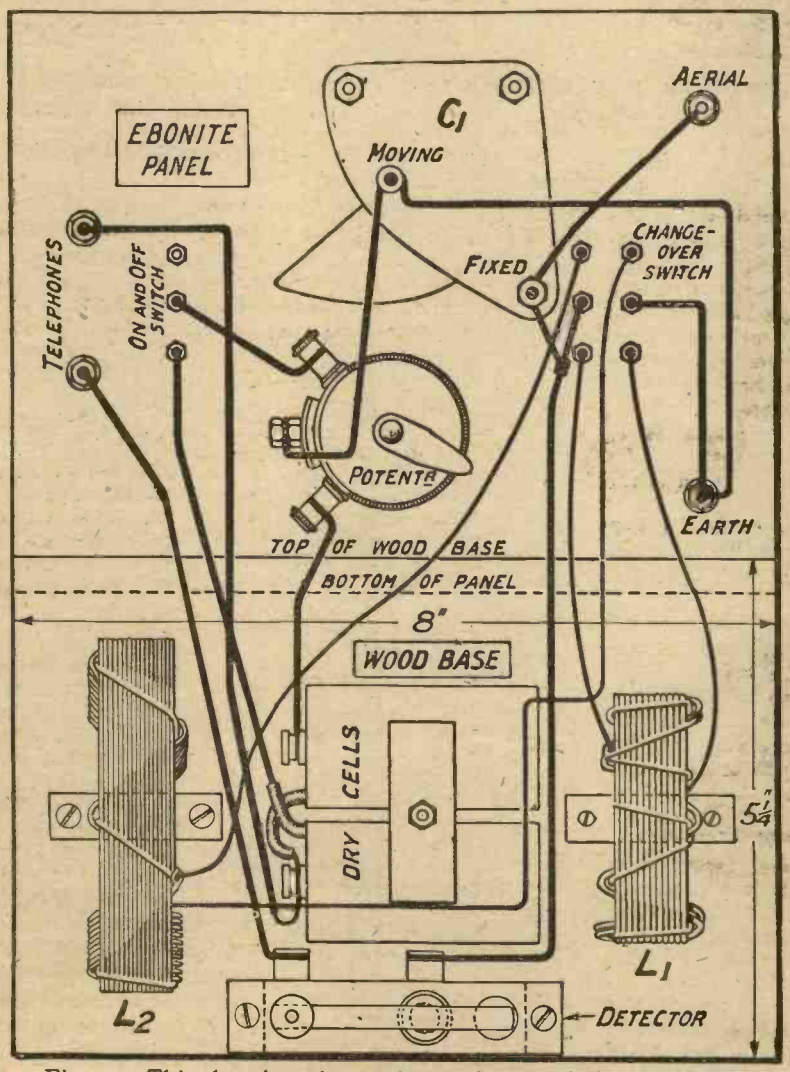

Fig. 3.—This drawing shows the wiring as if the panel and wooden base had been flattened out.

Mounting the Detector

A piece of steel clock spring about ¼ in. wide and 2½ in. long is straightened, if necessary, and then thoroughly cleaned with fine emery paper. This is gripped firmly in a terminal, mounted as shown in the photographs, the head of a similar terminal being screwed on to the shank of this to lift it above the ebonite strip. A soldering lug or copper strip is also provided under the fixing nut of this support. The head of the terminal at the other end of the detector is screwed only half way on, and the spring is arranged so that it just presses lightly on the crystal and firmly on the head of this terminal. A slight rotation of this terminal head will then give ample control of the pressure of the spring on the crystal. Finally, mount the detector on the baseboard by means of brass screws passing through the ebonite, and two small blocks of wood to give the necessary clearance.

Dry Cells

The two dry cells are held down to the baseboard by a strip of ebonite 2½ in. by ½ in. by ⅛ in.; a short length of 4 B.A. screwed rod passes through a hole in the centre of this strip and through the baseboard, and nuts are screwed on each end, that under the baseboard being countersunk into the wood.

The Tuning Coils

At this stage the coils may be made; they are both "lattice-wound" coils, and are simple to make, yet very efficient. Of course, if the constructor desires he may utilise any good make of plug-in coils fitted into sockets mounted on the baseboard. The coil to receive the lower wavelength broadcasting stations is wound with No. 18 D.C.C., and consists of three layers of 12 turns each, the layers being spaced by two layers of the zig-zag winding.

The Chelmsford Coil

The larger coil has 11 layers of 16 turns each of No. 20 D.C.C., and both coils have an internal diameter of 2 in., and are about ¾ in. wide. They are best wound upon the type of former made specially for winding the various forms of multi-layer coils, or failing this, upon a circular wooden former 2 in. in diameter, in which two sets of nails are fixed radially and spaced round the circumference, the two sets being staggered and about 1 in. apart.

The Smaller Coil

In the case of the smaller coil, 5 nails in each set are sufficient, and the method of winding consists in starting at one nail, winding one complete zig-zag layer, finishing at the same nail, then winding a complete single layer between the nails, then a further zig-zag layer corresponding with the first, then another single layer and so on. When the last single layer is finished the loose end of the wire is temporarily secured round a nail. All the nails are then withdrawn

(*Continued on p. 462.*)

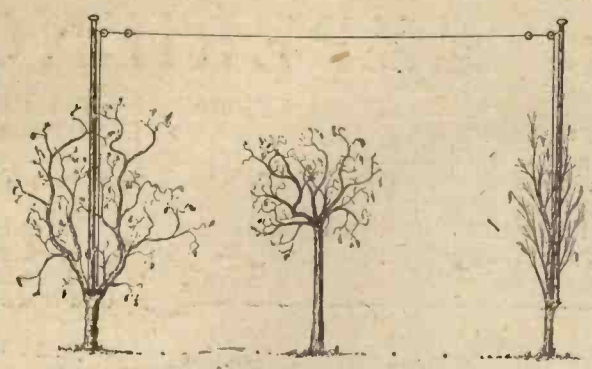

Fig. 1.—The aerial was raised well above the tops of the trees

Aerials for Difficult Places

(1) Erecting an Aerial in Trees

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

An interesting account of how an aerial was erected in difficult conditions

WHEN an aerial is to be erected in a garden, consideration must be given to the height and position of any tall trees there may be in or near that garden. Frequently such trees are very much in the way. Occasionally a tall tree happens to be situated at the extremity of the garden in such a position as to make an excellent substitute for an aerial mast. When such is the case, the owner of the garden is decidedly fortunate, for if a tree can be used as an aerial mast, there is a saving in both time and money.

One of the most efficient aerials I have ever used was slung across a garden from the top of a tall pear tree some 30 ft. high to a chimney on a house. This particular aerial was fixed very quickly, and it left nothing to be desired in the way of results.

Aerial well above Tree-tops

Where there are trees in a garden, however, it is a good rule to try to get the aerial wire at least 10 ft. above the level of the tree tops. There will then be little to fear from shielding effects.

It is when trees come in the middle of a garden that trouble is caused for those who wish to erect an aerial running across the garden. I have recently helped to erect an aerial in a garden where there were tall trees at the bottom of the garden and where there was a mountain ash tree right in the centre of the garden, in the worst position imaginable. This mountain ash tree was a good 30 ft. high, and it seemed to be in the way no matter how the run of the aerial wire was planned.

The tree was a very graceful one, and in summer time it gave the only shade there was in the garden. Its removal, however, seemed inevitable if an aerial was to be at all possible. Many objections were raised against the destruction of the tree, and it was decided as a compromise to have the tree "topped." Two masts were purchased, each 30 ft. high, and it was intended to take a good 10 ft. or 15 ft. off the top of the mountain ash.

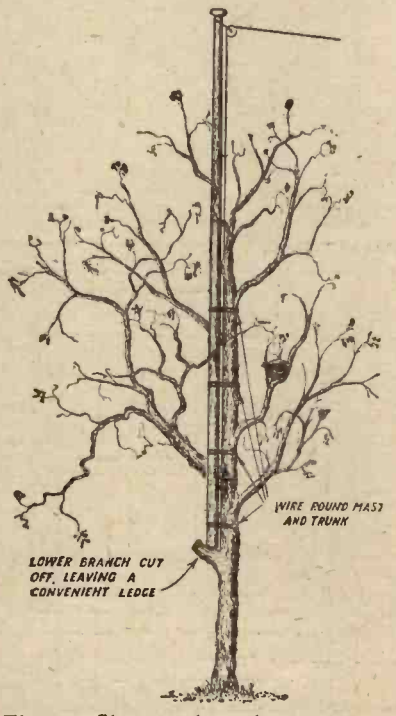

Fig. 2.—Showing how the mast was secured to the lime tree.

Securing the Mast in the Tree

Before the tree was to come under the knife or saw, or whatever would have been necessary to top it, someone suggested that if the two masts were fixed *in* a lime tree at the bottom of the garden and an elderberry tree at the top of the garden, so that their bases were a good 8 ft. from the ground, there would be no need to cut the tree at all. Accordingly, this was done, and the tree was spared from even the smallest amount of trimming.

The fixing of the mast to the lime tree was a comparatively simple matter. The lower branches of the tree had been cut away and a convenient shelf was left on which to set the base of the mast. When in position, the mast in the lime tree was a good 8 ft. above the ground.

Hoisting the Mast

The mast was hoisted into the tree by means of a rope passed over a high branch. Only two men were required to fix the mast. One climbed the tree and tied a rope loosely round the mast and the tree trunk. The other hauled away at the rope and hoisted the mast. When the mast was in its final position, it was made secure by galvanised iron wire tied tightly round the mast and the tree trunk in three or four positions. Fig. 2 will show how the mast was fixed in its final position.

The Second Mast

The fixing of the mast in the elderberry tree was a more difficult proposition. Although the tree was strong enough, its shape did not lend itself readily to the carrying of a mast. There were two separate limbs of the tree, one of which was fairly straight, the other bending away at a height of 10 ft. above the ground. It was necessary to fix an iron rod some 9 ft. long firmly in the ground with its top end just under the mast when in position. This rod carried the weight of the mast. A post would perhaps have been better, but the

iron rod was available. The rod was held in position under the mast by a number of nails driven upwards into the base of the mast. As in the case of the mast in the lime tree, this second mast was secured by galvanised iron wire wrapped round the mast and the tree trunk.

The Aerial Wire

Some difficulty was experienced in getting the aerial wire hoisted. The pulley cords were inclined to foul the branches of the trees, and the aerial wire was inclined to fasten itself on the mountain ash tree. However, with a little help from a wireless neighbour and a little patience, the aerial wire was hoisted into position with the gratifying result that it cleared the top of the mountain ash tree by five or six feet.

The Completed Aerial

The picture at the head of this article shows the position of the aerial with respect to the mountain ash tree under it. No doubt this "tree" aerial would come under a good deal of criticism in the ordinary course of events. Results obtained on the aerial, however, are particularly good. On a simple crystal set, Chelmsford, 140 miles away, is distinctly readable, and a low-power relay station twenty miles away comes in equally well on the same simple crystal set. A two-valve set (detector and low-frequency amplifier) is sufficient to bring in Chelmsford and two broadcasting stations roughly fifty miles away. The addition of a third valve brings in the remaining broadcasting stations and the usual continental transmissions.

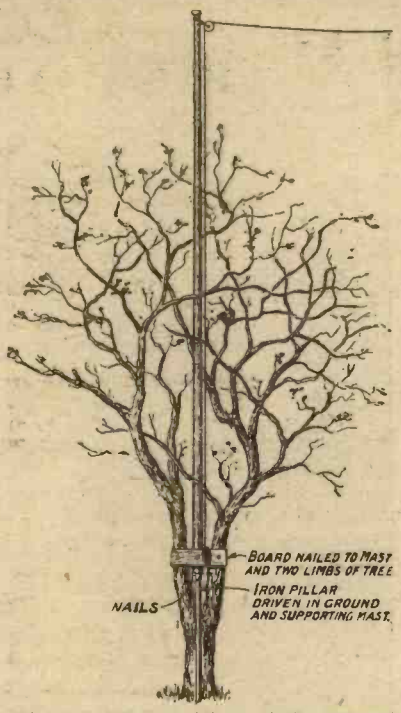

Fig. 3.—The position of the second mast.

Results

From the results obtained with this "tree" aerial it appears that it is well worth recommending the fixing of aerial masts in trees wherever such a course can be followed. The excellent results obtained with the "tree" aerial no doubt come from two things, extra height and absence from shielding.

Have you a strange Aerial? Write and tell us about it!

How to File Your Ebonite Panels Square

FOR trimming up the edges of panels it is as well to have two or three good files. For rough work use a 10 in. Dreadnought file, which removes superfluous material very rapidly. When you have taken the edge down nearly as far as you want it, make use of an 8 in. medium cut file. Finish off with a fine 6 in. file which will smooth out the cuts made by the others and will prepare the way for the last process conducted with the aid of fine emery cloth. You will find that ebonite is very apt to clog files of all kinds, so that when they have been in use for some time they will hardly cut at all.

A File Card

To obviate this purchase a file card. The name is rather misleading, for it is not a card at all, but a brush with a wooden back and stiff wire bristles. With its help you can remove all the clogging from your files and keep them always keen. Filing, though it looks easy, is perhaps the most difficult of all workshop arts to attain to perfection. When you first start you will find it very difficult indeed to obtain a straight edge to a panel. The tendency naturally is to take off far more from the part farthest away from you than from that which is quite close to your body. Further, you will probably find that the edge is not at right-angles to the upper surface of the panel, but slopes down towards either top or bottom. A little investigation will show you that you tend to take off too much from the part next your right hand and too little from the other side.

This loud speaker is ten feet high, and was demonstrated at a recent American exhibition.

Practice on Scrap Ebonite

Skilful filing comes only with practice, and the beginner will soon learn to hold his file horizontally, to apply the pressure evenly, as well as to cut just as hard near his body as away from it. The best advice one can give to any enthusiast who desires to obtain workshop skill will be this: Invest a shilling or two in a job lot of scrap ebonite. Practise for a short time each day at cutting out, squaring off, filing, drilling, and tapping. At the end of a week you will find that you have thoroughly got the "feel" of your tools and that you can turn out neat, well-finished work.

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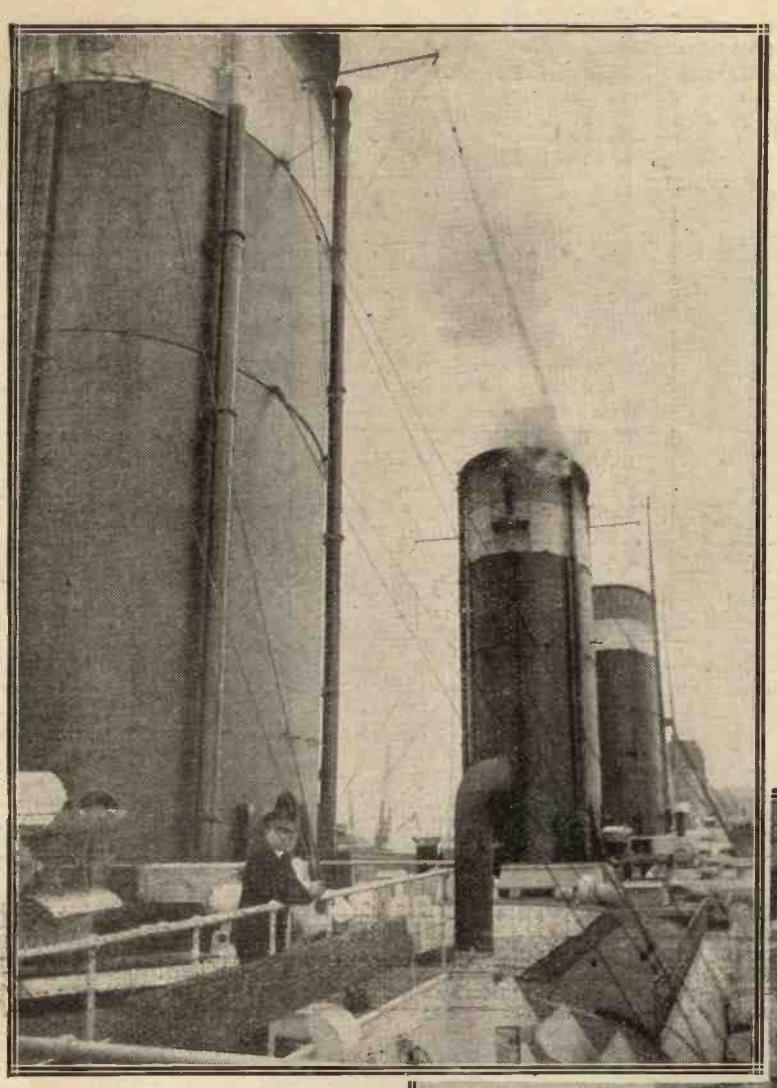


Broadcasting from a Liner

Listen for the "Leviathan" during March

A FEW months ago Radio Press Ltd., were inundated with enquiries regarding speech and music received from a ship at sea. On investigation the source was found to be the great liner "Leviathan," belonging to the United States Shipping Board, and running between New York and Southampton. Excellent signals were heard on Radio Press sets all over the country.

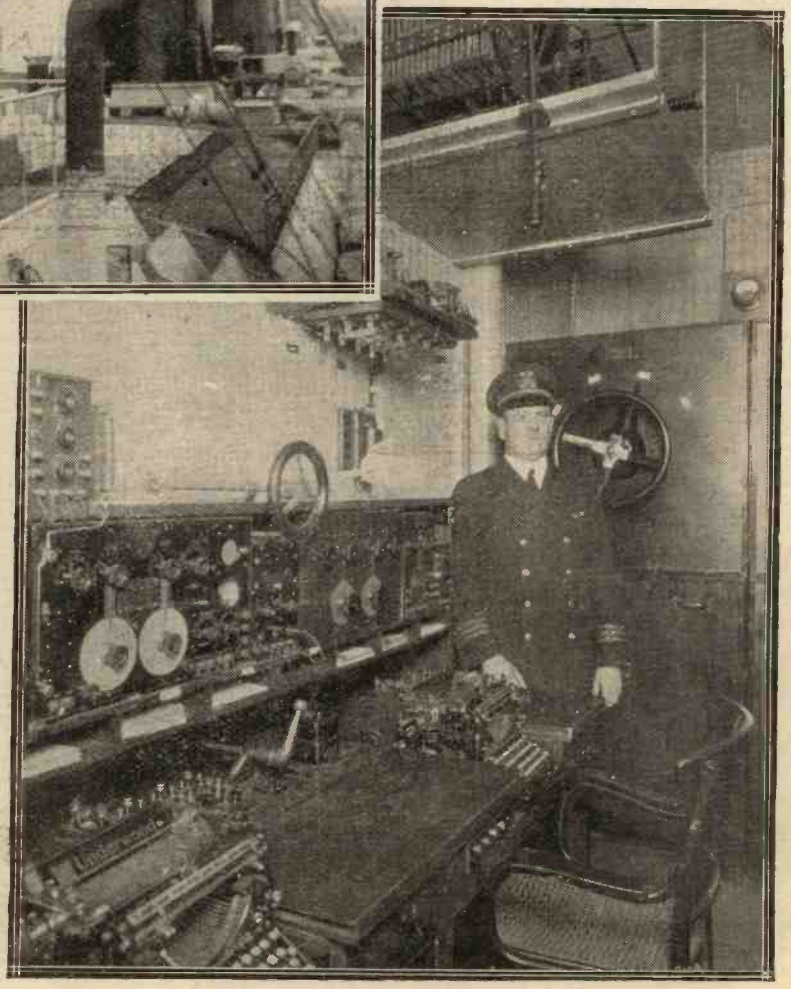
The "Leviathan" has a remarkably complete wireless installation, several transmitters (valve and damped wave) being fitted. Simultaneous transmission and reception on different wavelengths is regularly carried out, and telephony can be used without interfering with the ship's regular traffic.

Readers who did not hear the previous broadcasting from the "Leviathan" will have an opportunity of listening during March, when further items will be broadcast in the evenings, after 2LO has closed down, on wave lengths between 200 and 545 metres. The actual wavelength used will probably vary from time to time.

The "Leviathan" carries no less than eight operators. Our lower photograph shows Mr. E. N. Pickerill, the chief operator, in the wireless cabin. Amateur transmitters who pride themselves on "putting an amp. in the aerial" will be interested to hear that at times the aerial ammeter on the "Leviathan" reads between 30 and 40 amperes! The upper photograph depicts the boat deck of the great liner, and shows a portion of the aerial.

On the Left: The boat deck on the Leviathan, showing the aerial.

Below: In the operating room.



The Thrill of Distance.

TO the real wireless enthusiast there seems no thrill like that of picking up some far distant station. Especially great is the gratification if the improvement is known to have followed upon a clearly understood increase in the efficiency of the set.

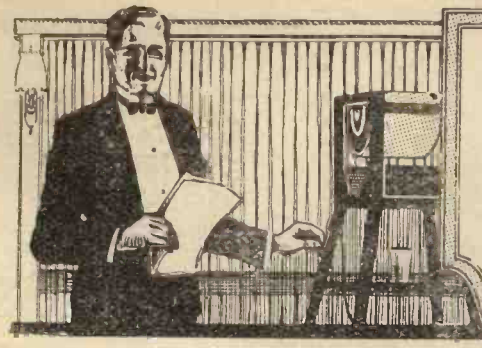
The Tuning Arrangements

Probably no part of the set is more open to improvement than the tuning arrangements, and certainly none is so neglected by the majority of experimenters. Good, short wiring, well soldered joints, variable condensers of high quality, and so on, are all important; but even more so are the tuning coils themselves. Bad coils will spoil the results of the best set, while coils of more than the average efficiency, such as the experimenter can make for himself very easily, will often enable a quite simple set to give a remarkable performance.

Whether the experimenter uses bought coils or winds his own, he ought to know the difference between a good coil and a bad one, and he should not fail to consult a little book which Radio Press has published to settle all such problems, besides giving complete and full instructions for winding the different types, damp-proofing, coil mounting, etc. This is "Tuning Coils and How to Wind Them" (Radio Press, Ltd., 1s. 8d. post free), by G. P. Kendall, B.Sc., who has made a special study of the whole subject.

WIRELESS IN A SCHOOL

Rugby St. Matthew's Central School has an energetic Wireless Club. This photograph shows some of the members and some apparatus constructed by them.



How to Increase Selectivity

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

Some practical notes upon a subject of increasing importance

IN these days of the constantly increasing numbers of the broadcasting and relay stations, improvement in the sensitivity of receiving sets, and so on, the selectivity problem is becoming constantly more acute, and these notes are intended to assist those who have already built a set, find its selectivity inadequate, and do not wish to scrap it and build a new one upon more ambitious lines. Much can be done with an existing set, if one does not mind taking a certain amount of trouble, and the first thing that should be done is to go over the complete installation and ask oneself whether it is possible to improve its general efficiency, and therefore in most cases its selectivity, at some point or other.

The Aerial System

Take first the case of the aerial and earth system. In the majority of cases the best possible aerial will already have been erected, and attention given to such points as good insulation and the use of a low resistance conductor, which should of course be one of the high conductivity metals, such as copper and phosphor bronze. Those who are prepared to make any alteration in their aerial system should remember that it is usually found that a long and rather low aerial is probably more selective, or at any rate less troubled by interference from a strong local station than a shorter and higher one.

The Waterpipe Earth

When we come to the earth connection, on the other hand, we usually find a very different state of affairs. Here there is a tendency to make a connection to the nearest water pipe and let the matter go at that without any further consideration. The earth connection obtained in such a way is often very far from good, and makes really sharp tuning of the aerial circuit practically an impossibility. A really good and low-resistance earth connection is absolutely an essential to selectivity in

(*Continued on p.* 458.)

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3 only ·001
These condensers I have found accurate and of good workmanship.

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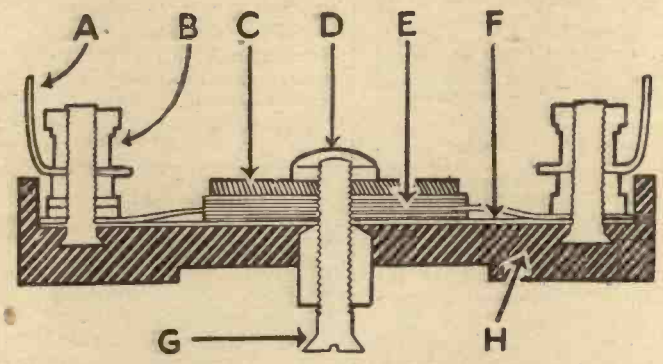

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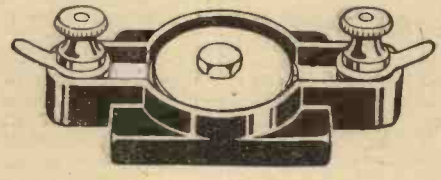

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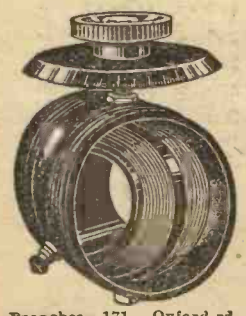

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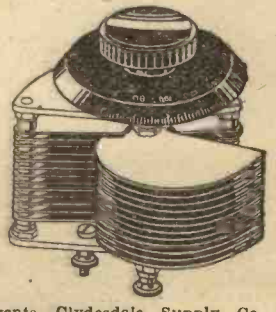

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Barclays 667

Practical Workshop Hints

Wire Cutters—Holes in Ebonite—Rulers—Corners of Cabinets

Wire Cutters

THERE are three kinds of wire cutters in ordinary use. The first (Fig. 1) consists of two little notches cut in the jaws of a pair of pliers near the centre pin. These are opposite one another when the pliers are open, but move apart when the jaws are closed. This arrangement, though quite useful for rough jobs, is of very little use to the constructor of wireless sets, since it does not enable ends to be snipped off neatly and closely. A much better cutter is that shown as part of the combination pliers in Fig. 2. In this case each of the jaws is provided with a cutting edge, the two coming together when the pliers are closed. With pliers of this kind very neat work can be done and, provided that they are of respectable size, wire of quite heavy gauge can be dealt with.

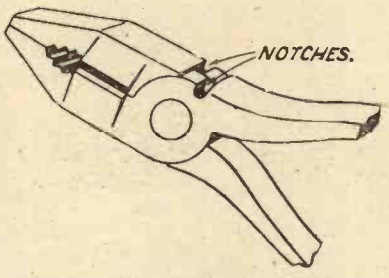


Fig. 1.—Notched wire cutters.

In purchasing combination pliers of this type there are several points to look to carefully, and a hint or two on this subject may not be out of place. The first thing to do is to close the pliers tightly and hold them up to the light. If they are poorly made, you will find that, when the flat portions on the front of the jaws come together, there is a gap between the cutting edges. Or it may be that the cutting edges close properly, leaving a space between the flats. Pliers made in this way are not of much use, for if the cutters do not close properly, neat, clean snips cannot be made and it may be found impossible to cut thin wire at all.

Should the cutting edges meet whilst the flats do not, they will very soon be blunted if the pliers are used for gripping fine wires or thin pieces of sheet metal. Having examined the cutting edges and the flats, make quite sure that the pliers are made of decent steel. The best way of doing this is to pull out of your pocket a piece of iron wire and to request the salesman to cut it with them. Should he refuse to do so, you may be

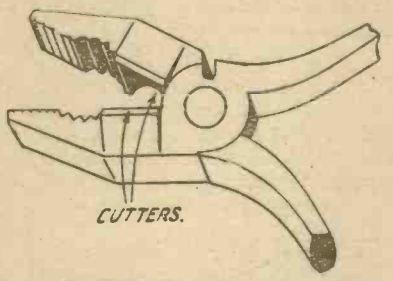


Fig. 2.—Combination Pliers with side cutters.

pretty certain that he is doubtful about the quality of his goods, whilst, if he complies with your request, you should afterwards hold the pliers up to the light again. Soft cutters will show distinct notches after operating on your sample of wire. Lastly, see that there is little or no play in the centre pin which holds the two portions of the pliers together. A pair of combination pliers which passes these tests can be relied upon to give satisfactory service to the wireless constructor, provided that he does not ill-use them by calling upon them to tackle work that is too big for them to deal with. The most satisfactory sizes of combination pliers for the wireless man are those from 5½ to 6 in. in length over all.

End Nippers

Quite the best appliance for cutting wire is a special pair of

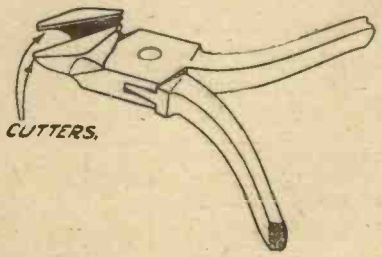


Fig. 3.—End nippers.

pliers such as that shown in Fig. 3 designed to serve no other purpose. These are known as end nippers, and they possess many good points. In the first place, as they are designed specially for cutting, they are made of material suitable for the purpose. As the demand for them is not nearly so great as for other forms of general-utility pliers, it does not pay makers of shoddy stuff to turn them out and, so far as I know, end nippers are made only by firms of good standing. With cutters of this kind you can snip off wire easily and cleanly and, what is more, you can cut off unwanted ends very closely. A very convenient size is that measuring 6 in. over all, with which wire of the heaviest gauge used in wireless construction can be cut without the slightest difficulty. I have a pair of nippers of this size that have been in use now for several years. Though they have been heavily used for cutting wire of all sizes as well as for the $\frac{1}{16}$ in. square tinned rod, which most constructors now prefer for making connections below the surfaces of their panels, the edges have not the smallest notch in them, and they will still cut a single strand of wire as fine as No. 36. Though combination pliers provided with side cutters are quite useful since

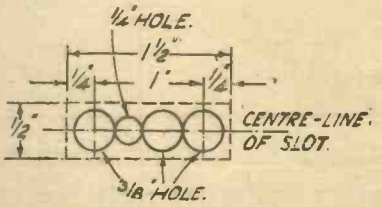


Fig. 4.—Making a slot in ebonite.

they serve a great number of purposes, I think that wiring is best done with the help of two separate tools—a pair of flat-nosed pliers 6 in. in length, and a pair of end nippers.

Making a Slot in Ebonite

It happens not infrequently that the constructor is faced with the job of making a slot in a piece of ebonite, as, for instance, when he is mounting an anti-capacity switch with lever control, or a small slider potentiometer of the ex-Army type. To make this is really a much easier matter than might be thought at first sight. First, mark out on your panel the centre line of the slot as shown in Fig. 4. Then with the scriber and the setsquare scratch in its outlines, marking fairly deeply. In the example shown in Fig. 4 we have supposed that the necessary dimensions of the slot are, width ½ in. and length 1½ in. We select a drill which will make a hole whose diameter is slightly smaller than the width of the slot. In this case we can use a

⅜ in. drill, and we punch-mark our drilling centres on the centre line ¼ in. from both top and bottom edges of the slot that is to be made.

Further Holes

When the holes have been made, we mark other centres between them and remove most of the unwanted ebonite by drilling further holes. It is now quite a simple business to clean up the slot with a flat file, taking it down to the scribed line all round. So long as care is taken to make your punch marks on the centre line and to make them large enough to hold the point of the drill, a perfectly clean-cut slot can be made in a very short time. A little difficulty may be found, by the way, in keeping

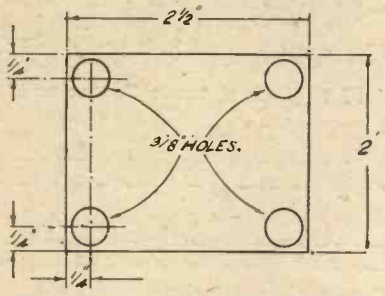


Fig. 5.—Making a rectangular hole 2 ins. by 2½ ins.

the point of so large a drill as one ⅜ in. in diameter in a punch mark when it is first started. The best method of ensuring that your holes are made exactly where you want them is this. Make your punch marks accurately and then make a hollow at each with a medium drill, say, a 3/16 in. or about a No. 20 Morse. There will then be no risk that the point of the big drill will slip when it is used, for the hollows will hold it securely.

Larger Holes

Much the same process as that described in the preceding paragraph may be used for making larger holes in panels. In Fig. 5 I have supposed that we want to cut a rectangular piece 2 in. by 2½ in. out of a panel. Here we shall use the biggest drill in the workshop outfit, which in the case of the majority of constructors will probably be the ⅜ in. We punch the centres ¼ in. from each edge at every corner and put the drill through at these points. We may now proceed as before to join up the first set of holes with others, doing the final cutting with a file.

A Fretsaw

A better way, though, in most cases is to use a fretsaw, which if carefully handled will cut ebonite quite well. Special blades intended for cutting very hard wood can, I believe, be obtained for fretsaws, and these are much more suitable than the ordinary kind. With the fretsaw one simply cuts along from corner hole to corner hole until the middle piece falls out. Final trimming is then done as before with a file. When large holes are made chiefly with the help of the brèast drill, it will be found that there is a good deal of surplus ebonite still to be cut away before the scribed lines are reached.

The Wood Rasp

The best tool for doing this rough work quickly is the ordinary wood rasp, which is much more rapid in its action than a file. You can rasp down to about 1/32 in. from the scribed line, which will leave you room enough to remove the rasp marks with a file. Circular holes can be made in the same way as rectangular by either of the methods described.

Rulers

A tool which the wireless constructor absolutely must have is an accurately graduated foot rule, for he often needs to make very careful measurements and a small error may cause a heap of trouble. Quite unsuitable for his purposes is the folding wooden pocket rule, since with this it is almost impossible to make fine measurements accurately. The reason is that these rulers are usually about 3/16 in. thick, so that, when they are

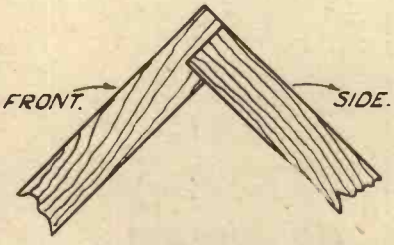
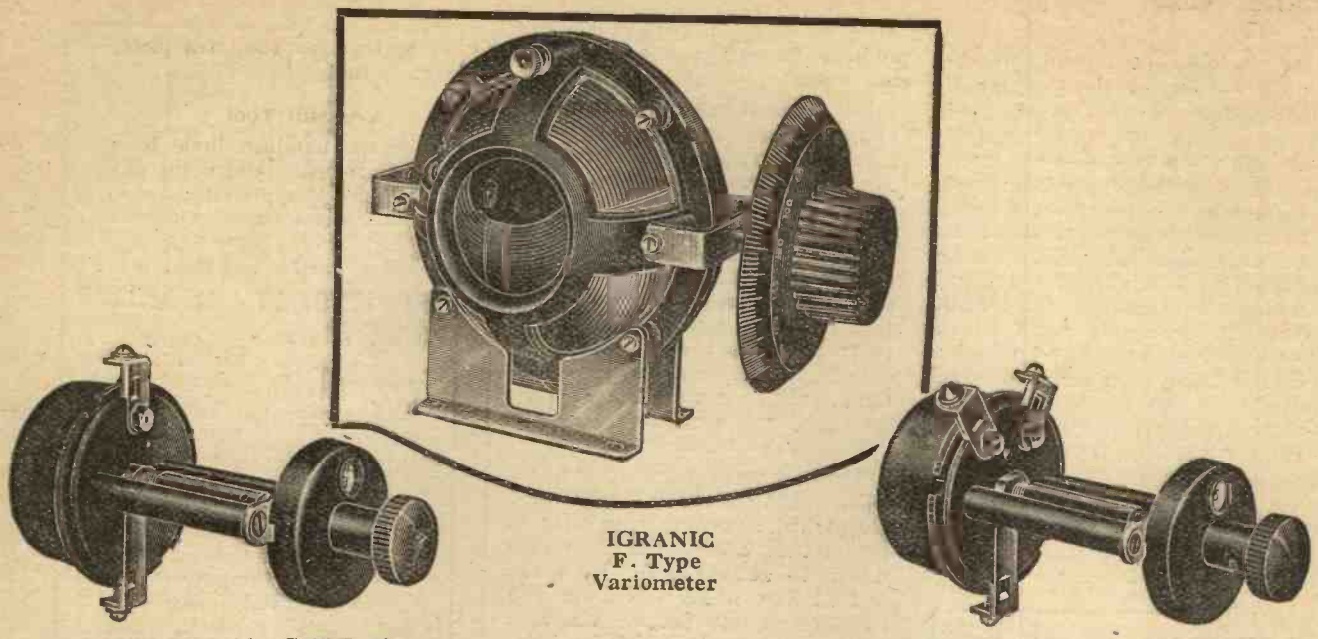


Fig. 6.—A Halved-in corner.

laid upon, say, a piece of ebonite, the graduated scale is 3/16 in. above its surface. You may very easily make a large error in your measurements owing to the effects of displacement, unless your eye is exactly opposite the point on the rule at which a mark has to be made on the panel.

The Boxwood Rule

The straight boxwood ruler with bevelled edges is very much better than the folding type, but best of all is the flat rule made of thin steel. These can be so finely graduated that even divisions of 1/64 in. are quite



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The great feature of this new Igranic Variometer lies in the fact that the stator moulding has been "skeletonised." Instead of the half stator moulding being a solid annular piece, the outer and inner rings are joined by four webs. In addition, the rotor winding is self-supporting, and thus the usual rotor moulding is dispensed with. The elimination of the moulded material which has been effected has resulted in a very big improvement in efficiency, due to the reduction of self-capacity and to the fact that the clearance between rotor and stator windings is very small. This type variometer is ideal for aerial tuning in either crystal or valve sets receiving B.B.C. stations. Supplied complete for fixing.

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easy to see and, owing to the thinness of the metal, errors due to displacement do not occur. The steel ruler has the further advantage that it is not liable to warp, nor is it so easily damaged by rough usage as those made of wood.

Prevention of Rusting

It must, however be remembered that a steel ruler can be quickly spoilt if it is allowed to rust. Once it has been discoloured by corrosion, the fine graduations are very difficult to read. The steel ruler should therefore be rubbed over with a greasy rag every now and then to protect it from the effect of damp. The best all-round measuring tool for the wireless constructor is a 12 in. steel straight-edged ruler, though he will find a folding steel rule very convenient for certain jobs.

The Corners of Cabinets

A good many constructors now make both the large cabinets required for complete receiving sets and the small ones used for mounting components such as variable condensers and the like. Those who are skilled carpenters will generally prefer to make the joints at the corners by means of dovetailing, a method which, beside producing a very good appearance, also makes for great strength.

Dovetailing

Dovetailing is, however, rather beyond the skill of the average home worker, and he wants a corner joint that is simple to make. Very neat corners can be made by means of the "halved-in" joint which is shown in Fig. 6. To make this the wood at both ends of the front and back members

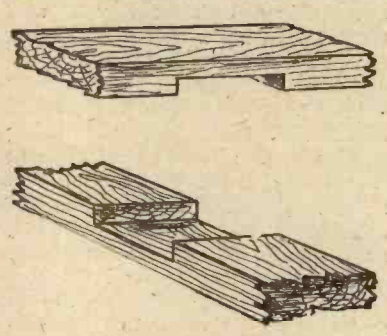


Fig. 7.—A Halved-in "X" joint.

of the frame is cut away with a tenon saw so that the sides are let in. The latter are secured by means of small nails or countersunk screws. The "halved-in" method is also extremely useful for making "X"-joints, such as those required for fixing together the cross pieces of frame aerials.

A Useful Tool

One of the handiest little tools that the wireless constructor can add to his workshop equipment is the jeweller's hacksaw, which is obtainable from any good tool shop quite cheaply. This is a miniature hacksaw taking very fine blades about 6 in. in length. With it one can do a good deal of work which is really too fine for the ordinary metal-work hacksaw. The blades make such a fine cut that it is actually possible with them to make one's own valve pins by splitting pieces of brass rod. The jeweller's hacksaw is far handier than the larger tool for shortening screws or for cutting threaded brass rod; owing to the fine cut which it makes, it injures the threads very much less. Again, the little blade with which it is fitted goes splendidly through ebonite, and I much prefer it to the metal hacksaw for cutting out panels. If by any chance you are unable to obtain a jeweller's hacksaw, the tool shop to which you go may have a dentist's hacksaw. This is used for the fine work of making dental plates, and it is just as good as the jeweller's hacksaw for wireless jobs. R.W.H.

(*Continued from p. 450.*)

the aerial circuit, and I would strongly urge every one who is troubled by the selectivity problem (and who is not ?) to pay special attention to his earth. Most readers will no doubt be aware that what is called a counterpoise earth is particularly beneficial from the point of view of selectivity, but space is usually lacking for the erection of such an arrangement. Those who have the space may, nevertheless, care to try it, and they should try a counterpoise—or earth screen, as it is sometimes called—consisting of perhaps four wires a few feet above the ground beneath the aerial, each wire being not less than about eight feet from its neighbour, the whole being well insulated, joined together at the end nearest to the leading-in point, and a short lead-in taken to an insulator similar to the leading-in tube. This is probably to be regarded rather as an ideal counterpoise than a practical one, and

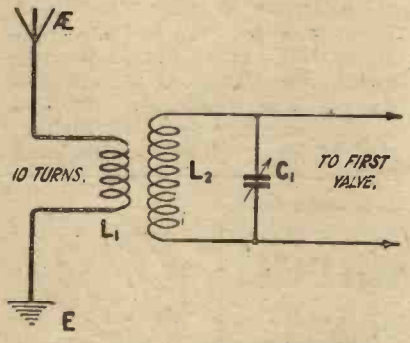


Fig. 1.—A simple method of increasing selectivity.

readers should remember that, should they be unable to erect such an elaborate affair, it is often possible to obtain quite good results from a much simpler one. A real increase in selectivity is almost always obtained, and if the counterpoise is a good one no loss of signal strength should result, but in some occasions a noticeable increase.

Buried Earths

A direct earth is of course the necessary arrangement in the majority of cases, and here the customary water pipe often leaves much to be desired, and various different buried connections should generally be tried. The conventional arrangement is to use a large sheet of some metal which does not corrode very readily, such as galvanised iron, in the form of a foot-bath, or copper. Important points to note here are that it must be buried at such a depth that the surrounding soil is always more or less moist, and that the lead-in wire should be soldered to it with extreme care and thoroughness, and the soldered joint painted over with tar when finished.

Dry Weather

Provisions should always be made for watering such earth connections in dry weather, a depression in the ground above the point at which it is buried being very convenient for the purpose. Such connections are, as a rule, only really successful upon damp clay soils, and wherever the soil is dry and sandy the buried wire will no doubt show a marked superiority. This consists of an arrangement of wires somewhat like those of a counterpoise, buried only a few inches deep beneath the aerial. Three or four wires separating at the leading-in point and spreading out to cover the surface beneath the aerial provide an extremely efficient arrangement.

The buried wire system may be impossible where the space is too cramped, and here it is well worth trying the vertical earth tube. Suitable tubes for driving into the ground can now be purchased at reasonable prices, and several of these arranged so as to have earth wires of equal length attached to them will usually be found to make quite a good connection.

The Circuit

Attention should now be directed to the circuit itself, and you should ask yourself whether the tuning arrangement represents the maximum efficiency possible under the particular circumstances, paying particular regard to the tuning coils. Obviously, unless really efficient coils are used, it is quite impossible to obtain selectivity, and the main requirements here are that they should be wound with a reasonably thick gauge of wire, upon an efficient system. In the majority of cases, of course, commercial plug-in coils are used, and it is very difficult for the comparative novice to decide whether they are of an efficient type or not, since there are certainly both sorts upon the market. Probably the best recommendation I can give here is that anyone who is in doubt should wind for himself a few simple basket coils with, say, No. 22 or 24-gauge double cotton-covered wire, putting upon them the same number of turns as those of his commercial coils, using a very thin cardboard former of approxi-

mately the same inner diameter as that of his bought coils, baking the new coils thoroughly when they are finished, so that they shall be properly dried. Then compare the results obtained with those of the bought coils; the results may be extremely instructive.

Modifications

Having satisfied ourselves that the actual components used in the tuned circuit, namely, the coils and the variable condensers, are of reasonably high efficiency, we now come to the question of modifications to improve selectivity. The obvious modification to the circuit which is always suggested to improve selectivity is, of course, the incorporation of a loose-coupled primary and secondary tuner. This, no doubt, is quite a useful arrangement, but it is by no means easy for the operator of only moderate skill to obtain anything like good results from such a tuner, and my own experience goes to show that other methods are most decidedly to be preferred in most cases. Practically as great an increase in selectivity can be obtained by other methods which are much easier to operate.

One of the best known of these circuits is illustrated in Fig. 1, being the aperiodic aerial system.

The Aperiodic Arrangement

Here we have the usual secondary circuit $L_2 C_1$, across which the first valve is connected, while the aerial circuit passes to earth through merely a 10-turn winding, which is placed closely on the top of the secondary coil, no provision being made for tuning the aerial. This arrangement gives quite good signal strength and selectivity and there is still only one circuit to tune. The actual winding of the coil has a considerable influence upon the results obtained, and numerous designs have appeared for such coils. As an experiment, one may construct a basket coil of the type already described, of which the first 10 turns are wound with double wire, from two bobbins. On the completion of the 10 double turns, cut off one of the wires, leaving the end free, and continue to wind another 50 turns. The inner 10-turn winding is then connected to the aerial circuit, the larger forming the secondary circuit. Somewhat better results are occasionally obtained with this arrangement by taking a connection also from the battery to earth.

To insert this coil in an existing receiver, the procedure is as follows: Mount the basket upon one of the ordinary basket coil mounts, and connect the ends of the larger winding to the plug and socket. Insert this in the aerial coil socket of the receiver, connecting the aerial tuning condenser in parallel, and connect aerial and earth to the ends of the 10-turn winding.

Auto-Coupled Circuits

A somewhat similar arrangement, using auto-coupling, is illustrated in Fig. 2, and for this the same former should be used and a basket coil wound upon it of 60 turns of No. 22 S.W.G. tappings being taken out from the 10th, 20th and 30th turns, the connections being as follows:—Mount the coil upon the same type of holder as before, connecting the extreme ends of the winding to the plug and socket. Take care to connect the inner end to the plug or socket, which is internally wired in the set to earth. Connect the earth lead to its usual terminal, with the aerial tuning condenser in parallel, and try the

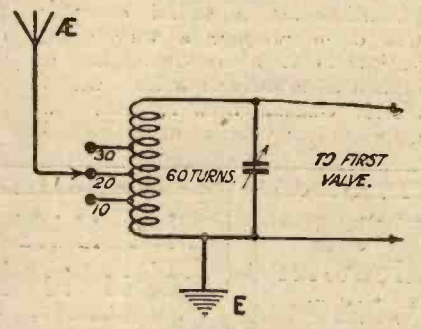


Fig. 2.—A useful modification of the aperiodic aerial method.

connection from the aerial (instead of upon the usual terminal) upon one or other of the tapping points which have been prepared. The set will then behave very much as in the previous case, but the adjustment of the number of turns can be arranged to suit any particular aerial and earth conditions. This is an extremely useful arrangement, which was, I believe, first described (in the case of a crystal set) by the Editor.

The Need for Reaction

A characteristic of both this and the preceding circuit which should be duly noted is that much less reaction is required to make the set oscillate than in the case of a direct-coupled circuit. A smaller reaction coil should therefore be used, and due care taken with adjustment. If one or other of these two arrangements is adopted, it should be noted that the coil must receive some kind of protection

against damp, unless it is to be used in a really dry room. The method of winding described produces quite an efficient coil so long as coil and former can be kept thoroughly dry and also provided some really thin cardboard has been used. If there is any reason to suspect that the coil may become damp, it is strongly recommended in the case of this type of coil that a very thin coat of shellac varnish be applied. Use extremely diluted varnish, adding perhaps one part of the varnish commonly sold by wireless dealers, to three parts of methylated spirits, applying this quite lavishly, and then shaking the coil to remove any excess. Thorough baking should follow when the coil is nearly dry.

Special Circuits

Most of the modifications which have been given are really easy to make, and are usually sufficient to increase selectivity to such a degree that the owner of the set feels that the apparatus will now serve him for some time and that when he requires a still higher degree of selectivity he will build a new set to obtain it, using possibly some neutrodyne circuit or other highly selective arrangement.

Control of Reaction

Before leaving the subject, however, we should perhaps devote a little attention to the question of reaction, since this is intimately concerned with the question of selectivity. The sharpening of tuning consequent upon the use of reaction is, of course, enormous, and those who possess sufficient skill to do so should certainly avail themselves of the benefits which can be obtained in this way. Where reaction has previously been used upon a tuned anode, it will usually be worth while upon adopting either the aperiodic aerial coil first described, or the modified arrangement in the second circuit, to transfer the reaction to this first tuned circuit. A perceptible increase in selectivity is usually noticed.

Potentiometer Control

Again, when employing two or more high-frequency valves, where reaction is controlled by means of a potentiometer, a skilful operator will often produce a very great improvement if he uses what is known as negative reaction, which merely consists of a reaction coil connected in what is normally the wrong direction, so that it damps down the oscillations in the aerial circuit instead of boosting them up. In this way the reaction coil can be used to check the tendency to self-oscillation, and the potentiometer can be turned further towards the negative end, which will generally have a marked beneficial influence upon selectivity. In the case of the high-frequency amplifier which I have recently constructed, consisting of three H.F. valves and a detector, the improvement upon using this method of reaction instead of relying entirely upon the potentiometer, which, of course, applies a heavy positive bias to the grids of the H.F. valves, was such that, whereas, with the potentiometer only, and no negative reaction, those stations below a wavelength of about 420 metres cannot be received without heavy jamming from London, with negative reaction I can obtain Madrid with only the faintest background from London, this being at 8 miles from 2LO and with a large and high outside aerial.

NEXT MONTH:
REACTION—ITS USE AND ABUSE.

How to Use the "Short Wire" Valve Panel

By A. S. CLARK

Some further notes upon this interesting unit

AS the valve panel described in the January WIRELESS CONSTRUCTOR has proved popular with readers, further particulars of the accessories required and how they are used in conjunction with this panel will be of help to those who have constructed it.

Valve

Any type of general-purpose valve may be used, either bright or dull emitter, the Lissenstat Minor being suitable for controlling the filament of either type. The voltage of the high-tension battery will vary slightly with the type of valve used, particulars of which will be found either upon the valve itself or else upon its wrapping, and a battery of 60 volts will generally be ample. The accumulator should be one of 4 volts if used with the ·06 type of valve, and can be either 4 or 6 volts for bright emitters. If no amplifier is used, it need not be of more than 10 ampere-hour actual capacity, but if possible one of larger capacity should be bought. Of course, with dull-emitters of suitable type dry cells can be used.

Any pair of high-resistance telephones is suitable, and in all cases a ·002 μF. condenser should be tried shunted across them, as suggested in the former article. Sometimes, when this condenser is not used, difficulty will be found in getting the set to oscillate. The only other accessories required are a variable condenser, a two-way coil-holder and suitable coils for the stations to be received. The coil-holder, together with the variable condenser (the latter need not be more than ·0005 μF.), can be mounted upon a baseboard as suits the convenience of the experimenter. A complete tuning unit to go with this panel will be described in next month's issue.

A Suggested Circuit

One of the most suitable circuits for use with this panel is an ordinary reaction circuit with parallel condenser. The method of connecting up the various components for this circuit is to connect the aerial to A, the earth to E, the fixed coil of the two-coil holder across the L_1 terminals, with the ·0005 μF. across the L_1 coil. The reaction coil should be connected across the L_2 terminals, with the batteries and telephones as indicated in the January issue.

Coils

With these connections and with a normal-size aerial, L_1 should be a 35 or 50 coil. Where a large aerial is used, a 25 coil may be more suitable. In nearly all occasions a 50 coil is suitable for the reaction L_2, but, if difficulty is experienced in getting the set to oscillate, a 75 coil can be tried. Some may prefer to use the tuning condenser C_1 as a series condenser, in which case the right connections were given in the original article. If series tuning is used, the aerial coil L_1 will be a No. 50 or 75 coil, while the reaction coil remains the same.

NEXT MONTH!

A complete Tuner Unit for use with this Single Valve Panel will be described in our next issue.

(*Continued from p.* 439.)

sufficiently to enable the first zigzag layer to be carefully pulled out. The coil may then be slipped off the former easily, and as each nail is withdrawn from the loops of wire formed round it a length of twine may be passed through these, alternately over the coil and through it, and the end tied on to the beginning. For further information regarding this type of coil, the reader is referred to "Tuning Coils and How to Wind Them," by G. P. Kendall, B.Sc. (Radio Press, Ltd., price 1s. 8d. post free).

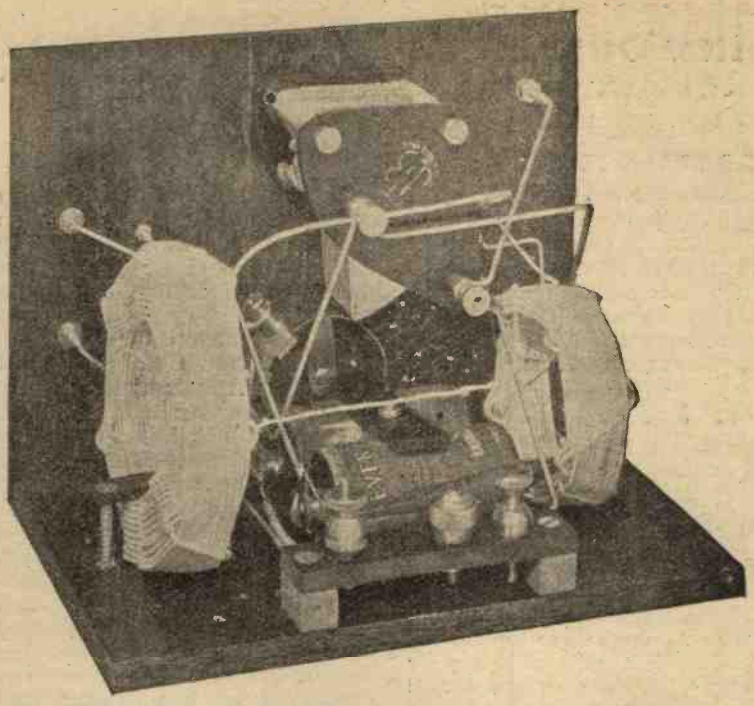
In this way the coil may be adequately secured, requiring no additional support. The larger coil is wound in exactly the same way, but six nails on each side will be found more convenient.

Make a Coil to Suit Your Aerial

Here it may be as well to mention that, since aerials differ widely in their characteristics, it will probably be necessary for some to use a four-layer coil of twelve turns per layer, in order to receive, say, a higher wavelength station in the 300-500 metre band.

Before the coils are mounted, and the panel fixed to the baseboard, it will simplify the wiring operations if the connections between the potentiometer and battery switch, and between the aerial and earth terminals, the condenser, and the change-over switch are made first. The panel may then be fixed to the baseboard by three ⅜ in. countersunk screws, and the remainder of the wiring carried out, making sure that all the connections are electrically sound. In the actual set square section tinned copper wire (No. 16 gauge) was used (except for connection to coils), and soldered connections were made.

Finally each coil is mounted direct on to the baseboard with the aid of a short strip of ebonite, drilled at each end to take brass wood screws, and the connections made to the switch. The method of mounting is quite clear from the back of panel photographs, and is quite satisfactory provided the baseboard is of good dry wood, preferably varnished.



This photograph clearly shows the crystal detector and how it is mounted on the wooden base.

Operating the Set

The operation of the set is quite simple: the aerial and the earth and telephone leads are connected to their respective terminals, the battery switch is placed in the "on" position, and the change-over switch to, say, the position for the lower wavelength range. Then adjust the detector so that the spring presses fairly firmly on the crystal. Then by turning the potentiometer knob, and rotating the condenser, the local station should be heard in the 'phones.

It will probably be found that there is an optimum pressure on the crystal, and there will be a definite setting on the potentiometer for the best results. Make both these adjustments to obtain the loudest and clearest signals. The set may then be placed in its cabinet and need not be taken out until the battery requires renewal, which should not be for many months.

In conclusion, it may be mentioned that, as a test of stability, the actual set has been dropped while in use from a height of about 6 in. on to a table without affecting reception in the slightest.

BUSINESS AS USUAL!

The influence of Wireless in the City.

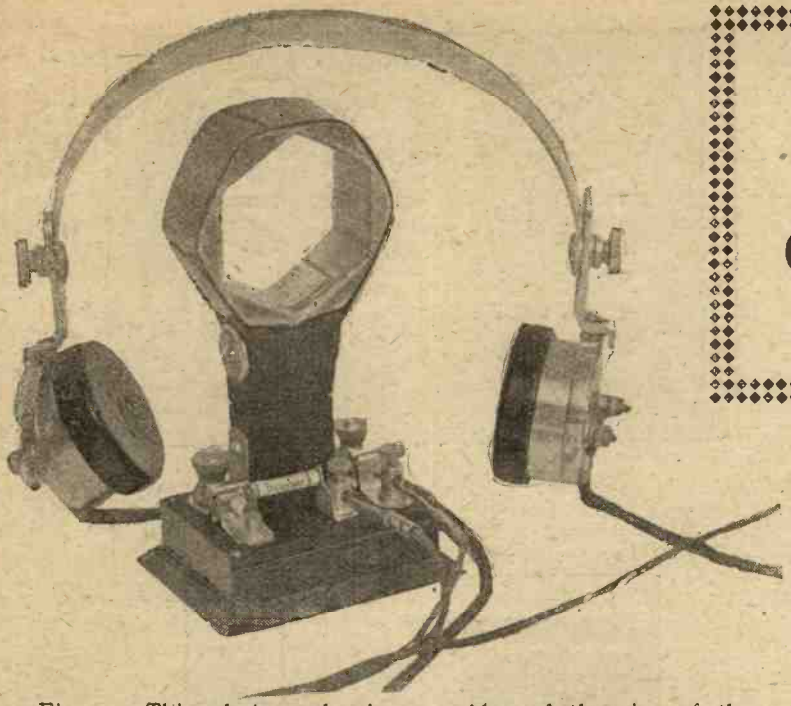


Fig. 1.—This photograph gives an idea of the size of the crystal receiver.

A Miniature Crystal Set

By H. BRAMFORD

ALTHOUGH the receiver about to be described measures only 2 in. × 3 in. × 2½ in. over all, it is thoroughly efficient. It is not a mere toy, it works, and signals obtained by the writer have proved to be excellent. In this case a 40 ft. indoor aerial was used, only 20 ft. high, at a distance of 9 miles from 2LO. Those who wish to make a receiver which will go with ease into their jacket pocket will find this receiver just the thing. They can take it round to their friends and listen-in comfortably whenever they feel so inclined. One of its further advantages is, there is nothing to do in the operating of it—not even a catwhisker to adjust, as the detector may be made up as described, or a permanently fixed detector may be purchased. There are no wired connections in the receiver whatever. In Fig. 1 a photograph of the complete receiver, with a plug-in coil and phones attached, is shown. A glance at the phones in the picture will give a good idea of the size of the receiver itself.

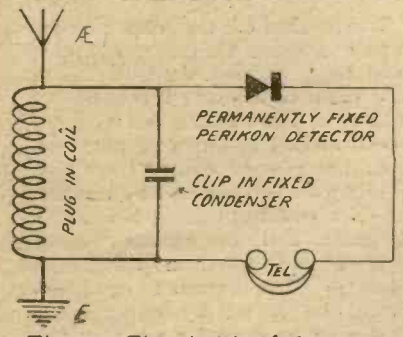


Fig. 2.—The circuit of the set.

Material

The following materials will be required to build this set:—

1 piece of ebonite measuring 2 × 3 × ⅛ in. or 3/16 in.

1 coil plug with brackets (K. Raymond).

2 terminals, W.O. type.

2 terminals, telephone.

1 permanent detector, as described, or "Hovimo," or "Catseye."

Small quantity of strip brass.

Small quantity of ⅛ in. or 3/16 in. wood.

A plan and elevation of the receiver is clearly shown in the drawing, Fig. 6.

Panel

The panel is drilled as shown in Fig. 5. The panel-securing holes are drilled 6 B.A. clear, the other five holes being drilled 4 B.A. clear.

Clips

The next item to consider is the brass clips, one of which is shown in Fig. 3. This clip connects to the aerial on one side, and acts as a detector clip on the other. Its construction is clearly shown in the diagram. The dimensions given should be carefully followed. First, cut out a piece of strip brass, as shown in the development, and drill 3 4 B.A. clearing holes in the given positions, then bend to shape where the dotted lines are marked. In bending the portion which is to hold a clip-in condenser, the brass strip should be bent over and pinched round a knitting needle. When the knitting needle is withdrawn, a rounded bend will have been made. In Fig. 4 two further clips are shown. Clip No. 2 connects to one side of the telephones, and incidentally acts as the other clip for the detector. Clip No. 3, which is somewhat similar to Clip No. 1, connects to the earth terminal on one side, and to the opposite side of the phones on the other. Both of these clips are constructed on similar lines to No. 1 clip.

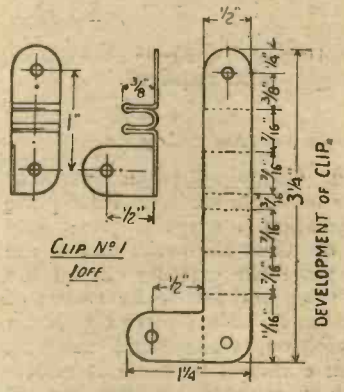


Fig. 3.—Details of one of the clips necessary.

Detector

The detector may be made as shown in Fig. 7. First, cut a piece of ebonite tubing 1 in. long and ½ in. external diameter. Slightly warm one end and force a small 4 or 6 B.A. nut in. When the tubing cools it will contract and firmly grip the nut. Next, place a short length of light tension spring inside the tube and follow with a small piece of zincite crystal. Next drop in a small piece of bornite crystal, and a

further corresponding length of spring. Secure the whole by forcing a further nut into the open end of the ebonite tube, as before. Two B.A. screws are then inserted, one in each end of the tube—round-headed screws should be used, as they will locate themselves in the existing holes in the clip.

Alternatively a Catseye or Hovimo permanently fixed detector may be used if inserted between the existing clips on the receiver.

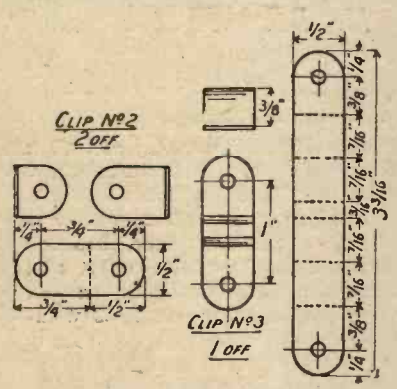


Fig. 4.—Two clips as above are also required.

Assembly

Fig. 6 makes panel assembly quite a simple matter. First place in position upon the panel clip No. 1. Over the aerial end of the clip place the existing clip of the coil plug, and secure by means of terminal A. Next place clip No. 3 in position, seeing that the end which connects to earth is underneath the other existing clip of the coil plug. Secure by means of terminal E. The detector end of clip No. 1 is then secured with a 4 B.A. cheesehead screw. Clip No. 2 is secured by means of one of the telephone terminals, and the other end of clip No. 3 by means of the other telephone terminal. This completes the panel assembly,

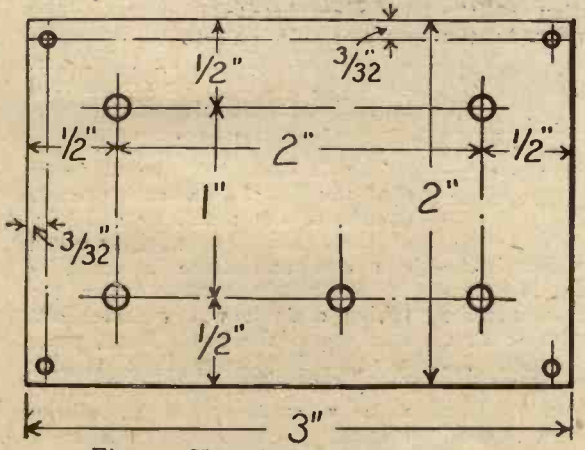


Fig. 5.—How the ebonite is drilled.

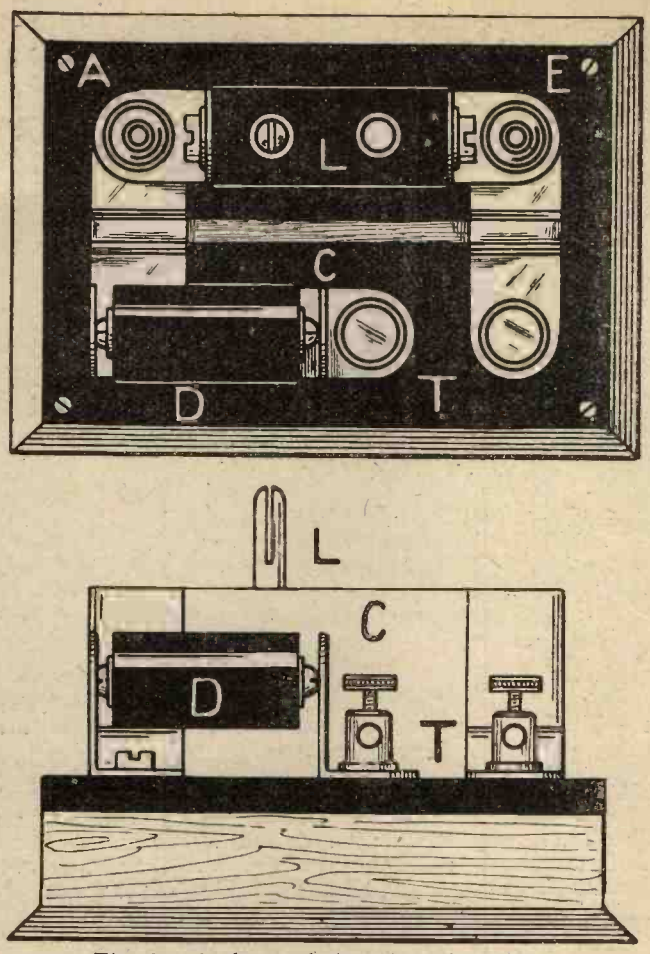


Fig. 6.—A plan and elevation of the set.

the detector being inserted in between clips Nos. 1 and 2.

Box

The box may be made from any suitable wood, preferably mahogany or oak. The sides should be cut to the following dimensions: Two pieces 3 in. × ½ × 3/16, two pieces 1⅝ in. × ½ × 3/16. The base should measure 3⅜ in. × 2⅜ × 3/16. The edges of the base piece are bevelled to an angle of 45°, thus leaving the top surface measurement 3 in. × 2. The bevelling may easily be done with either a small plane or sand paper block set on a 45° rest. The sides and base may then be assembled by glueing and clamping. Walnut stain will give a good finish if treated with beeswax after application. A final coating of spirit varnish may be applied if desired.

Clip In Condenser

Where desired the clip in condenser shown in the diagram, Fig. 2, may be dispensed with, in which case plain connecting brackets will suffice. The exact wavelength would in this instance be obtained from the plug-in coil. Excellent results may be obtained by making a spider coil from some No. 26 or 28 enamelled or cotton-covered wire wound upon a cardboard former. The number of turns should be found by experiment. This may be done by winding the coil and connecting the free ends temporarily to the receiver until the best signals are heard from the local broadcasting station. When this point in the winding has been found the coil may be permanently finished by attaching it to a plug-in adapter.

Circuit

A theoretical diagram of the circuit is shown in Fig. 2. As a plug-in coil is used, the best size to suit individual circumstances is

found by experiment, but once found, no other coil will be required for reception of the local station. The writer has found that No. 50 gives excellent results on an indoor aerial, and a No. 250 should easily get 5XX. A clip-in condenser may be used in parallel with the inductance, the best value being also found by experiment, but the writer has not found this to be necessary. No tuning is necessary with this receiver, and no detector adjustment, and it is excellent for those who wish to have a set by them which they can merely place upon the table and see it work, or, alternatively, for those who are unfortunately not even able to adjust a detector. It was, in fact, such a circumstance as this that suggested the idea to the writer.

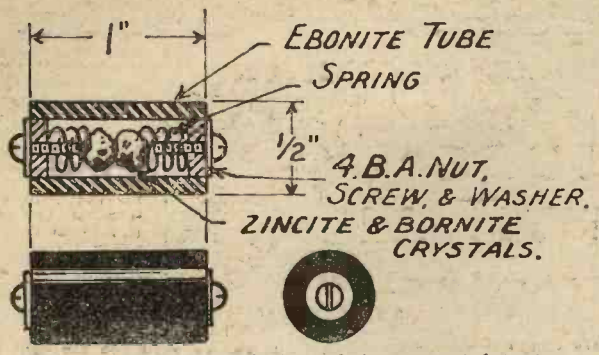


Fig. 7.—The construction of the crystal detector.

Editor's Note: Commercial plug-in coils will often give excellent results with this set, but for best results home-made coils adjusted to suit the wave-length received are recommended.

A READER'S FINE RESULTS

RADIO PRESS ENVELOPE No. 8.

SIR,—You will, no doubt, be interested to learn the remarkable results which I have obtained with the single-valve reflex receiver described in Radio Press Envelope No. 8.

Being in need of a simple, but efficient, single-valve reflex receiver, I made up this one about a week ago. The components are as specified, with the exception of the L.F. transformer, which is a T.M.C. The fixed condensers also have not quite the same values as those specified and the valve sockets are of the ordinary conventional type. The valve is a Marconi Osram D.E.R. running off a 2 volt accumulator, and between 40 and 60 volts high tension. I have so far used the set without grid bias. I am not sure what sort of crystal I am using, but it is a very good one of the galena type. The set is inclined to oscillate a little at times, but a suitable grid bias will probably stop this. My aerial is a standard P.M.G. single wire fairly well situated, and the earth is the water main.

So far I have obtained the following stations:—

Birmingham, uncomfortably loud in two pairs of 'phones.

Manchester, Bournemouth, Cardiff, Nottingham, London, all comfortably loud.

Aberdeen, Belfast, easily readable.

Hamburg and Le Petit Parisien are quite loud. L'Ecole Superieure and Radio Iberica (Madrid) come in at reasonable strength, as also does some other foreign station which I believe to be Rome.

One Friday night I was listening to Madrid and, when they closed down at about 12.15, I started searching for any other station which might not have yet closed down. I soon came across a woman's voice, apparently telling a story—in English. It sounded very like a "Children's Corner." I waited and heard the announcer, with an unmistakable American accent, saying that it was the Westinghouse station, WBZ (the Z being pronounced zee), of Boston. I cannot be sure of the time, but I think it was about 12.30; the station closed down until 10.0, American time, when it was to give the time signal. I again heard the station last night, signals being very strong at times and then fading off so that they could not be heard at all. Atmospherics and "mush" were also bad.

I consider that the set is wonderful and I shall recommend it to my friends. I have not yet got any coils, etc., big enough for the higher wavelengths, but, when I have, I expect Chelmsford and the higher-wave European stations will be very good.

I remain,
Yours, faithfully,
E. W. BISHOP.

Malvern.


Birmingham's gift to local hospitals.
Over 6,000 toys were presented at Christmas.
Above: The scene in the studio.

The famous Eureka Gravity Detector

Two months ago this fool-proof Crystal Detector was used in a Crystal Receiver designed by Mr. Percy W. Harris. As a result we were so inundated with orders that production was completely disorganised. Our apologies are due to all who were disappointed at the time.

The Eureka Gravity Detector has now been slightly remodelled internally and improved. It is still the only detector on the market—not of the permanent type—that does not use a catwhisker and involve a lot of fiddling adjustments to find a new sensitive spot. Just a slight turn and a new spot is found automatically. Complete with plated clips and terminals. **6/6**

Eureka Rheostats

An entirely new type of high-grade Rheostat. Utilises a wire core with a sliding contact sliding within it. Everything totally enclosed. Because no dirt can possibly enter, the contacts must always remain clean. Frictionless, yet entirely positive movement. Heavily nickel plated and one-hole fixing. Only takes up one inch of panel. Far superior to all carbon pile rheostats. Made in three resistances: 7 ohm, 13 ohm and 30 ohm. **4/9**

Eureka Potentiometer

A splendid precision-made instrument. Totally enclosed movement—the only one of its kind on the market. Free from dirt or dust, therefore absolutely silent working. Wound to 300 ohms. One-hole fixing, heavily nickel-plated fittings. **6/6**

Portable Utilities Co., Ltd.,
Eureka House,
Fisher St., London, W.C.1.

No. 4 of a Series.

The Living Artiste

JUST as the balance wheel is to the watch so is the L.F. Transformer to the Receiving Set.

Without the proper functioning of the one even the finest gold watch is utterly useless. And without a Transformer capable of an equal amplification over all the usual frequencies even a super-Receiver and the most expensive Loud Speaker are little more than ornaments.

There's about as much difference between the ordinary cheap type of Transformer and the superb Eureka Concert Grand as there is between a cheap German watch and an English lever.

The Eureka Concert Grand is a laboratory production. Its 2¼ miles of wire are wound with scientific precision and its turn ratio is calculated to a nicety. Its design is not based on academic theory, but on the results of many hundreds of pounds worth of actual research work.

A non-laminated core—a coppered steel case—an extremely generous primary winding—these are some of the factors that have caused the Eureka to be considered Britain's Transformer-de-Luxe.

Concert Grand **30/-** *The Transformer which enables the Loud Speaker to re-create the living Artiste.* Eureka No. 2 **22/6** *(For Second Stage)*

Supreme EUREKA for Tone

Gilbert Ad. 2084

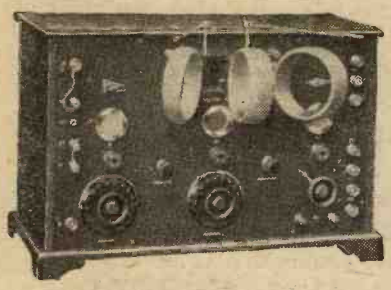
Easy-to-build Pilot Receivers based on Radio Press designs

No technical knowledge or skill required

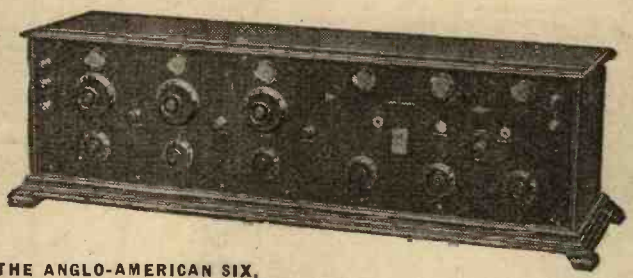
If you can use a pair of pliers to cut a length of wire—if you can screw a transformer to a ready-drilled panel—if you can follow a simple wiring diagram, then you can build any of the splendid Sets illustrated on this page. From the 2-Valve Resistoflex to the 6-Valve Anglo-American designed by Mr. Percy Harris for "The Wireless Constructor," they represent all that is best and most original in British Radio design to-day.

Every one of these Pilot Receivers carries our full guarantee that if made according to our working instructions, it will work perfectly. Indeed, we go further than that—we have instituted a special Service Department to ferret out faults for you at a nominal cost should the Set not work when you have made it up.

Choose the best Set you can afford from the chart herewith—if you have some of the parts already, we shall be pleased to supply you with the balance. If you have all the parts already, we shall be equally pleased to supply you with only the panel or the cabinet. If you cannot make up your mind which Set you will build, or if you want further information, write for a copy of our 32-page Pilot Booklet outlining the whole scheme, which will be sent for three penny stamps.

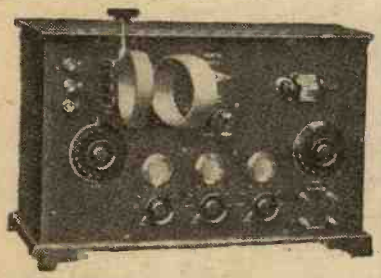


THE ALL-BRITAIN SET.
A wonderfully popular 3-Valve Set, which, as its name implies, is capable of receiving all the main B.B.C. stations at good strength. A very simple Set to operate, and recognised as being very selective. Uses the new tri-coil circuit.



THE ANGLO-AMERICAN SIX.
Mr. Percy Harris' latest Set embodying three stages of neutrodyned high-frequency. Gives practically the power of a super-heterodyne with a great saving in valves. A few feet of wire around the picture moulding of a room is all that is necessary to operate this Set.

THE S.T. 100.
The world's Standard 2-valve Reflex, which gives probably the loudest signals it is possible to obtain. Tens of thousands of S.T.100 Receivers have been built in America, although the circuit was first evolved by Mr. John Scott-Taggart (Editor of "Modern Wireless"). This Set is contained in a handsome oak double drop front, and possesses a most attractive appearance.

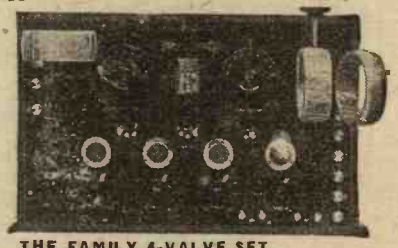


THE PURIFLEX SET.
Originally designed for "Modern Wireless" by Mr. Percy Harris. Uses a Crystal Reflex circuit with a two-stages of resistance coupled low-frequency amplification. Famed for its remarkable loud-speaker purity of reproduction. There is a complete absence of distortion with this Set.

See what you save by building a guaranteed Pilot Receiver at home—

Name of Receiver.	No. of Valves	Price and Size of Panel drilled and engraved.	Kit of Components.
All Concert-de-luxe (B)	3	15 6 16½ × 10	£4 15 6
S.T. 100	2	7 0 10 × 6¾	£4 14 0
Puriflex (B)	3	15 6 16½ × 10	£4 2 0
All-Britain (B) ..	3	15 6 16½ × 10	£4 16 1
4-Valve Family (B)	4	17 0 16½ × 10	£5 16 8
Transatlantic V. (B)	5	18 6 16½ × 10	£5 8 5
Anglo-American 6 ..	6	£1 5 0 36 × 9 (Without engrav'g)	£9 9 9
Transatlantic 4 ..	4	16 6 16½ × 10	£6 13 6
3-Valve Neutrodyne, Valve panel	3	12 0 12 × 10	£4 8 8
3-Valve Neutrodyne, Tuner panel	—	11 6 12 × 10	£4 2 3
T.A.T. 4-Valve Receiver (B)	—	£1 1 6 24 × 8	£6 12 6

¶ SPECIAL NOTE.—Where all components and panel are purchased together, a Marconi Royalty of 12s. 6d. per valve-holder must be paid.



THE FAMILY 4-VALVE SET.
An ideal family Receiver originally designed by Mr. Percy Harris. Uses the familiar tuned anode and reaction circuit. Large numbers of users report regular reception of American broadcasting on this Set. Can be used as a two, three or four-valve Set at will.

THE ALL CONCERT-DE-LUXE.
A most handsome Receiver with all fittings supplied nickel-plated. Simple switches enable note magnifier valve being cut out if not required. Has a telephone range of 800 to 1,000 miles under normal conditions. All battery connections at rear, and plugs and jacks for telephones and loud-speaker fitted to panel.

CABINETS.
Special Oak Cabinets (panel size 16½ × 10"), complete with baseboard for the All Concert-de-luxe, Puriflex, All-Britain, 4-Valve Family, Transatlantic V, 17/- each. For the Anglo-American Set (panel size 36 × 9"), as illustrated, Oak £3/1/6, Mahogany £3/4/6. For the 3-Valve Neutrodyne, to take both panels (size 24 × 10"), 33/6. For the S.T. 100, in Oak with double drop flap, 30/-. For the 4-Valve T.A.T. Receiver Oak £1/7/6, Mahogany £1/12/6.

THE TRANSATLANTIC V. RECEIVER.
The first standard Set to use two stages of high-frequency amplification. A real long-distance Set. Will work particularly well on a simple little indoor aerial. Regular reception of American broadcasting and long-distance Continental stations at loud-speaker strength is an easy matter with this 5-valve Set.

The first step— send for the Pilot Chart

If you cannot select your Set from these illustrations, send 3d. for a copy of our 32-page Pilot Chart, giving the fullest details of the full range of Sets, together with many illustrations.

SEND TO-DAY
for a copy of our 48-page Component Catalogue (post free 3d.) and for a copy of our Wireless Book (containing over 80 circuit diagrams and much useful wireless information), 1/3, post free 1/5

You can build this Trap to cut out local interference.

Now for a Change—Switch over to Bournemouth.

Anyone can build a wireless set from instructions contained in the Radio Press Envelopes. Build yourself the wavetrap described in Envelope No. 6. These Envelopes may be obtained from your regular wireless dealer, newsagent or direct from Dept. W, Radio Press Ltd., Bush House, Strand, London, W.C.2

YES, but can you cut out your local Station? How often is that question asked by radio enthusiasts? The answer is to be found in the Radio Press Envelope No. 6, which contains full details for the construction of the A.B.C. Wave Trap—an instrument which is the result of much research by G. P. Kendall, B.Sc., into the question of the elimination of undesired signals. This instrument contains no less than 3 distinct types of wave trap arrangements, any one of which can be brought into operation at will. The contents of the Envelope include a general treatise on the experiments, instruction sheets, blue prints, photographs and working drawings. When tested 3 miles from 2LO the A.B.C. Wave Trap completely eliminated the London Station and brought in Bournemouth. Although theoretically a loss in signal strength must be admitted, it is so small that it is seldom apparent to the human ear.

This highly efficient Wave Trap gives a choice of working with either A, B or C type of eliminator circuits, and its great efficiency is obtained by the elimination of losses in design.

We have every confidence in telling our readers that the A.B.C. WAVE TRAP will enable them to cut out their Local Station without sacrifice of signal strength, provided always that their aerial and earth systems are of average efficiency.

You can build this Wave Trap for about 30/- inclusive of handsome cabinet and coils which are built into the design. Normally Constructed to operate on the 300-600 metre band.

1/6 POST FREE 1/9

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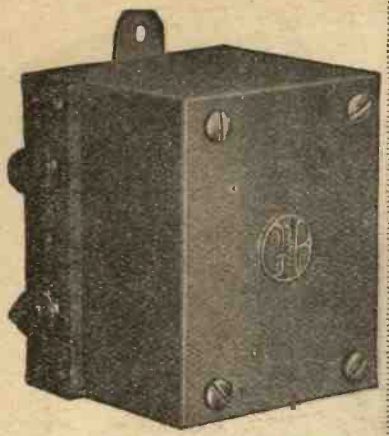
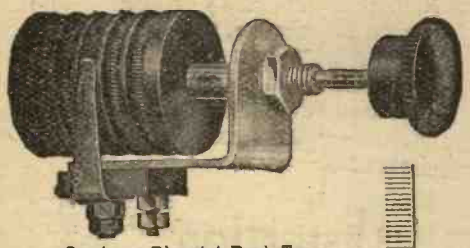


Gambreco L.F. Transformer
Stage 1 and Stage 2, 27/6 each



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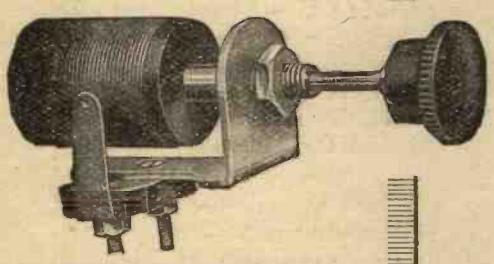
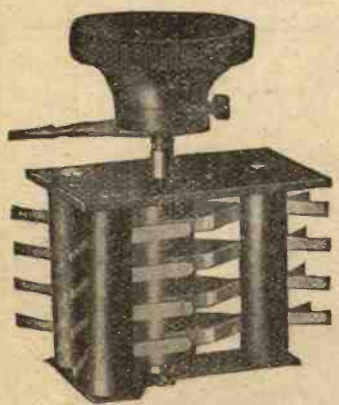
5/6 each



Gambreco Rheostat (5 ohms)
3/6 each



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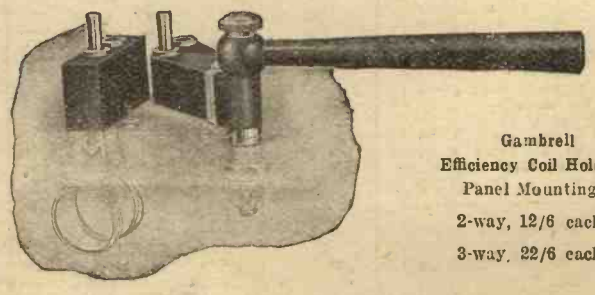

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Panel Mounting
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Patent Pending for all the above Components

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Give your Set that Professional Look!

About the year 1749 an engraver named John Sadler, of Liverpool, whilst taking proofs off a plate he had engraved, was suddenly startled by shouts of jubilation from his children in the room. On turning round to see the cause he found that one of them had picked up a still wet spoilt copy that he had thrown on the floor and applied it to a piece of crockery, and was triumphantly holding up the decorated piece of china. This accidental revelation was pursued by Sadler, and it is on record that, together with a master printer named Green, they, a short time afterwards, printed "1,200 earthenware tiles in about six hours, better and neater than one hundred skilled pot-painters could have painted in the common and usual way of painting with a pencil."

This is probably the earliest known transfer printing; after Liverpool, many other factories, such as Battersea, Worcester, Bilston, Staffordshire, Swansea, Coalport and others, made transfer-printed ware.

Transferring is a common process in Lithography where it is used for "making up work," viz., transferring a lot of impressions either all of the same matter or different to a large stone so that they can all be printed at once.

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By using "RADIO PRESS WIRELESS PANEL TRANSFERS" (6d. per large packet of 80 labels), you can give to your set that finished appearance which makes all the difference. Not only are these transfers the cheapest and best but they are officially issued by the Radio Press for their sets. Buy a packet or two from your wireless dealer. They are also obtainable through every bookseller, *but get the title right*, if you want Radio Press quality.

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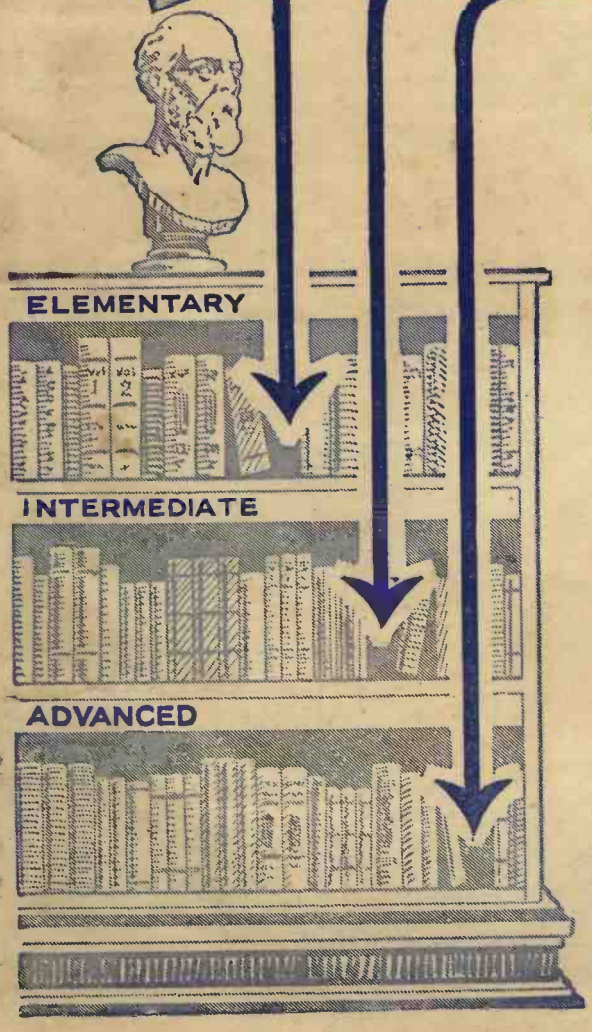

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